TÜRKİYE CUMHURİYETİ
ADANA ALPARSLAN TÜRKEŞ SCIENCE AND TECHNOLOGY UNIVERSITY

GRADUATE SCHOOL
INDUSTRIAL ENGINEERING DEPARTMENT

MEASURING CORPORATE SUSTAINABILITY PERFORMANCE BY USING A NOVEL HYBRID MCDM MODEL

BÜŞRA KARA BALTACI

M.Sc.

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Prof. Dr. NEŞE YALÇIN

ADANA, 2025

DECLARATION OF CONFORMITY

In this thesis study, which was prepared following the thesis writing rules of Adana Alparslan Türkeş Science and Technology University Institute of Graduate School, I declare that I provide all the information, documents, evaluations and results in accordance with scientific ethics and moral codes without resorting to any means or assistance that would be contrary to scientific ethics and traditions. I also declare that I refer to all of the articles I used in this study with appropriate references and accept all moral and legal consequences if a situation is found contrary to my statement regarding my work.

06/11/2025

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Büşra KARA BALTACI

ABSTRACT

MEASURING CORPORATE SUSTAINABILITY PERFORMANCE BY USING A NOVEL HYBRID MCDM MODEL

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The perpetual consumption of finite natural resources to satisfy human needs necessitates a critical examination of resource efficiency and its long-term implications for future generations. Addressing this challenge, corporate sustainability has emerged as the business imperative, requiring firms to balance economic objectives with crucial environmental and social considerations. While corporate activities significantly advance societal welfare, they simultaneously generate adverse effects, including environmental degradation and labor issues. This growing awareness among stakeholders has consequently intensified the demand for greater transparency and accountability. Therefore, sustainability reporting has become an indispensable mechanism for firms to effectively communicate their holistic environmental, social, and economic performance to the public.

In this thesis, it is aimed to evaluate the corporate sustainability performances of firms in terms of economic, social and environmental dimensions and to compare the corporate sustainability performances of firms. A novel hybrid Multi-Criteria Decision-Making (MCDM) model based on CRITIC and RAWEC was proposed to evaluate the corporate sustainability performance of firms for the years 2021, 2022, and 2023. Criteria weights are determined using the CRITIC method. Then, alternative firms are ranked using the RAWEC method. According to the results obtained from the proposed MCDM model, Arçelik A.Ş. (A1) ranked first with the highest performance in 2021, and Aselsan A.Ş. (A2) in 2022 and 2023. In contrast, Kardemir Karabük Iron and Steel Ind. and Tic. A.Ş. (A9) ranked last with the lowest performance in all three years. At the end of the study, sensitivity analysis was performed to test the accuracy and validity of the proposed model.

Keywords: Sustainability, Corporate Sustainability Performance, CRITIC, RAWEC, GRI Index.

ÖZET

YENİ BİR HİBRİT MCDM MODELİ KULLANARAK KURUMSAL SÜRDÜRÜLEBİLİRLİK PERFORMANSININ ÖLÇÜLMESİ

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Danışman: Prof. Dr. Neşe YALÇIN

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İnsani ihtiyaçları karşılamak için sınırlı doğal kaynakların sürekli tüketilmesi, kaynak verimliliğinin ve gelecek nesiller üzerindeki uzun vadeli etkilerinin eleştirel bir şekilde incelenmesini gerektirmektedir. Bu zorluğun üstesinden gelmek için kurumsal sürdürülebilirlik, firmaların ekonomik hedefleri ile kritik çevresel ve sosyal hususları dengelemesini gerektiren bir iş zorunluluğu olarak ortaya çıkmıştır. Kurumsal faaliyetler toplumsal refahı önemli ölçüde artırırken, aynı zamanda çevresel bozulma ve işgücü sorunları da dahil olmak üzere olumsuz etkilere de yol açmaktadır. Paydaşlar arasındaki artan farkındalık, daha fazla şeffaflık ve hesap verebilirlik talebini artırmıştır. Bu nedenle, sürdürülebilirlik raporlaması, firmaların bütünsel çevresel, sosyal ve ekonomik performanslarını kamuoyuna etkili bir şekilde iletmeleri için vazgeçilmez bir mekanizma haline gelmiştir.

Bu tez çalışmasında, firmaların kurumsal sürdürülebilirlik performanslarının ekonomik, sosyal ve çevresel boyutlar açısından değerlendirilmesi ve firmaların kurumsal sürdürülebilirlik performanslarının karşılaştırılması amaçlanmaktadır. Firmaların 2021, 2022 ve 2023 yıllarındaki kurumsal sürdürülebilirlik performanslarını değerlendirmek amacıyla CRITIC ve RAWEC tabanlı yeni hibrit bir Çok Kriterli Karar Verme (ÇKKV) modeli önerilmiştir. Kriter ağırlıkları CRITIC yöntemi kullanılarak belirlenmiş, ardından alternatif firmalar RAWEC yöntemi kullanılarak sıralanmıştır. Önerilen ÇKKV modelinden elde edilen bulgulara göre, 2021 yılında Arçelik A.Ş. (A1), 2022 ve 2023 yıllarında ise Aselsan A.Ş. (A2) en yüksek performansı göstererek ilk sırada yer almıştır. Buna karşılık, Kardemir Karabük Demir Çelik San. ve Tic. A.Ş. (A9) her üç yılda da en düşük performansla son sırada konumlanmıştır. Çalışmanın sonunda, önerilen modelin doğruluğunu ve geçerliliğini test etmek için duyarlılık analizi yapılmıştır.

Anahtar Kelimeler: Sürdürülebilirlik, Kurumsal Sürdürülebilirlik Performansı, CRITIC, RAWEC, GRI Endeksi.

For Erdem, my soulmate and forever — for walking every path with me.

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LIST OF ABBREVIATIONS

ACCA	: Association of Chartered Certified Accountants
AHP	: Analytic Hierarchy Process
ANP	: Analytic Network Process
ARAS	: Additive Ratio ASessment
COBRA	: Compherensive Distance Based Ranking
COPRAS	: COmplex PRoportional ASsessment
CoCoSo	: Combined Compromise Solution
CODAS	: COmpromise Decision ASsessment
CRITIC	: CRiteria Importance Through Inter-Criteria Correlation
CSD	: Commission on Sustainable Development
CSRD	: Corporate Sustainability Reporting Directive
DM	: Decision Matrix
DOBI	: DOmbi–BonferronI
EDAS	: Evaluation based on Distance from Average Solution
ELECTREE	: ELimination et CHOix Traduisant la REalité
EWM	: Entropy Weighting Method
GHG	: GreenHouse Gas
GRA	: Grey Relational Analysis
GRI	: Global Reporting Initiative
IEE	: Integrated Environmental Evaluation
IPO	: Initial Public Offering
ISO	: International Organization for Standardization
LOPCOW	: LOgarithmic Percentage Change-driven Objective Weighting
MABAC	: Multi-Attributive Bordering Area Comparison
MAUT	: Multi-Attribute Utility Theory
MAXC	: MAXimum of Criterion
MCDA	: Multi-Criteria Decision Analysis
MCDM	: Multi-Criteria Decision Making
MHE	: Materials Handling Equipment

MEREC	: Minimum Entropy Weighting Method based on the Removal of Criteria
MOORA	: Multi-Objective Optimization on the basis of Ratio Analysis
NGOs	: Non-Governmental Organizations
PIV	: Proximity Indexed Value
PROMETHEE	: Preference Ranking Organization METHod for Enrichment of Evaluations
PV	: Present Value
R&D	: Research and Development
RAWEC	: Ranking of Alternatives with Weights of Criterion
ROV	: Real Option Valuation
SAW	: Simple Additive Weighting
SBSC	: Sustainability Balanced Scorecard
SDI	: Sustainable Development Investi
SDL	: Service-Dominant Logic
SWARA Step-wise	:Weight Assessment Ratio Analysis
TSKB	: Türkiye Sınai Kalkınma Bankası A.Ş
TOPSIS	: Technique for Order Preference by Similarity to Ideal Solution
TRY	: Turkish Lira
UNEP	: United Nations Environment Programme
WASPAS Weighted	:Aggregated Sum-Product Assessment
VIKOR	: VIšeKriterijumska Optimizacija I Kompromisno Resenje

LIST OF SYMBOLS

r_{ij}	: Normalized elements of decision matrix
a_{ij}	: Elements of decision matrix (DM)
a_j^{min}	: Minimum element in criteria j
a_j^{max}	: Maximum element in criteria j
σ_j	: Standard deviation
c_{jk}	: Linear correlation matrix
q_j	: Key indicator
w_j	: Vector of criteria weights
v_{ij}	: Sum of deviations from normalized values
$v'ij$	: Sum of deviations from the second normalized values
nij	: First normalized value (i. alternative, j. criterion)
$n'ij$	: İkinci (çift) normalize edilmiş değer
xij	: Performance value of the i. alternative on the j. criterion
Qi	: Final score value of the i. alternative

1. INTRODUCTION

For centuries, people have been consuming natural resources, both individually and through firms, to meet their needs. Since natural resources are limited and future generations need these resources, the most efficient use of resources is becoming an increasingly important issue. Developing and implementing new policies for a sustainable life is critical for both individuals and firms (Özevin O. , 2022).

Nowadays, stakeholders expect firms to fulfill their sustainability responsibilities and request information about how they address sustainability. As a natural consequence, firms have begun to respond in corporate reporting forms within the framework of sustainability principles (Ecer F. , 2019).

1.1. Conceptual Framework of Sustainability

The term sustainability (German: Nachhaltigkeit) was first used in Europe in 1713 in the book Sylvicultura Oeconomica, written by German scientist and forester Hans Carl von Carlowitz. The concept of planting trees as a means of achieving "sustained-yield forestry" was later adopted by foresters in France and England (Kuhlman & Farrington, 2010).

After the United Nations World Commission on Environment and Development's Brundtland Report in 1987 defined sustainable development as development that "meets the needs of the present generation without compromising the ability of future generations to meet their own needs," the term became widely used (Kutlu, 2023). Despite its widespread usage and significant influence, this definition of sustainability has drawn criticism for failing to specifically address the unsustainable nature of the employing nonrenewable resources and for generally ignoring the problem of population growth (Bartlett, 1997).

In order to address issues pertaining to the declining link between our global ecological and continuous economic development, the word sustainability was created. Sustainability identified strategies for achieving economic growth while taking purported environmental constraints into account (Chiesa et al., 1999).

From a semantic perspective, sustainability denotes an eternally existing link between an artifact and its surroundings. To put it another way, sustainability is the state in which an artifact and its surrounding environment coexist in harmony and interact without causing harm to one another (Faber & Van Engelen, 2005).

1.2. Importance of Sustainability

By creating a concept of sustainable development in 1987, the World Commission on Environment and Development aimed to solve the issue of conflicts between environmental and development goals. Since then, the notion has been widely discussed and used, and three key components of sustainable development have come to be more recognized (Harris, 2003). *Economic:* A system that is economically sustainable has to be capable of consistently generating commodities and services, maintaining control over the amount of foreign and government debt, and avoiding serious sectoral imbalances that negatively impact industrial or agricultural output.

Environmental: An environmentally sustainable system must maintain a stable resource base while avoiding overexploitation of environmental resources and consuming non-renewable resources moderately only when necessary. This includes the protection of biodiversity, atmospheric stability and other ecosystem services that are not classified as economic resources.

Social: A socially sustainable system requires equitable distribution of opportunity, appropriate provision of social services such as health and education, gender equity, and political responsibility and involvement.

Sustainable development is being investigated by a growing number of firms, trade associations, communities, government planners, non-governmental organizations (NGOs), building and facility owners, and research organizations/laboratories worldwide. They are looking for innovative ways to combine their desire for financial success with the guarantee of environmental preservation and the standard of living for present and future generations (Placet et al., 2005).

1.3. Definition of Corporate Sustainability

The equivalent of the concept of sustainability for firms is called corporate sustainability. Corporate sustainability is defined as meeting the needs of a firm's direct and indirect stakeholders (partners, employees, customers, society, etc.) without compromising the ability to meet the needs of future stakeholders (Dyllick & Kai, 2002). Corporate sustainability emphasizes that firms must consider and protect economic, environmental and social resources while striving to achieve their financial goals.

Nowadays, firms stand out as one of the main factors contributing to the increase in society's well-being. By producing quality goods and services, firms raise living standards. However, despite these positive impacts, firms also cause problems such as environmental pollution and employee rights, which negatively impact society and the environment. The desire of firms stakeholders to closely monitor these negative impacts has led to the rise of responsibility and sustainability issues in firms (Tüm, 2014). According to a recent McKinsey survey, many firms are actively incorporating sustainability principles into their operations. They are doing this by aiming for objectives that go well beyond the previous focus on reputation management, such as energy conservation, the creation of green products, and employee retention and motivation. These initiatives all help firms realize value through growth and return on capital (Bonini & Görner, 2011).

1.4. Corporate Sustainability Reporting

The requirement to inform stakeholders regarding the fulfillment of responsibilities placed on firms by corporate sustainability has led to the necessity of reporting and presenting environmental and social data alongside financial information about firms operations (Once et al., 2015). Sustainability reports, first developed in the 1980s and prepared within specific standards today, are crucial for firms due to the frequent occurrence of economic, social, and environmental crises.

Global Reporting Initiative (GRI) is an independent, worldwide organization that assists firms and other organizations in accepting accountability for their effects by giving them a universal vocabulary to express such effects. Today, improving sustainability is not only a duty but also an obligation for firms. The GRI standards are extensively used to track and report on sustainability in a systematic and transparent way. By allowing firms to openly communicate the social, environmental, and financial effects of their operations, GRI standards foster confidence, particularly among investors, consumers, government agencies, and civil society. GRI reporting enables firms to assess their performance in relation to their sustainability objectives, pinpoint areas of weakness, and create plans for development. Environmentally and socially conscious investors place a high value on reporting that is found on accurate and transparent data. GRI-compliant reports boost investor trust in this way. Sustainability reporting is required by laws like the Corporate Sustainability Reporting Directive (CSRD) of the European Union. The infrastructure offered by GRI complies with these rules. It offers the chance to contrast information from firms across various industries and regions. This makes evaluation procedures easier, both within and outside. The firms can successfully interact with a variety of stakeholders, including staff, clients, suppliers, and locals, thanks to GRI reporting. It helps include sustainability concerns in decision-making processes as well as reporting. This encourages the production of long-term value (GRI (Global Reporting Initiative), 1997).

The content of sustainability reports is determined by the Global Reporting Initiative (GRI) using very strict standards and metrics. GRI, which standardizes sectoral reporting areas, is currently the sole initiative in the field of sustainability reporting (Gençoğlu & Aytaç, 2016).

The primary reason firms create sustainability reports is the belief that these reports will benefit stakeholders and the firms and help achieve specific goals. The main objectives and benefits can be summarized as follows (Herzig & Schaltegger, 2011)**:**

- Identification of goods, services, and firm operations that generate environmental and social effects
- Enhancing corporate image and brand value
- Providing competitive advantages
- Benchmarking and comparison against competitors
- Increasing transparency and accountability in firms
- Delivering internal insights, implementing control procedures, and enhancing employee motivation

Therefore, it is crucial for firms to increase their sustainability activities and inform their stakeholders through sustainability reports.

In light of the information above, the purpose of this study is to evaluate the sustainability performance of firms. The selection of alternative firms was based on the ISO 500 (2024) list, which ranks the 500 largest industrial firms in Türkiye. In order to focus on more successful firms, the top fifty firms on this list were included in the study in the first stage. An examination of the reports available on the official websites of these fifty firms revealed that twenty-one had published corporate sustainability reports aligned with the GRI index. To identify the largest common set of years in which corporate sustainability reports were published by firms, the publication years of these reports were reviewed, and it was found that thirteen firms had released reports for the years 2021, 2022, and 2023. However, four of these thirteen firms did not address all seventeen criteria determined in this study within their reports. Consequently, these four firms were excluded from the study. Ultimately, the corporate sustainability performance of nine firms was evaluated for the years 2021, 2022, and 2023.

It has been observed in the literature that MCDM methods are frequently employed for the purpose of evaluating corporate sustainability performance (Yalçın & Karakaş, 2019). MCDM methods are systematic analysis tools used to determine the most appropriate option in situations where multiple, often conflicting, criteria are present. In real life, decisions cannot usually be made based on a single criterion; different criteria such as cost, quality, sustainability, and risk must be evaluated simultaneously. MCDM methods offer decision-makers the opportunity to conduct numerical and comparative analysis in such situations. They are particularly preferred for complex, multi-optional, and uncertain problems. In this study, a novel hybrid MCDM model integrating the CRITIC and RAWEC methods is proposed to evaluate the corporate sustainability performance of nine selected firms. As far as we know, the MCDM model proposed in our study has been used for the corporate sustainability assessment problem for the first time. Thus, it is thought that this thesis study may fill this gap in the literature.

The criteria to be used as input in the proposed MCDM model were obtained from studies based on the GRI index in the literature. In the proposed MCDM model, objective criteria weights were obtained using CRITIC method. Then alternative firms were ranked using the RAWEC method. In addition, the proposed model was validated by conducting a sensitivity analysis. This proposed model was compared with some ranking MCDM methods, including MARCOS, CRADIS, ARAS, COPRAS, TOPSIS, SAW, WASPAS and EDAS. It was observed that the comparison methods and the proposed model had similar results.

This thesis consists of five sections, including the introduction and conclusion. In Section 2, information is given about the concept of corporate sustainability and studies on corporate sustainability assessment in the literature, and a literature review of the CRITIC and RAWEC methods used in the study is presented. The stages of the CRITIC and RAWEC methods are given in Section 3. Results and discussion as well as the sensitivity analysis are also presented in Section 4. Conclusions are provided in Section 5.

2. THEORETICAL FOUNDATIONS AND LITERATURE REVIEW

Within the scope of this thesis in this section, the literature was reviewed under three headings: The MCDM literature on corporate sustainability assessment, Studies Incorporating the CRITIC Method and Studies Incorporating the RAWEC Method.

2.1. MCDM Literature of Corporate Sustainability Performance

MCDM literature for corporate sustainability evaluation was reviewed. A literature review was conducted methodically.

Numerous studies have been conducted on the measurement of corporate sustainability performance in the banking sector:

Özçelik and Öztürk (2014) applied Grey Relational Analysis (GRA) for evaluating sustainability performance of three banks in Turkey. The evaluation was made based on a total of nine criteria, including four environmental, two social and three economic criteria. Criteria were determined according to GRI index and criteria values were taken from sustainability reports. The criteria weights were determined equally. According to the results of the analysis, TSKB ranked first in terms of sustainability performance, followed by Garanti Bank and Akbank.

Ömürbek et al. (2017) applied Entropy, ARAS, MOORA and COPRAS methods for assessing sustainability performance of banks in Turkey. The assessment was made for seven banks according to a total of thirteen criteria, including two environmental, five operational and six financial criteria. Criteria and criteria values were taken from sustainability reports. Criteria weights were determined using Entropy method, and the corporate sustainability performance of the firms was evaluated using ARAS, MOORA and COPRAS methods. As a result of the study Ziraat Bank ranked first in all three methods used.

Aras et al. (2017) used Entropy and TOPSIS methods for measuring corporate sustainability performance of a bank operates in Turkey. The assessment was made for five years according to a total of one hundred and twenty-eight criteria, including twenty-five environmental, ninety-two social and thirteen economic criteria. Criteria were determined based on different indexes such as GRI, ACCA, UNEP and criteria values were taken from sustainability reports. Criteria weights were determined using Entropy method, and the corporate sustainability performance of the firm was evaluated using TOPSIS method. The results showed that the corporate sustainability performance of firm tended to increase in the period examined and economic dimension has the highest impact on sustainability performance.

Aras et al. (2018) suggested Entropy and TOPSIS methods for evaluating corporate sustainability performance. The four firms operating in the banking sector in Turkey were evaluated according to a total of eighty-six criteria, including twenty-one environmental, forty-four social and ten economic criteria. Criteria were determined based on literature and sustainability reports and criteria values were taken from sustainability reports. Criteria weights were determined using Entropy method, and the three-year corporate sustainability performance of the banks was evaluated using TOPSIS method. It was concluded that rather than having the best score in one or more dimensions of sustainability, improvements across all dimensions contribute significantly to the bank's overall sustainability performance.

Yılmaz and İnel (2018) proposed a model integrated balanced scorecard approach and TOPSIS method for the measurement of corporate sustainability performance. The measurement was made for six banks for 2015 and seven banks for 2016 based on a total of twenty criteria, including five environmental, two social, six corporate and seven economic criteria. Criteria and criteria values were taken from GRI based sustainability reports. While the criteria weights were determined using the Entropy method, the corporate sustainability performance of the banks was evaluated using the TOPSIS method. As a result, it was seen that the same bank had the best sustainability performance in the measurements for both years.

Ecer (2019) used Entropy and ARAS methods for the assessment of corporate sustainability performance. The assessment was made for five banks according to a total of seventeen criteria, including six environmental, six social and five economic criteria. Criteria and criteria values were taken from GRI based sustainability reports and Turkish Banks Association. While the criteria weights were determined using the Entropy method, the corporate sustainability performance of the banks was evaluated using the ARAS method. Sensitivity analysis was conducted by adjusting the weights to determine how ranking is affected. The results show that Türkiye İş Bankası is the bank with the best corporate sustainability performance.

Kestane and Kurnaz (2019) applied GRA method for the assessment of corporate sustainability performance. The assessment was made for fourteen banks operates in Turkey a total of thirty-one criteria, including nine environmental, six social and sixteen economic criteria. Criteria and criteria values were taken from sustainability reports. While the criteria weights were determined equally, the corporate sustainability performance of the banks was evaluated using the GRA method. In terms of environmental sustainability, Akbank had the best performance among fourteen banks, while the worst-performing bank was the privately owned Turkish Economy Bank. In terms of economic sustainability, Türkiye İş Bankası had the best performance among fourteen banks.

Stauropoulou and Sardianou (2019) proposed a framework to understand and measure corporate sustainability performance in banking sector. The framework is based on GRI index and AHP method. A total of thirty-two criteria, including thirteen environmental, eleven social and eight economic criteria were determined for measuring the corporate sustainability performance. It was concluded that the proposed framework provides a tool for benchmarking a firm over the years and for comparatively analyzing banking firms.

Eş and Kamacı (2020) applied Entropy, EDAS and ARAS methods for the evaluation of corporate sustainability performance. The evaluation was made for seven banks according to a total of eleven criteria, including two environmental, four social and five economic criteria. Criteria and criteria values were taken from sustainability reports. While the criteria weights were determined using the Entropy method, the five-year corporate sustainability performance of the banks was evaluated using EDAS and ARAS methods. It was concluded that İşbank had the highest performance score in terms of corporate sustainability for both methods across all years.

Yarlıkaş and Öztürk (2021) applied CRITIC and MOORA methods for the assessment of corporate sustainability performance. The measurement was made for six banks according to a total of fourteen criteria, including four environmental, four social and six economic criteria. The criteria were determined based on literature and criteria values were taken from sustainability reports. While the criteria weights were determined using the CRITIC method, the corporate sustainability performance of the banks was evaluated using MOORA method. The results show that Türkiye İş Bankası is the bank with the best corporate sustainability performance.

Ecer and Pamucar (2022) proposed a novel LOPCOW-DOBI methodology for corporate sustainability performance assessment. The measurement was made for nine banks according to a total of seventeen criteria, including six environmental, six social and five economic criteria. Criteria were determined according to GRI index and criteria values were taken from sustainability reports. While the criteria weights were determined using the LOBCOW method, the corporate sustainability performance of the banks was evaluated using DOBI method. It was concluded that Garanti BBVA performed better than other banks.

Doğan and Kılıç (2022) used Entropy and GRA methods for the assessment of corporate sustainability performance. The measurement was made for eight banks according to a total of 30 criteria, including ten environmental, eleven social, five financial and four corporate responsibility criteria. While the criteria weights were determined using the Entropy method, the two-year corporate sustainability performance of the banks was evaluated using GRA method. It was concluded that Garanti BBVA performed better than other banks.

Bektaş (2022) applied MEREC and ARAS methods for the evaluation of corporate sustainability performance. The measurement was made for three banks according to a total of eight criteria, including two environmental, three social and three economic criteria. The criteria values were taken from annual and sustainability reports and Turkish Banks Association database. While the criteria weights were determined using the MEREC method, the eight-year corporate sustainability performance of the banks was evaluated using ARAS method. It was concluded that Vakıfbank performed better than other banks.

Bektaş (2023) used LOPCOW and CoCoSo methods for the assessment of corporate sustainability performance for a bank. The assessment was made according to a total of 16 criteria, including five environmental, five social and six economic criteria. The criteria values were taken from annual and sustainability reports and Turkish Banks Association database. Criteria weights were determined using the LOPCOW method, and the corporate sustainability performance of the bank was evaluated using CoCoSo method. It was conducted that the years with the best sustainability performance were 2018, 2017 and 2014, respectively.

Yıldırım and Yaman (2023) applied Entropy, TOPSIS and ARAS methods for the analysis of corporate sustainability performance of five banks. The assessment was made according to a total of nine criteria, including one environmental, five social and three economic criteria. The criteria were determined based on literature and sustainability reports. Criteria weights were determined using the Entropy method, and the five-year corporate sustainability performance of the banks was evaluated using TOPSIS and ARAS methods. The results showed that the sustainability performance of banks varies depending on the years and the analysis method.

Hüseyin and Çetin (2024) applied TOPSIS method for analyzing corporate sustainability reports. The analysis was made for eight banks according to a total of nineteen criteria, including five environmental, eight social and six economic criteria. It was concluded that Yapıkredi performed better than other banks.

Çıtak and Ünlü (2024) applied MEREC and COBRA for the assessment of corporate sustainability performance. The assessment was made for seven banks according to a total of seventy-five criteria. The criteria were determined based on sustainability indexes and literature. Criteria weights were determined using the MEREC method, and the corporate sustainability performance of the banks was evaluated using COBRA method. It was concluded that Akbank performed better than other banks.

Chao (2024) applied Entropy and TOPSIS methods for the evaluation of corporate sustainability performance of five banks. The assessment was made according to a total of fifteen criteria. While the criteria weights were determined using the Entropy method, the corporate sustainability performance of the banks was evaluated using TOPSIS method. It was concluded that ICBC performed better than other banks.

Aydın (2025) used MAXC and ROV methods for the assessment of corporate sustainability performance. The assessment was made for a firm operating in banking industry based on a total of seventeen criteria. The criteria were determined based on Refinitiv Eikon database. Criteria weights were determined using MAXC methods, and the eleven-year corporate sustainability performance of the bank was evaluated using ROV method. The results showed that 2022, 2012 and 2014 were the strongest years financially, while 2021, 2022 and 2020 were the strongest years environmentally and socially.

Six studies have been conducted on measuring corporate sustainability performance in the oil and gas sector:

Infante et al. (2013) applied ELECTREE III method for ranking firms according to corporate sustainability performance. The five largest firms with the highest market value operating in the oil and gas sector were evaluated according to a total of fifteen criteria, including ten environmental, three social and two economic criteria. Criteria were determined according to GRI index and criteria values were taken from sustainability reports. The weights of criteria were assigned through surveys and interviews with experts. Sensitivity analysis was conducted by adjusting the weights and some criteria settings to ensure the results were more robust. The results showed that combining sustainable strategies with the Triple Bottom Line makes a difference from a corporate and operational perspective.

Goyal and Rahman (2014) developed an AHP based model to evaluate corporate sustainability performance. The assessment was made for a firm operating in the oil and gas sector based on a total of twenty-one criteria, including eleven environmental, six social and four economic criteria. The criteria were determined in line with literature and expert opinions and criteria values were taken from sustainability reports. The weights of criteria were obtained from experts through surveys. It is concluded that the model can help analyze corporate sustainability performance in terms of competitive advantage in the long term and help stakeholders evaluate the corporate sustainability performance of specific firms and their relative performance with their competitors.

Rabbani et al. (2014) proposed a model integrated sustainability balanced scorecard (SBSC), ANP and fuzzy COPRAS methods for evaluating corporate sustainability performance. The six oil producing firms in Iran were evaluated according to a total of twenty criteria, including five environmental, twelve social and three economic criteria. The criteria were determined in line with literature and expert opinions. While the criteria weights were determined using the ANP method, the corporate sustainability performance of the six firms was evaluated using the fuzzy COPRAS method. The results show that the proposed model has a high potential to evaluate and rank the corporate sustainability performance of oil producing firms.

Vivas et al. (2019) applied PROMETHEE method for the measurement of corporate sustainability performance. The measurement was made for a firm operating in the oil and gas sector based on a total of twenty criteria, including seven environmental, eight social and five economic criteria. Criteria and criteria values were taken from GRI based sustainability reports. Criteria weights were determined equally, and the nine-year corporate sustainability performance of the firm was evaluated using the PROMETHEE method. Sensitivity analysis was conducted by adjusting the weights and number of the criteria to ensure the results were more robust. As a result, the best sustainable performance of firm was seen in 2010 and 2011.

In addition, PROMETHEE has proven to be a suitable tool for sustainability performance analysis.

Vivas et al. (2020) applied AHP and PROMETHEE for the evaluation of sustainability performance. The assessment was made for a firm operates in oil and gas industry in Brazil according to a total of nineteen criteria, including six environmental, nine social and four economic criteria. The criteria were determined based on different sustainability indexes such as GRI, CSD, SDI. While the criteria weights were determined using the AHP method, the corporate sustainability performance of the firm was evaluated using the PROMETHEE method. The results showed that the sustainability performance of the selected firm from 2009 to 2017, with the best performance demonstrated in 2011.

Reig-Mullor et al. (2022) proposed a methodology using Neutrosophic AHP and TOPSIS for evaluation of corporate sustainability performance. The measurement was made for nine firms that operate in gas and oil energy sector according to a total of ten criteria, including three environmental, four social and three economic criteria. The criteria values were taken from EIKON database. Criteria weights were determined using Neutrosophic AHP method, and the corporate sustainability performance of the firms was evaluated using TOPSIS method. It was concluded that China Petroleum & Chemical Corp had the highest performance score in terms of corporate sustainability.

Six studies have been conducted on measuring corporate sustainability performance in the energy sector:

Medel-Gonzalez and Salomon (2015) proposed a methodology using ANP and AHP methods to measure corporate sustainability performance. The four firms operating in the energy sector in Cuba were evaluated according to a total of eighteen criteria, including seven environmental, six social and five economic criteria. Criteria were selected based on GRI index, ISO 14031 standard and Cuban energy sector indicators. While the criteria weights were determined using the ANP method, the corporate sustainability performance of the four firms was evaluated using the AHP method. It was concluded that the model developed using ANP and AHP methods will be useful in future studies for measuring corporate sustainability performance.

Garcia et al. (2016) applied Integrated Environmental Evaluation (IEE) model for evaluating corporate sustainability performance. The assessment was made for a firm operating in the electricity industry in Brazil based on a total of seventy-four criteria, including thirty environmental, thirty-six social and eight economic criteria. Criteria and criteria values were taken from sustainability reports. Criteria weights were determined equally, and the four-year corporate sustainability performance of the firm was evaluated using IEE method. The results show that the model has potential to support decisions and combine traditional management control systems with corporate sustainability performance measuring and reporting activities.

Öztel et al. (2018) used Entropy and TOPSIS for measuring corporate sustainability performance. The measurement was made for a firm operating energy sector in Turkey based on a total of forty-two criteria, including eleven environmental, seventeen social and fourteen economic criteria. Criteria and criteria values were taken from sustainability reports. Criteria weights were determined using Entropy method, and the seven-year corporate sustainability performance of the firm was evaluated using TOPSIS method. The results showed that the three dimensions of sustainability were found to exhibit inconsistent performance. Firms must invest in environmental and social dimensions as well as economic dimensions to be more sustainable.

Yalçın and Karakaş (2019) proposed an approach integrated CRITIC and EDAS methods for the evaluation of corporate sustainability performance. The evaluation was made for a firm operating in the energy sector based on a total of thirty-two criteria, including nine environmental, fourteen social and nine economic criteria. Criteria were determined based on sustainability reports and expert opinions and criteria values were taken from annual and sustainability reports. Criteria weights were determined using CRITIC method, and the nine-year corporate sustainability performance of the firm was evaluated using the EDAS method. The results showed that sustainability performance of the firm was found to exhibit inconsistent performance. In addition, the approach proposed in the study is an effective and appropriate approach that can be used in evaluating corporate sustainability performance.

Ersoy and Taslak (2022) performed comparative analysis of MCDM methods for the assessment of corporate sustainability performance. The measurement was made for thirty firms that operate in energy sector according to a total of twenty-three criteria, including eight environmental, seven social and eight economic criteria. Criteria values were taken from sustainability and annual reports. While the criteria weights were determined using the Entropy method, the corporate sustainability performance of the firms was evaluated using PIV, ROV, GRA and MARCOS methods. Sensitivity analysis was conducted by determining criteria weights using improved Entropy method. It was concluded that Asian energy firms are more sustainable than European energy firms. In addition, it has been observed that the criterion weights obtained using different methods differ in the results.

Özevin (2022) applied Entropy and TOPSIS methods for measuring corporate sustainability performance. The measurement was made for twelve firms that operate in manufacturing and energy sectors according to a total of twelve criteria, including four environmental, four social and four economic criteria. Citeria values were taken from sustainability reports. Criteria weights were determined using Entropy method, and the three-year corporate sustainability performance of the firms was evaluated using TOPSIS method. The results showed that the firms with the lowest sustainability performance are those producing energy through stone and soil-based industries, while the firms with the highest performance are those engaged in technology-intensive production.

Three studies were conducted on measuring corporate sustainability performance in the durable consumer goods and consumer electronics sector:

Ersoy (2016) applied Entropy, TOPSIS and GRA methods for evaluating corporate sustainability performance. The assessment was made for a firm operating in the consumer durables and consumer electronics industry in Turkey based on a total of seventy-four criteria, including eight environmental, five social and seventeen economic criteria. Criteria and criteria values were taken from sustainability reports. Criteria weights were determined using Entropy method, and the four-year corporate sustainability performance of the firm was evaluated using TOPSIS and GRA methods. The results showed that the corporate sustainability performance of firm tended to increase in the period examined.

Sofyalıoğlu and Sürücü (2018) proposed AHP and TOPSIS methos for measuring corporate sustainability performance. The measurement was made for a firm operating consumer durables and consumer electronics industry in Turkey based on a total of thirteen criteria, including three environmental, four social and six economic criteria. Criteria and criteria values were taken from sustainability reports and annual reports of the firm. Criteria weights were determined using AHP method, and the six-year corporate sustainability performance of the firm was evaluated using TOPSIS method. It is observed that corporate sustainability performance follows a fluctuating course in the period examined and social dimension has the highest impact on sustainability performance.

Ersoy (2018) applied Entropy, TOPSIS and GRA methods for measuring corporate sustainability performance. The measurement was made for a firm operating consumer durables and consumer electronics industry in Turkey based on a total of twenty-five criteria, including seven environmental, five social and sixteen economic criteria. Criteria and criteria values were taken from GRI based sustainability reports. Criteria weights were determined using Entropy method, and the seven-year corporate sustainability performance of the firm was evaluated using TOPSIS and GRA methods. It was concluded that proposed methods can be used effectively in sustainability performance measurement. Additionally, the TOPSIS and GRA methods used in the study gave different ranking results.

Three studies were conducted on measuring corporate sustainability performance in the insurance sector:

Beiragh et al. (2020) proposed a model for the assessment of corporate sustainability performance for insurance firms. The assessment was made for fourteen insurance firms operates in Iran according to a total of fifteen criteria, including three environmental, four social and eight economic criteria. Criteria and criteria values were taken from Iran Central Insurance database. Corporate sustainability performance of firms was evaluated using AHP method. The results showed that three firms Dana, Razi and Dey had the best sustainability performance.

Taşçı (2024) proposed a model integrated SWARA, MEREC and COBRA methods COBRA for the assessment of corporate sustainability performance. The assessment was made for a firm operating in insurance sector based on a total of thirteen criteria, including five environmental, four social and four economic criteria. Criteria weights were determined using the SWARA and MEREC methods, and the corporate sustainability performance of the firm was evaluated using COBRA method. It was conducted that the year with the best sustainability performance was 2022 and the year with the worst sustainability performance was 2018.

Ünal (2025) applied Spherical Fuzzy AHP, TOPSIS, CODAS and PIV methods for the evaluation of corporate sustainability performance of insurance firms. The assessment was made for five firms according to a total of eleven criteria, including three environmental, four social and four economic criteria. Criteria weights were determined using Spherical Fuzzy AHP methods, and the corporate sustainability performance of the firms was evaluated using TOPSIS, CODAS and PIV methods. It was concluded that Euroko Insurance Firm performed better than other firms.

There are eighteen studies on measuring corporate sustainability performance in various sectors except banking, oil and gas, energy, consumer durables and consumer electronics, and insurance:

Alp et al. (2015) used Entropy and MAUT method for assessing corporate sustainability performance. The assessment was made for a firm operating in the chemical industry based on a total of ninety criteria, including thirty-one environmental, thirty-eight social and twenty-one economic criteria. The criteria and criteria values were taken from sustainability report of the firm. Criteria weights were determined using Entropy method, and the four-year corporate sustainability performance of the firm was evaluated using MAUT method. The results showed that while economic and social sustainability performances show an increasing trend, environmental sustainability performance appears to be unstable.

Calabrese et al. (2016) proposed fuzzy AHP model for assessing corporate sustainability performance. The assessment was made for a firm operating in the water technologies industry in Italia based on ninety-one criteria. The criteria were determined according to the GRI index, and the model recommends the GRI index for sustainability reporting. The weights of criteria were obtained from expert opinions, and sustainability performance assessment made by AHP method. It was concluded that the proposed model allows firms to effectively identify corporate sustainability performance assessments indicators and support firms to create sustainability reports based on GRI index.

Ersoy (2017) proposed a MCDM methodology for evaluating corporate sustainability performance. The assessment was made for a firm operating in the rubber and coating sector based on a total of twenty criteria, including eight environmental, five social and seven economic criteria. Criteria and criteria values were taken from GRI based sustainability reports. Criteria weights were determined using Entropy, CRITIC, SD and MW methods, and the five-year corporate sustainability performance of the firm was evaluated using COPRAS and VIKOR methods. It was concluded that the approach proposed in the study is an effective and appropriate approach that can be used in evaluating corporate sustainability performance.

Liern and Perez-Gladish (2018) applied fuzzy TOPSIS method for ranking corporate sustainability performance. The evaluation was made for seventy-nine firms operating in various sectors. Criteria and criteria values were taken from Equitics and Compustat databases. Criteria weights were determined equally, and corporate sustainability performance of the firms was evaluated using fuzzy TOPSIS method. The results showed that Henkel ranked first among the seventy-nine firms.

Kaya and Öztel (2018) used Entropy and GRA methods for the assessment of corporate sustainability performance. The measurement was made for a firm operating automotive sector in Turkey based on a total of forty-eight criteria, including eleven environmental, twenty-four social and thirteen economic criteria. Criteria and criteria values were taken from sustainability reports. Criteria weights were determined using Entropy method, and the four-year corporate sustainability performance of the firm was evaluated using GRA method. The results showed that 2016 have the best corporate sustainability performance.

Bilbao-Terol et al. (2018) proposed a methodology for assessing the social dimension of corporate sustainability. The assessment was made for eight firms operating in various sectors in Spain based on fourteen social criteria. Criteria and criteria values were taken from GRI based sustainability reports. A special multi-criteria model used for assessment. It was concluded that the model would help investors with social concerns who want to make their own financial investments to make more informed decisions.

Wicher et al. (2019) proposed a methodology using fuzzy ANP method for the assessment of corporate sustainability performance. The assessment was made for a firm operating metallurgical industry based on a total of eleven criteria, including four environmental, three social and four economic criteria. Criteria and criteria values determined based on literature and World Steel Association. It was concluded that the proposed approach is a suitable tool for corporate sustainability performance evaluation of industrial firms.

Aksoylu and Taşdemir (2020) used TOPSIS method for the assessment of corporate sustainability performance. The assessment was made for six firms operating in manufacturing industry according to a total of fifteen criteria, including six environmental, four social and five economic criteria. Criteria and criteria values were taken from sustainability reports. While the criteria weights were determined equally, the corporate sustainability performance of the firms was evaluated using the TOPSIS method. It was concluded that Otokar had the highest performance score in terms of corporate sustainability.

Aktaş and Demirel (2021) used Entopy, VIKOR, TOPSIS and MAUT methods for evaluating corporate sustainability performance. The evaluation was made for a furniture firm based on a total of thirty-three criteria, including eleven environmental, fifteen social and seven economic criteria. The criteria were determined based on literature and sustainability indexes such GRI, UNCG. Criteria weights were determined using the Entropy method, and the six-year corporate sustainability performance of the firm was evaluated using VIKOR, TOPSIS and MAUT methods. The results show that VIKOR and MAUT have the same ranking for economic and environmental dimensions, but different results were obtained in terms of social dimension. The results showed that the sustainability performance of the selected firm from 2009 to 2017, with the best performance demonstrated in 2018.

Bezerra et al. (2021) applied PROMETHEE II method for assessing corporate sustainability performance. The assessment was made for four firms operating in construction industry according to a total of thirteen criteria, including seven environmental, two social, two corporate and two economic criteria. The results showed that the model is mathematically consistent and easy to implement.

Özkan and Ağ (2021) proposed a model integrated CRITIC and ARAS methods for the assessment of corporate sustainability performance. The assessment was made for six firms operating in manufacturing sector based on a total of 18 criteria, including six environmental, five social and seven economic criteria. Criteria and criteria values were taken from sustainability reports. While the criteria weights were determined using the CRITIC method, the five-year corporate sustainability performance of the firms was evaluated using ARAS method. It was concluded that Otokar had the highest performance score in terms of corporate sustainability.

Sarker et al. (2021) proposed a model integrated fuzzy AHP, SAW, fuzzy TOPSIS and fuzzy VIKOR methods for the measurement of corporate sustainability performance. The measurement was made for three firms operating in leather industry according to a total of twenty-one criteria, including six environmental, eight social and seven economic criteria. The criteria were determined based on sustainability indexes. Criteria weights were determined using fuzzy AHP method, and the corporate sustainability performance of the firms was evaluated using SAW, fuzzy TOPSIS and fuzzy VIKOR methods. It was concluded that the proposed model is a suitable tool for corporate sustainability performance measurement for industrial managers who want to evaluate the effectiveness of their sustainability strategies.

Arsu and Arsu (2023) applied MEREC and CoCoSo methods for the evaluation of corporate sustainability performance. The measurement was made for fourteen firms that operate manufacturing industry according to a total of eleven criteria, including five environmental, three social and three economic criteria. The criteria were determined based on literature and criteria values were taken from sustainability reports. Criteria weights were determined using the MEREC method, and the corporate sustainability performance of the firms was evaluated using CoCoSo method. It was concluded that the firms with the highest corporate sustainability performance were Türk Traktör, Ford, Tofaş and Otokar.

Tanç and Çardak (2024) used TOPSIS method for evaluating corporate sustainability performance. The evaluation was made for twenty-five firms that operate various sectors according to a total of five criteria. It was concluded that Anadolu Efes had the best sustainability performance, whereas Petkim has the worst.

Deng et al. (2025) applied DEMATEL, ANP and VIKOR methods for the evaluation of corporate sustainability performance. The measurement was made for a firm that operates pharmaceutical industry according to a total of twelve criteria, including two environmental, six social and four economic criteria. The criteria were determined based on literature and expert opinions. Criteria weights were determined using the DEMATEL and ANP methods, and the corporate sustainability performance of the firm was evaluated using VIKOR method. The results showed that environment is the most important dimension for corporate sustainability.

Rençber (2024) used Entropy and TOPSIS methods for measuring corporate sustainability performance. The assessment was made for a firm operating in aviation industry based on a total of twenty-two criteria, including eight environmental, nine social and five economic criteria. The criteria were determined based on sustainability reports and literature. Criteria weights were determined using the Entropy method, and the nine-year corporate sustainability performance of the firm was evaluated using the TOPSIS method. The results showed that 2019 was the most successful year in terms of environmental sustainability performance, 2021 in terms of social sustainability performance, and 2022 in terms of economic sustainability performance.

Ayyıldız and Öztel (2024) applied Entropy and MAIRCA methods for the assessment of corporate sustainability performance. The assessment was made for a firm operating in defense industry based on a total of twenty-four criteria, including nine environmental, eight social and seven economic criteria. Criteria weights were determined using the Entropy method, and the three-year corporate sustainability performance of the firm was evaluated using the MAIRCA method. The results showed that economic sustainability, which remained at a low level in 2020 due to the restrictive effect of the pandemic, showed a recovery trend in 2021 and 2022.

Silva et al. (2024) proposed a methodology using 7E model for the measurement of corporate sustainability performance. The measurement was made for four firms that operate tea sector according to a total of ninety-six criteria. The criteria were determined based on different sustainability indexes, literature and author opinions. It was concluded that the proposed approach is a suitable tool for managers and organizations to measure corporate sustainability performance.

The analysis of the studies in the literature is given in Table 2.1.

Table 2.1. Literature Review of Corporate Sustainability Performance Assessment

#	Article	# of criteria	Criteria Index/Source	MCDA Method for CSP	Weight Determination Method	Sector	# of Firms
1	(Infante et al., 2013)	15	GRI	ELEKTRE III	Expert opinion	Oil and Gas	5
2	(Goyal & Rahman, 2014)	21	Literature & Expert Opinion	AHP	Expert opinion	Oil and Gas	1
3	(Rabbani et al., 2014)	20	Literature & Expert Opinion	Fuzzy COPRAS	ANP	Oil and Gas	6
4	(Özçelik & Öztürk, 2014)	9	GRI	GRA	Equal weights	Banking	3
5	(Alp et al., 2015)	90	Sustainability Reports	MAUT	Entropy	Chemical	1
6	(Medel-González et al., 2015)	18	GRI & ISO14031 & Energy Sector Indicators	AHP	ANP	Energy	4
7	(Garcia et al., 2016)	74	Sustainability Reports	IEE	Equal weights	Energy	1
8	(Ersoy, 2016)	74	Sustainability Reports	TOPSIS and GRA	Entropy	Consumer durables and consumer electronics	1
9	(Calabrese et al., 2016)	91	GRI	AHP	Expert opinion	Water Technologies	1
10	(Ömürbek et al., 2017)	13	Sustainability Reports	ARAS, MOORA and COPRAS	Entropy	Banking	7
11	(Aras et al., 2017)	128	GRI & ACCA & UNEP	TOPSIS	Entropy	Banking	1
12	(Ersoy, 2017)	20	GRI	COPRAS and VIKOR	Entropy, CRITIC, SD and MW method	Rubber and Coating	1
13	(Liern & Pérez-Gladish, 2018)	-	Equitics and Compustat database	Fuzzy TOPSIS	Equal weights	Various sectors	79
14	(Sofyalıoğlu & Sürücü, 2018)	13	Sustainability Reports	TOPSIS	AHP	Consumer durables and consumer electronics	1
15	(Öztel et al., 2018)	42	Sustainability Reports	TOPSIS	Entropy	Energy	1
16	(Ersoy, 2018)	25	GRI	TOPSIS and GRA	Entropy	Consumer durables and consumer electronics	1
17	(Kaya & Öztel, 2018)	48	Sustainability Reports	GRA	Entropy	Automotive	1
18	(Aras et al., 2018)	56	Literature & Sustainability Reports	TOPSIS	Entropy	Banking	4
19	(Bilbao-Terol et al., 2018)	14	GRI	Special MCDA	-	Various sectors	8
20	(Yılmaz & Nuri İnel, 2018)	20	GRI	TOPSIS	Entropy	Banking	6
21	(Yalçın & Karakaş, 2019)	32	Sustainability Reports & Expert opinion	EDAS	CRITIC	Energy	1
22	(Vivas et al., 2019)	20	GRI	PROMETHEE	-	Oil and Gas	1
23	(Ecer F. , 2019)	17	GRI & Turkish Bank Association	ARAS	Entropy	Banking	5
24	(Wicher et al., 2019)	11	Literature & World Steel Association	Fuzzy ANP	-	Metallurgy	1

25	(Kestane & Kurnaz, 2019)	31	Sustainability Reports	GRA	Equal weights	Banking	14
26	(Stauropoulou & Sardianou, 2019)	32	GRI	AHP	Expert opinion	Banking	-
27	(Gharizadeh Beiragh et al., 2020)	15	Iran Central Insurance database	AHP	Expert opinion	Insurance	14
28	(de Castro Vivas et al., 2020)	19	GRI, CSD and SDI	PROMETHEE	AHP	Oil and Gas	1
29	(Aksoylu & Taşdemir, 2020)	15	Sustainability Reports	TOPSIS	Equal weights	Manufacturing	6
30	(Eş & Kamacı, 2020)	11	Sustainability Reports	EDAS and ARAS	Entropy	Banking	7
31	(Aktaş & Demirel, 2021)	33	GRI and UNCG	VIKOR, TOPSIS and MAUT	Entropy	Furniture	1
32	(Bezerra et al., 2021)	13	-	PROMETHEE II	Equal weights	Construction	4
33	(Özkan & Ağ, 2021)	18	Sustainability Reports	ARAS	CRITIC	Various sectors	6
34	(Sarker et al., 2021)	21	Sustainability Reports	SAW, Fuzzy TOPSIS and Fuzzy VIKOR	Fuzzy AHP	Leather	3
35	(Yarlıkaş & Öztürk, 2021)	14	Sustainability Reports	MOORA	CRITIC	Banking	5
36	(Ecer & Pamucar, 2022)	17	GRI	DOBI	LOPCOW	Banking	9
37	(Ersoy & Taslak, 2023)	23	Sustainability Reports	PIV, ROV, GRA and MARCOS	Entropy	Energy	30
38	(Reig-Mullor et al., 2022)	10	EIKON database	TOPSIS	Neutrosophic AHP	Oil and Gas	9
39	(Özevin, 2022)	12	Sustainability Reports	TOPSIS	Entropy	Manufacturing & Energy	12
40	(Doğan & Kılıç, 2022)	30	-	GRA	Entropy	Banking	6
41	(Bektaş, 2022)	8	Sustainability Reports & Turkish Bank Association	ARAS	MEREC	Banking	3
42	(Arsu & Arsu, 2023)	11	Literature	CoCoSo	MEREC	Various sectors	14
43	(Bektaş, 2023)	16	Sustainability Reports & Turkish Bank Association	CoCoSo	LOPCOW	Banking	1
44	(Yıldırım & Yaman, 2023)	9	Literature & Sustainability Reports	TOPSIS and ARAS	Entropy	Banking	5
45	(Hüseyin & Çetin, 2024)	19	-	TOPSIS	-	Banking	8
46	(Çıtak & Ünlü, 2024)	75	Literature & Sustainability Indexes	COBRA	MEREC	Banking	7
47	(Tanç & Çardak, 2024)	5	-	TOPSIS	-	Various sectors	25
48	(Taşci, 2024)	13	-	COBRA	SWARA & MEREC	Insurance	1
49	(Deng et al., 2025)	12	Literature & Expert Opinion	VIKOR	DEMATEL & ANP	Pharmaceutical	1
50	(Rençber, 2024)	22	Literature & Sustainability Reports	TOPSIS	Entropy	Aviation	1
51	(Ayyildiz & Öztel, 2024)	24	-	MAIRCA	Entropy	Defense	1
52	(Chao, 2024)	15	-	TOPSIS	Entropy	Banking	5

53	(Silva et al., 2024)	96	Sustainability Indexes	7E	-	Tea	4
54	(Ünal, 2025)	11	-	TOPSIS, CODAS and PIV	Spherical Fuzzy AHP	Insurance	5
55	(Aydın, 2025)	17	EIKON database	ROV	MAXC	Banking	1
	This Thesis Study	**17**	**GRI based Literature**	**RAWEC**	**CRITIC**	**Various sectors**	**9**

2.2. Studies Incorporating CRITIC Method

There are many studies in the literature using the CRITIC method. The MCDM model studies incorporating the CRITIC method between 2020 and 2025 are given in Table 3.1.

Table 2.2. The MCDM model studies incorporating the CRITIC method between 2020-2025

Article	Methodology	Decision Problem
(Krishnan et al., 2021)	Distance Correlation Based **CRITIC** (D-CRITIC)	Objective weight estimation for smartphone criteria
(Li et al., 2022)	**CRITIC** and VIKOR	Weighting risk indices for submarine pipelines and determining critical/priority lines
(Mestanza & Bakhat, 2022)	**CRITIC** and VIKOR	Overtourism assessment, prioritization of sustainable measures
(Xu et al., 2020)	NSGA-II (metaheuristic), **CRITIC** and TOPSIS	Configuration optimization of off-grid hybrid energy systems (wind/PV/hydrogen) and ranking of alternatives
(Zhong et al., 2023)	Improved **CRITIC** (methodological development)	Evaluating thermal coal suppliers
(Yin et al., 2023)	**CRITIC** and TOPSIS	Smart community governance performance assessment
(Luo et al., 2024)	BWM (Best-Worst), **CRITIC**, VIKOR	Assessing investment alternatives in the oil/gas sector
(Akram et al., 2024)	Pythagorean fuzzy rough numbers based **CRITIC** and REGIME	Developing a new methodology based on Pythagorean fuzzy rough numbers
(Bilişik et al., 2024)	Interval-valued intuitionistic fuzzy sets based **CRITIC** and TOPSIS	Determining the most appropriate mode of transportation
(Haktanır & Kahraman, 2022)	Picture fuzzy sets based **CRITIC** and REGIME	Selection of wearable health technology (WHT)
(Naz et al., 2024)	PULq-ROFS (probabilistic uncertain linguistic q-rung orthopair fuzzy sets) based **CRITIC** and VIKOR	Selection of industrial robots
(Abdel-Basset & Mohamed, 2020)	**CRITIC** and TOPSIS	Assessing sustainable supply chain risks
(Yu et al., 2024)	AHP, **CRITIC** and TOPSIS	Assessing young consumer preferences; Product design prioritization
(Hassan et al., 2023)	**CRITIC** and TOPSIS	Site selection for large-scale solar photovoltaic (PV) systems: weighting technical, economic, and environmental criteria and ranking alternatives
(Alrababah & Gan, 2023)	**CRITIC** and VIKOR	Importance ranking of product aspects based on customer reviews
(Kumaran, 2022)	**CRITIC** and VIKOR	Comparing and ranking the financial performance of public offering (IPO) firms
(Razzaq et al., 2025)	SWARA, **CRITIC** and COPRAS	Evaluating digital marketing strategies
(Ünver & Olgun, 2023)	CFV-q-ROFS, Fuzzy **CRITIC**, TOPSIS	Evaluating strategies for climate change management
(Liu et al., 2025)	**CRITIC,** and TOPSIS, fuzzy approaches	Evaluating and prioritizing alternatives in educational technologies. Finding the best sustainable option among insulation materials
(Dweib & Zortuk, 2023)	**CRITIC**, TOPSIS, VIKOR, and MOORA	Finding the best sustainable option among insulation materials

(Yazid et al., 2023)	**CRITIC** and TOPSIS	Selection of material handling equipment (MHE)
(Cilek & Seyranlıoğlu, 2023)	Entropy, **CRITIC**, IDDWS, PROMETHEE	Portfolio optimization of firms in the stock market – retail trade sector
(Kaur et al., 2023)	Neutrosophic based **CRITIC** and TOPSIS	Aircraft selection problem
(Ayyildiz et al., 2023)	**CRITIC**, Entropy, Standard Deviation, TOPSIS	Evaluation of universities from the perspective of students
(Çakalı & Baloğlu, 2022)	**CRITIC**, Entropy, TOPSIS, VIKOR	Profitability analysis and ranking of manufacturing subsectors in Turkey
(Şimşek et al., 2025)	**CRITIC**, LOPCOW, Machine Learning	Selection of electric vehicles
(Aggarwal et al., 2024)	Standard Deviation, **CRITIC,** GINI, Entropy, TOPSIS, MABAC, VIKOR CODAS, MAIRCA	Assessment of crime rates against women in Indian states
(Merkepçi, 2024)	**CRITIC**, Entropy, Standard Deviation, Evamix, ARAS, TOPSIS, VIKOR, WASPAS	The effect of different weighting methods on MCDM results
(Van Dua et al., 2024)	**CRITIC**, Entropy, MEREC, LOPCOW, MARA, RAM, PIV	Material selection practices
(Deepa et al., 2019)	**CRITIC**, AHP, COPRAS	Assessment of peanut crop areas
(Basilio et al., 2025)	**CRITIC**, Entropy, TOPSIS	Ranking firms based on social media metrics
(Zhang et al., 2024)	Improved **CRITIC** (CRITID) — distance correlation	Improving CRITIC to better capture nonlinear relationships and variable dependencies (methodological study)
(Ertemel et al., 2023)	Pythagorean fuzzy rough numbers based **CRITIC** and TOPSIS	Assessment of smartphone addiction in adolescents
(Li & Yuan, 2022)	**CRITIC** and improved TOPSIS	Lean level assessment of three production lines in a firm

2.3. Studies Incorporating RAWEC Method

The RAWEC method is a relatively new method and there are limited studies in the literature. MCDM studies in the literature that include the RAWEC method are given in Table 2.3.

Table 2.3. MCDM studies in the literature that include the RAWEC method

Article	Methodology	Decision Problem
(Puška et al., 2024)	LMAW, and RAWEC	Agricultural distribution center location selection
(Akbulut & Aydın, 2024)	MSD, MPSI, and RAWEC	Sustainability performance assessment of banks
(Do, 2024)	Equal weights, Entropy, LOPCOW, PIV, RAWEC, RAM, and SRP	Ranking of the top 10 universities in Vietnam
(Yürüyen & Ulutaş, 2024)	LOPCOW, and RAWEC	Assessing the urban competitiveness of 17 European cities
(Petrović et al., 2024)	Standard Deviation, Entropy, FANMA-RAWEC	Assessing the sustainability of transportation modes
(Mohamed et al., 2024)	SVTNSs, LMAW and RAWEC	Selecting materials for the development and construction of unmanned aerial vehicle wings

(Nedeljković et al., 2024)	Fuzzy MEREC and Fuzzy RAWEC	Selecting the most suitable sales channel for food products
(Hezam et al., 2024)	Global fuzzy set based CRITIC and RAWEC	Evaluation of blockchain platforms
(Demir & Ulusoy, 2024)	WENSLO and RAWEC	Selecting wind power plant locations
(Puška et al., 2024)	DiWeC and Fuzzy RAWEC	Assessing renewable energy resources used in agriculture
(Trung et al., 2024)	RAWEC and AROMAN	Selecting materials for production and maintenance processes
(Nguyen & Nguyen, 2025)	RAWEC	Selecting the most suitable materials for crankshaft production
(Dündar, 2024)	DIBR, and RAWEC	Prioritizing rural development programs
(Sandra et al., 2025)	T-SHFR, MEREC-G, and RAWEC	Selecting the best drilling method
(Puška et al., 2025)	Fuzzy–rough SiWeC and RAWEC	Selecting electric tractors
(Alrashdi et al., 2025)	Neutrosophic-based Entropy and RAWEC	Assessing renewable energy risks
(Katrancı et al., 2025)	Fuzzy RAWEC, Fuzzy SIWEC	Selecting waste management technologies (regional case)
(Tešić et al., 2025)	Fermatean fuzzy RAWEC	Uncertainty tests
(Giang & Thinh, 2025)	ROC, Rank-Sum, Lagrange method, RAWEC, TOPSIS, PIV, RAM	Ranking e-bike models
(Ergün, 2025)	Fuzzy FUCOM and Fuzzy RAWEC	Evaluating port alternatives with fuzzy FUCOM weights
(Durmus, 2025)	MSD, CRITIC and RAWEC	Assessing Türkiye's renewable energy performance
(Dündar & Karadağ, 2025)	F-LBWA, I-RAWEC	Selecting a leading cosmetics facility in Türkiye
(Karadağ, 2025)	Entropy, RAWEC, FUCA karşılaştırmaları	Comparing the financial performance of football clubs in Türkiye
(Badi et al., 2025)	F-SiWeC and RAWEC	Decision support system for railway infrastructure planning
(Demir & Chatterjee, 2026)	Fuzzy WENSLO and Fuzzy RAWEC	Carbon Evaluation of footprint reduction strategies
(Aydın, 2024)	LOPCOW, RANCOM and RAWEC	Corporate financial performance measurement for the insurance sector
(Çemrek, 2025)	LOPCOW and RAWEC	Assessment of the health performance of provinces in Türkiye

3. MATERIALS AND METHODS

Nowadays, a lot of decisions are made based on a variety of criteria. It is possible to make a decision by assigning weights to each criterion, all of which are gathered from expert groups. In particular, MCDM is crucial in the areas of investment choice, project evaluation, economic benefit evaluation, staff appraisal, and many other issues related to economy, manufacturing, material selection, the military, construction, etc (Gavade, 2014).

To address these issues, MCDA has created a variety of techniques and tools over the years. It is essential to define the problem, alternatives, and criteria before applying the procedures. The most appropriate option must be chosen when there are numerous options for a given problem. This can be accomplished by comparing alternatives using the MCDA method (Zlaugotne et al., 2020).

Numerous MCDM consider the weights of the criteria while creating the performance indicator of the options. The criteria's weights indicate how important they are and have a big impact on how the decision-making process turns out. Considering the significance of the weighing process, thorough study is necessary to make a balanced decision.

3.1. Multi-Criteria Decision Making Methods for Determining Weights of Criteria

There are various methods for determining the weights of the constituent parts of a complicated system. Three categories are established for evaluating criteria weights: subjective, objective, and integrated or combined approach to weighting (Odu, 2019).

The subjective weight is determined by taking into account the opinions of experts or expert groups that represent the views of various stakeholders. A significant issue with subjective approaches is evaluating the coherence of expert opinions. Methods based on statistical analysis and correlation are used to evaluate the consistency of expert opinions (Mukhametzyanov, 2021).

The category of objective assessment methods based on using the data regarding the criteria and how they interact that is included in the decision-making matrix. These methods include the entropy weighting method (EWM), CRiteria Importance Through Inter-criteria Correlation (CRITIC), standard deviation (SD), and their variations.

The core of the integrated approaches is combining the weighting results from many techniques and then using the Sum-method to normalize the numbers. Integration is thought to be able to get over the drawbacks of both subjective and objective weighing techniques.

In this study, objective weighting methods will be discussed in detail.

3.1.1. Objective Weighting Methods

Objective weighting methods rely on the mathematical analysis of raw data and are conducted using analytical models and algorithms rather than the preferences of decision-makers. While objective weighting methods do not allow for the incorporation of expert judgments, subjective methods may be prone to errors arising from the opinions and biases of decision-makers (Keskin & Delice, 2022)**.** These methods assume that a criterion is more important if the values of its alternatives are more spread out, as this indicates that the criterion contains more information. A higher weight is assigned when there is greater variance, lower entropy, or a larger difference between the values in the column. Conversely, a criterion for which all alternatives have the same value provides no additional information. To ensure comparability, data normalization is applied to align the measurement scales of all attributes (Mukhametzyanov, 2021). This study examines the CRITIC method, one of the objective weight techniques.

3.1.1.1. CRITIC

The CRITIC (Criteria Importance Through Intercriteria Correlation) method was first introduced by Diakoulaki et al. in 1995. The main objective of the method is to determine the objective weights of the criteria by considering both the amount of information they convey and the degree of conflict among them. In this context, the discriminating power of each criterion is calculated through its standard deviation values, while the similarity or dependency relationships between criteria are measured by correlation coefficients. In this way, the weights of highly correlated criteria are balanced to prevent information redundancy, whereas criteria carrying independent information are assigned higher weights. With this structure, the CRITIC method offers a data-driven approach independent of the decision maker's subjectivity, and it stands out as a reliable tool in MCDM applications due to its consideration of the intensity of conflict among criteria (Peng and Huang, 2020; Xu et al., 2020; Sama et al., 2020; Huang and Peng, 2020; Çınaroğlu, 2021; Maruf and Özdemir, 2021).

The CRITIC method consists of the following steps (Diakoulaki et al., 1995):

Step 1: Constructing the Decision Matrix

Decision matrix represents the initial step in all MCDM methods. In this step, the alternatives are evaluated based on the set criteria, and an initial decision matrix is created.

Step 2: Normalization of the Decision Matrix

The values of the decision matrix are transformed into normalization matrix (V).

$$r_{ij} = \frac{a_{ij} - a_j^{min}}{a_j^{max} - a_j^{min}}, r_{ij} \in [0; 1 \text{ for benefit criteria} \quad (3.1)$$

$$r_{ij} = \frac{a_j^{max} - a_{ij}}{a_j^{max} - a_j^{min}}, r_{ij} \in [0; 1] \text{ for cost criteria} \quad (3.2)$$

where

- r_{ij} is normalized elements of decision matrix
- a_{ij} is elements of decision matrix (DM)
- a_j^{min} is minimum element in criteria *j*
- a_j^{max} is maximum element in criteria *j*

Step 3: Calculating Standard Deviation (σj) and Creating the Linear Correlation Matrix

Standard deviation (σ_j) is calculated, and the linear correlation matrix (c_{jk}) is determined.

$$\sigma_j = std\ (V) = \sqrt{\frac{1}{m-1} \sum_{i=1}^{m} (r_{ij} - \bar{r}_j)^2} \quad (3.3)$$

$$c_{jk} = corr(V) = \frac{\sum_{i=1}^{m} (r_{ij} - \bar{r}_j)(r_{ik} - \bar{r}_k)}{\sqrt{\sum_{i=1}^{m} (r_{ij} - \bar{r}_j)^2 \sum_{i=1}^{m} (r_{ik} - \bar{r}_k)^2}}, \ j, k = 1,2, \dots, n \quad (3.4)$$

Step 4: Calculating the Total Information Values of Each Criterion (q_j)

Total information values of each criterion (q_j) are calculated.

$$q_j = \sigma_j \sum_{k=1}^{n} (1 - |c_{jk}|), \ j = 1,2, \dots, n \quad (3.5)$$

Step 5: Calculating the Criteria Weights (w_j)

The criteria weights (w_j) are calculated.

$$w_j = \frac{q_j}{\sum_{j=1}^{n} q_j} \tag{3.6}$$

The CRITIC method considers both variance and correlation when determining weights. This structure identifies redundant criteria and inter-criterion relationships. If a criterion has a high variance and a low correlation, it is more informative and receives a higher weight. It provides a robust solution to multiple conflicting decision problems. These features make it considered a more robust method compared to other objective weighting methods.

3.2. Multi-Criteria Decision Making Methods for Ranking Alternatives

Numerous approaches are available for problem-solving, and they can be grouped based on several criteria. There is no guarantee that applying a particular method with the same input data will result in the same outcome because each MCDA method has a different mathematical mechanism by which alternatives are queued. The type of result can be used to choose methods. (Ishizaka & Nemery, 2013). Ranking the options is a key component of MCDA, which helps make decisions logical and transparent, particularly when there are trade-offs between competing criteria.

This study examines the RAWEC method, one of the MCDM methods for ranking alternatives.

3.2.1. RAWEC

Ranking Alternatives with Weights of Criterion (RAWEC) is a novel MCDM method introduced by Puska et al. in 2024. The simplicity of the decision-making processes of the RAWEC method distinguishes it from other MCDM methods. While many emerging methods add extra steps that increase complex calculations, the RAWEC method was developed to simplify the decision-making process. The RAWEC consists of just 4 steps, and the first 2 steps are the same as other MCDM methods. The RAWEC method has created a unique structure by combining the two steps found in other MCDM methods: the creation of a weighted normalized decision matrix and the calculation of deviation from ideal and anti-ideal values.

The RAWEC method consists of the following steps (Puška et al., 2024):

Step 1: Constructing the Decision Matrix

The formation of the decision matrix represents the initial step in all MCDM methods. In this step, the alternatives are evaluated based on the set criteria, and an initial decision matrix is created.

Step 2: Normalization of the decision matrix

Double normalization is employed for normalizing the initial decision matrix is normalized. For benefit criteria, the normalized values are calculated as follows:

$$n_{ij} = \frac{x_{ij}}{x_{j\,max}} \tag{3.7}$$

$$n'_{ij} = \frac{x_{j\,min}}{x_{ij}} \tag{3.8}$$

For cost criteria, the normalized values are calculated as follows:

$$n_{ij} = \frac{x_{j\,min}}{x_{ij}} \tag{3.9}$$

$$n'_{ij} = \frac{x_{ij}}{x_{j\,max}} \tag{3.10}$$

Where $x_{j\,min}$ denotes the minimum value of alternatives for a specific criterion, and $x_{j\,min}$ denotes the maximum value of alternatives for the same criterion.

All criteria are transformed into benefit criteria with the first normalization (n_{ij}). By applying second normalization (n'_{ij}) all criteria are transformed into cost criteria.

Step 3: Calculating the deviation from the criterion weight

In this step, the weighting of the normalized decision matrix and the calculation of deviations from the criteria weights are combined.

$$v_{ij} = \sum_{i=1}^{n} w_j \ .(1 - n_{ij}) \tag{3.11}$$

$$v'_{ij} = \sum_{i=1}^{n} w_j \ .(1 - n'_{ij}) \tag{3.12}$$

where w_j represents criteria weight.

Firstly, the normalized data's deviations from the maximum values are calculated. Maximum values are represented by the number 1. Then total deviation is calculated by multiplying the deviation by the weight of the criteria. For the first value v_{ij} , a smaller deviation is desirable, while for the second value v'_{ij} , a larger deviation is preferable. Based on these values the final values of the alternatives are calculated.

Step 4: Calculating the value of the RAWEC method

The ranking of alternatives by the RAWEC method is calculated by employing the following expression.

$$Q_i = \frac{v'_{ij} - v_{ij}}{v'_{ij} + v_{ij}} \qquad (3.13)$$

The RAWEC method gives a result between 1 and -1. The alternative with the highest value represents the ideal selection.

4. RESULTS AND DISCUSSIONS

In this section of the thesis, the application of CRITIC & RAWEC model for the corporate sustainability performance measurement is presented. The flow diagram of the proposed model is shown in Figure 4.1.

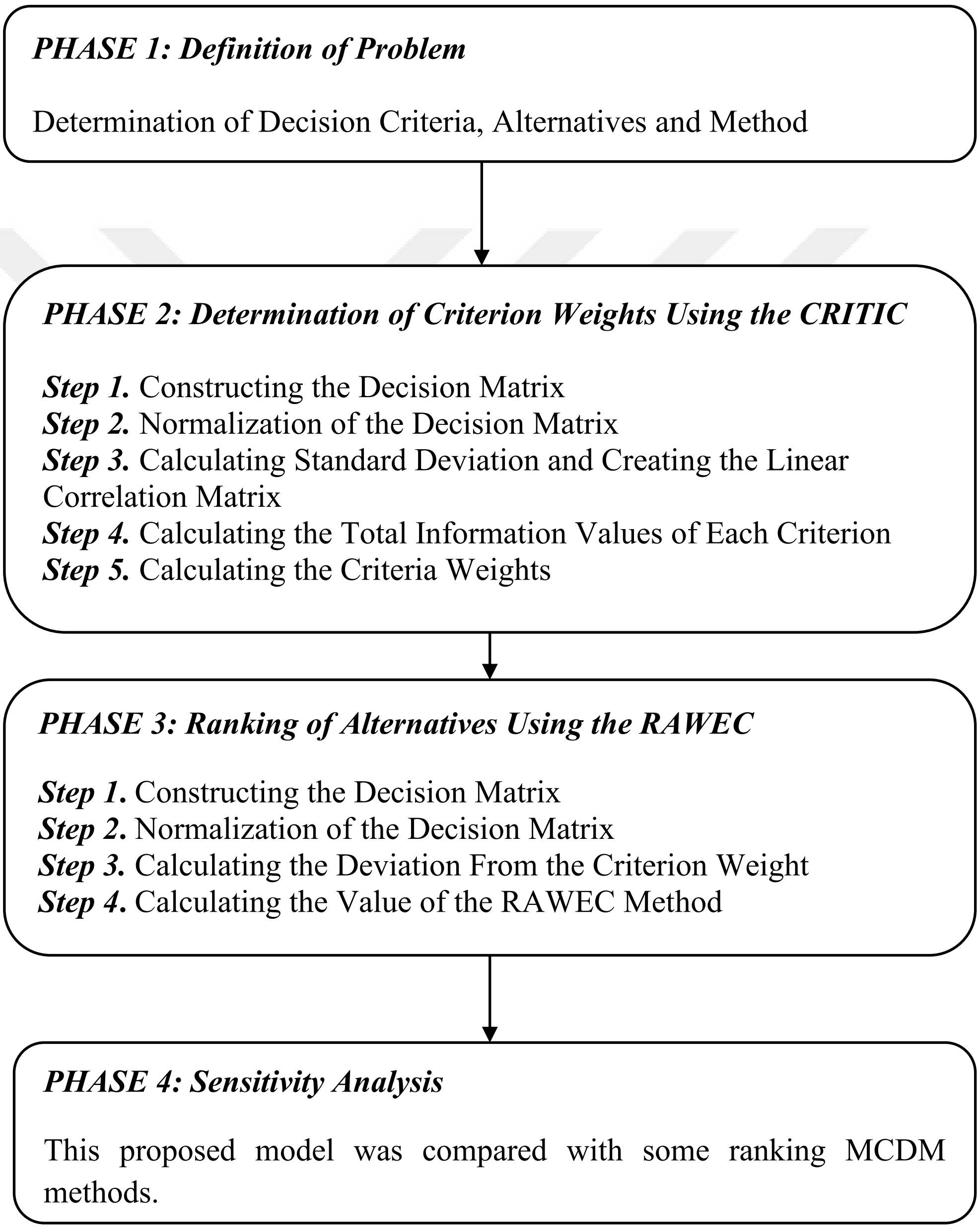

Figure 4.1. A Hybrid MCDM Model Based on CRITIC and RAWEC Methods

4.1. Purpose of This Study

The aim of the study is to evaluate the corporate sustainability performance of firms, covering their economic, social and environmental dimensions, to compare the corporate sustainability performance of the firms and to observe the change in the corporate sustainability performance of firms over the years. In this context, a novel hybrid MCDM model based on CRITIC and RAWEC was examined using data corresponding to seventeen GRI-indexed criteria (nine social, five environmental, and three economic) obtained from the 2021, 2022, and 2023 sustainability reports of nine firms.

4.2. Definition of Criteria

In order to determine the decision criteria, studies on corporate sustainability measurement based on the GRI index were examined. In accordance with the literature review and accessibility of the criteria values from sustainability reports, it was decided to use the seventeen criteria including nine social, five environmental and three economic criteria in the corporate sustainability performance evaluation.

While seven of these decision criteria are cost-based criteria that should be minimized by the alternatives, the remaining ten criteria are benefit-based criteria that should be maximized by the alternatives. The decision criteria type and the studies that reference the criteria used within the scope of this thesis study are given in the Table 4.1. The criteria and their GRI references are listed in the Table 4.2.

Table 4.1. The decision criteria type and the studies that reference the criteria

Main Criteria	Sub-Criteria	Type	References
CS-Social	CS1 Total number of employees	benefit	Ecer, F., & Pamucar, D. (2022), Yılmaz, G., & Nuri İnel, M. (2018), Aktaş, N., & Demirel, N. (2021), Bezerra, PRS, et al. (2021), Aras, G., Tezcan, N., et al. (2017), Stauropoulou, A. ve Sardianou, E. (2019)
	CS2 Women employee ratio	benefit	Aktaş, N., & Demirel, N. (2021), Vivas, R., et al. (2019), Stauropoulou, A. ve Sardianou, E. (2019)
	CS3 Ratio of new hires to total employees	benefit	Bilbao-Terol, Amelia, et al. (2018)
	CS4 The ratio of newly hired male employees to the total number of newly hired employees	benefit	Bilbao-Terol, Amelia, et al. (2018)
	CS5 The ratio of newly hired women employees to the total number of newly hired employees	benefit	Bilbao-Terol, Amelia, et al. (2018)
	CS6 Employee turnover	cost	Ecer, F., & Pamucar, D. (2022), Aktaş, N., & Demirel, N. (2021), Ersoy, N. (2018), Özçelik and Öztürk (2014)
	CS7 Retention rate of women employees after their return from parental leave	benefit	Bilbao-Terol, Amelia, et al. (2018)
	CS8 Average hours of training per employee	benefit	Bilbao-Terol, Amelia, et al. (2018), Ecer, F., & Pamucar, D. (2022), Yılmaz, G., & Nuri İnel, M. (2018), Aktaş, N., & Demirel, N. (2021), Calabrese, A., Costa, R., et al.(2016), Ersoy, N. (2018), Ersoy, N. (2017), Stauropoulou, A. ve Sardianou, E. (2019), Özçelik and Öztürk (2014)
	CS9 The number of work accidents	cost	Bilbao-Terol, Amelia, et al. (2018), Aktaş, N., & Demirel, N. (2021), Bezerra, PRS, Schramm, et al. (2021), Vivas, R., et al. (2019), Calabrese, A., Costa, R., Levialdi, N., & Menichini, T. (2016), Ersoy, N. (2017)
CEN-Environmental	CEN1 Total energy consumption (MWh)	cost	Bezerra, PRS, et al. (2021), Vivas, R., et al. (2019), Calabrese, A., et al. (2016), Ersoy, N. (2018), Ersoy, N. (2017), Aras, G., Tezcan, N., et al. (2017)
	CEN2 Total Waste (tonnes)	cost	Bezerra, PRS, Schramm, et al. (2021), Ersoy, N. (2017), Infante et al. (2013)
	CEN3 Total Hazardous Waste (tonnes)	cost	Vivas, R., et al. (2019)
	CEN4 Water consumption (m3)	cost	Silva, D. N., et al. (2024), Ecer, F., & Pamucar, D. (2022), Yılmaz, G., & Nuri İnel, M. (2018), Bezerra, PRS, et al. (2021), Vivas, R., Sant'anna, Â., et al. (2019), Ersoy, N. (2017), Stauropoulou, A. ve Sardianou, E. (2019)
	CEN5 Greenhouse gas (GHG) emissions (tonnes CO2 equivalent)	cost	Calabrese, A., Costa, R., Levialdi, N., & Menichini, T. (2016), Ersoy, N. (2018), Ersoy, N. (2017), Infante et al. (2013)
CEC-Economic	CEC1 Revenue (TRY Million)	benefit	Aktaş, N., & Demirel, N. (2021), Bezerra, PRS, Schramm, F. ve Schramm, VB (2021), Vivas, R., Sant'anna, Â., Esquerre, K., & Freires, F. (2019), Stauropoulou, A. ve Sardianou, E. (2019)
	CEC2 R&D investments (TRY Million)	benefit	Aktaş, N., & Demirel, N. (2021)
	CEC3 Donations and social responsibility projects expenditures (TRY)	benefit	Ersoy, N. (2017), Aras, G., Tezcan, N., et al. (2017)

Table 4.2. The criteria and their GRI references

Main Criteria	Sub-Criteria	GRI Reference
CS-Social	CS1 Total number of employees	2-7 Employees
	CS2 Women employee ratio	2-7 Employees
	CS3 Ratio of new hires to total employees	401-1 New employee hires
	CS4 The ratio of newly hired male employees to the total number of newly hired employees	401-1 New employee hires
	CS5 The ratio of newly hired women employees to the total number of newly hired employees	401-1 New employee hires
	CS6 Employee turnover	401-1 Employee turnover
	CS7 Retention rate of women employees after their return from parental leave	401-3 Parental leave
	CS8 Average hours of training per employee	404-1 Average hours of training per year per employee
	CS9 The number of work accidents	403-1 Occupational health and safety management system
CEN-Environmental	CEN1 Total energy consumption (MWh)	302-1 Energy consumption within the organization
	CEN2 Total Waste (tonnes)	306-3 Waste generated (tonnes)
	CEN3 Total Hazardous Waste (tonnes)	306-3 Waste generated (tonnes)
	CEN4 Water consumption (m3)	303-5 Water consumption
	CEN5 Greenhouse gas (GHG) emissions (tonnes CO2 equivalent)	305-1 Direct (Scope 1) GHG emissions
CEC-Economic	CEC1 Revenue (TRY Million)	201-1 Direct economic value generated and distributed
	CEC2 R&D investments (TRY Million)	201-1 Direct economic value generated and distributed
	CEC3 Donations and social responsibility projects expenditures (TRY)	413-1 Operations with local community engagement, impact assessments, and development programs

4.3. Definition of Alternatives

Alternative firms were determined based on the ISO500 2024 list, which identifies the 500 largest industrial firms in Türkiye. In the first phase, the top fifty firms on the ISO 500 list were included in this study to focus on more successful firms. It was identified that twenty-one of these fifty firms published GRI-based corporate sustainability reports. In order to identify the largest common set of years in which corporate sustainability reports were published by firms, the years in which firms published reports were examined and it was identified that thirteen firms published reports in 2021, 2022 and 2023. It was observed that four of these thirteen firms did not include all seventeen criteria determined within the scope of this study in their corporate sustainability reports. Therefore, these four firms were excluded from the study. In this study, it was determined to evaluate the corporate sustainability performance of nine firms for the years 2021, 2022 and 2023. Alternative firms and their sectors are shown in Table 4.3.

Table 4.3. Alternative firms and their sectors

Firms	Sector
A1 Arçelik A.Ş.	Durable consumer goods and consumer electronics
A2 Aselsan A.Ş.	Defense
A3 Ford	Automotive
A4 PETKİM Petrokimya Holding A.Ş.	Petrochemicals
A5 Türkiye Şişe ve Cam Fabrikaları A.Ş.	Glass and Chemicals
A6 TÜPRAŞ-Türkiye Petrol Rafinerileri A.Ş.	Oil and Gas
A7 SÜTAŞ Süt Ürünleri A.Ş.	Food
A8 Enerjisa Enerji Üretim A.Ş.	Energy
A9 KARDEMİR Karabük Demir Çelik San. ve Tic. A.Ş.	Metallurgy

4.4. Determination of Criteria Weights Using the CRITIC Methods

The weights of 17 criteria determined under the three main criteria of sustainability, namely social, environmental and economic dimensions, were determined separately for the years 2021, 2022 and 2023 using the CRITIC method. Local weights of the sub-criteria were calculated separately for each main criteria and each year. Then, the local weights of the sub-criteria were multiplied by the main criteria weights to obtain the global weights. The weight of each main criterion was assumed to be equal (0.333).

Criteria weights (Social, Environmental, Economic) for 2021 were calculated as follows.

Calculating the weights of Social criteria for 2021:

Step 1: Constructing the Decision Matrix

The decision matrix of social criteria for 2021 is given in Table 4.4.

Table 4.4. The decision matrix of social criteria for 2021

	benefit	benefit	benefit	benefit	benefit	cost	benefit	benefit	cost
	CS1	**CS2**	**CS3**	**CS4**	**CS5**	**CS6**	**CS7**	**CS8**	**CS9**
A1	40934	0,2604	0,033	0,639	0,361	0,129	0,04	18,7	13
A2	9460	0,208	0,1443	0,795	0,205	0,0552	0,05	33,7	41
A3	13724	0,19	0,17	0,73	0,27	0,093	0,0001	62	123
A4	2335	0,076	0,053	0,69	0,31	0,0248	0,5	42,2	12
A5	22589	0,228	0,115	0,678	0,322	0,2121	0,53	22,2	494
A6	5893	0,09	0,032	0,81	0,19	0,05	0,04	28	75
A7	4962	0,135	0,158	0,874	0,126	0,14	0,43	16	12
A8	11300	0,1	0,13	0,927	0,073	0,059	0,0294	36,9	27
A9	4099	0,04	0,0075	0,87	0,13	0,0034	0,0001	35,14	9
max	**40934**	**0,2604**	**0,17**	**0,927**	**0,361**	**0,2121**	**0,53**	**62**	**494**
min	**2335**	**0,04**	**0,0075**	**0,639**	**0,073**	**0,0034**	**0,0001**	**16**	**9**

Step 2: Normalization of the Decision Matrix

Using Equation (3.1) and (3.2), the decision matrix is normalized.

The calculation for Alternative 1 (A1) and criterion CS3 (benefit criterion) is done with Equation (3.1) as follows:

$$r_{13} = \frac{0{,}033 - 0{,}0075}{0{,}17 - 0{,}0075} = 0{,}1569$$

The normalization matrix of social criteria for 2021 is given in Table 4.5.

Table 4.5. The normalization matrix of social criteria for 2021

	benefit	benefit	benefit	benefit	benefit	cost	benefit	benefit	cost
	CS1	**CS2**	**CS3**	**CS4**	**CS5**	**CS6**	**CS7**	**CS8**	**CS9**
A1	1,0000	1,0000	0,1569	0,0000	1,0000	0,3982	0,0753	0,0587	0,9918
A2	0,1846	0,7623	0,8418	0,5417	0,4583	0,7518	0,0942	0,3848	0,9340
A3	0,2951	0,6806	1,0000	0,3160	0,6840	0,5707	0,0000	1,0000	0,7649
A4	0,0000	0,1633	0,2800	0,1771	0,8229	0,8976	0,9434	0,5696	0,9938
A5	0,5247	0,8530	0,6615	0,1354	0,8646	0,0000	1,0000	0,1348	0,0000
A6	0,0922	0,2269	0,1508	0,5938	0,4063	0,7767	0,0753	0,2609	0,8639
A7	0,0681	0,4310	0,9262	0,8160	0,1840	0,3455	0,8113	0,0000	0,9938
A8	0,2323	0,2722	0,7538	1,0000	0,0000	0,7336	0,0553	0,4543	0,9629
A9	0,0457	0,0000	0,0000	0,8021	0,1979	1,0000	0,0000	0,4161	1,0000

Step 3: Calculating Standard Deviation (σ_j) and Creating the Linear Correlation Matrix

Using Equation (3.4), the linear correlation matrix is created.

The calculation for criterion CS1 and CS2 is done with Equation (3.4) as follows:

$$c_{12} = \frac{\sum_{i=1}^{9}(r_{i1} - \bar{r}_1)(r_{i2} - \bar{r}_2)}{\sqrt{\sum_{i=1}^{9}(r_{i1} - \bar{r}_1)^2 \sum_{i=1}^{9}(r_{i2} - \bar{r}_2)^2}}$$

$$= \frac{\begin{array}{c}(1-0{,}2714)(1-0{,}4877) + (0{,}1846-0{,}2717)(0{,}7623-0{,}4877) + (0{,}2951-0{,}2714)(0{,}6806-0{,}4877) + \\ (0-0{,}2714)(0{,}1633-0{,}4877) + (0{,}5247-0{,}2714)(0{,}8530-0{,}4877) + (0{,}0922-0{,}2714)(0{,}2269-0{,}4877) + \\ (0{,}0681-0{,}2714)(0{,}4310-0{,}4877) + (0{,}2323-0{,}2714)(0{,}2722-0{,}4877) + (0{,}0457-0{,}2714)(0-0{,}4877)\end{array}}{\sqrt{\begin{array}{c}[(1-0{,}2714)^2 + (0{,}1846-0{,}2717)^2 + (0{,}2951-0{,}2714)^2 + (0{,}2951-0{,}2714)^2 + (0-0{,}2714)^2 + (0{,}5247-0{,}2714)^2 \\ +(0{,}0922-0{,}2714)^2 + (0{,}0681-0{,}2714)^2 + (0{,}2323-0{,}2714)^2 + (0{,}0457-0{,}2714)^2].[(1-0{,}4877)^2 + (0{,}7623-0{,}4877)^2 + \\ (0{,}6806-0{,}4877)^2 + (0{,}1633-0{,}4877)^2 + (0{,}8530-0{,}4877)^2 + (0{,}2269-0{,}4877)^2 + (0{,}4310-0{,}4877)^2 + (0{,}2722-0{,}4877)^2 + (0-0{,}4877)^2]\end{array}}}$$

$$= 0{,}8065$$

The linear correlation matrix of social criteria for 2021 is given in Table 4.6.

Table 4.6. The linear correlation matrix of social criteria for 2021

	CS1	**CS2**	**CS3**	**CS4**	**CS5**	**CS6**	**CS7**	**CS8**	**CS9**
CS1	1	0,8065	-0,0912	-0,6182	0,6182	-0,5904	-0,1231	-0,3175	-0,2820
CS2	0,8065	1	0,3767	-0,6247	0,6247	-0,7315	0,0379	-0,2066	-0,4313
CS3	-0,0912	0,3767	1	0,1758	-0,1758	-0,4114	0,1507	0,2411	-0,2201
CS4	-0,6182	-0,6247	0,1758	1	-1,0000	0,4119	-0,3046	-0,0118	0,3988
CS5	0,6182	0,6247	-0,1758	-1,0000	1	-0,4119	0,3046	0,0118	-0,3988
CS6	-0,5904	-0,7315	-0,4114	0,4119	-0,4119	1	-0,4834	0,4594	0,7192
CS7	-0,1231	0,0379	0,1507	-0,3046	0,3046	-0,4834	1	-0,3320	-0,4627
CS8	-0,3175	-0,2066	0,2411	-0,0118	0,0118	0,4594	-0,3320	1	0,1181
CS9	-0,2820	-0,4313	-0,2201	0,3988	-0,3988	0,7192	-0,4627	0,1181	1

Step 4: Calculating the Total Information Values of Each Criterion (q_j)

Using Equation (3.3) and (3.5), the total information values of each criterion (q_j) are calculated.

The calculation of the total information value for criterion CS1 is done as follows:

$$q_1 = \sigma_1 \sum_{k=1}^{9} (1 - |c_{1k}|$$

$$= (0{,}3169).\,[(1 - |1|) + (1 - 0{,}8065) + (1 - |-0{,}0912|) + (1 - |-0{,}6182|) + (1 - 0{,}6182) + (1 - |-0{,}5904|) + (1 - |-0{,}1231|) + (1 - |-0{,}3175|) + (1 - |-0{,}2820|)] = 2{,}7235$$

The total information values of each criterion (q_j) of social criteria for 2021 are given in Table 4.7.

Table 4.7. The total information values of each criterion (q_j) of social criteria for 2021

	CS1	CS2	CS3	CS4	CS5	CS6	CS7	CS8	CS9
CS1	0	0,1935	1,0912	1,6182	0,3818	1,5904	1,1231	1,3175	1,2820
CS2	0,1935	0	0,6233	1,6247	0,3753	1,7315	0,9621	1,2066	1,4313
CS3	1,0912	0,6233	0	0,8242	1,1758	1,4114	0,8493	0,7589	1,2201
CS4	1,6182	1,6247	0,8242	0	2,0000	0,5881	1,3046	1,0118	0,6012
CS5	0,3818	0,3753	1,1758	2,0000	0	1,4119	0,6954	0,9882	1,3988
CS6	1,5904	1,7315	1,4114	0,5881	1,4119	0	1,4834	0,5406	0,2808
CS7	1,1231	0,9621	0,8493	1,3046	0,6954	1,4834	0	1,3320	1,4627
CS8	1,3175	1,2066	0,7589	1,0118	0,9882	0,5406	1,3320	0	0,8819
CS9	1,2820	1,4313	1,2201	0,6012	1,3988	0,2808	1,4627	0,8819	0
$\boldsymbol{std\ (V)}$	0,3168	0,3481	0,3822	0,3484	0,3484	0,3135	0,4380	0,3056	0,3224
$\boldsymbol{q_i}$	2,7235	2,8361	3,0404	3,3353	2,9362	2,8338	4,0349	2,4559	2,7590

Step 5: Calculating the Criteria Weights ($\boldsymbol{w_j}$)

Using Equation (3.6), the criteria weights (w_j) are calculated.

The calculation of weight for criterion CS1 is done as follows:

$$w_1 = \frac{q_1}{\sum_{j=1}^{9} q_j} = \frac{2{,}7235}{(2{,}7235 + 2{,}8361 + 3{,}0404 + 3{,}3353 + 2{,}9362 + 2{,}8338 + 4{,}0649 + 2{,}4559 + 2{,}7590)} = 0{,}1010$$

The local weights of social sub-criteria for 2021 are given in Table 4.8.

Table 4.8. The local weights of social sub-criteria for 2021

	CS1	CS2	CS3	CS4	CS5	CS6	CS7	CS8	CS9
$\boldsymbol{w_j}$	0,1010	0,1052	0,1128	0,1237	0,1089	0,1051	0,1497	0,0911	0,1024

Calculating the weights of Environmental criteria for 2021:

Step 1: Constructing the Decision Matrix

The decision matrix of environmental criteria for 2021 is given in Table 4.9.

Table 4.9. The decision matrix of environmental criteria for 2021

	cost	cost	cost	cost	cost
	CEN1	**CEN2**	**CEN3**	**CEN4**	**CEN5**
A1	671.037	135.899	3.298	29.818	5.214
A2	85.109	1.806	466	487.614	15.481
A3	2.326.504	96.659	8.902	1.069.294	77.013
A4	8.908.580	253.809	25.301	11.033.306	1.838.003
A5	23.610.903	1.691.314	41.361	45.878.355	5.743.237
A6	25.483.151	37.740	25.079	15.530.000	6.299.649
A7	475.871	165.540	138	4.767.835	108.998
A8	136.902	11.367	3.804	95.285	21.065.942
A9	60.442.676	1.372.388	124.846	22.080.283	6.079.120
Max	**60.442.676**	**1.691.314**	**124.846**	**45.878.355**	**21.065.942**
Min	**85.109**	**1.806**	**138**	**29.818**	**5.214**

Step 2: Normalization of the Decision Matrix

The normalization matrix of environmental criteria for 2021 is given in Table 4.10.

Table 4.10. The normalization matrix of environmental criteria for 2021

	cost	cost	cost	cost	cost
	CEN1	**CEN2**	**CEN3**	**CEN4**	**CEN5**
A1	0,9903	0,9206	0,9747	1,0000	1,0000
A2	1,0000	1,0000	0,9974	0,9900	0,9995
A3	0,9629	0,9439	0,9297	0,9773	0,9966
A4	0,8538	0,8508	0,7982	0,7600	0,9130
A5	0,6102	0,0000	0,6694	0,0000	0,7275
A6	0,5792	0,9787	0,8000	0,6619	0,7011
A7	0,9935	0,9031	1,0000	0,8967	0,9951
A8	0,9991	0,9943	0,9706	0,9986	0,0000
A9	0,0000	0,1888	0,0000	0,5191	0,7116

Step 3: Calculating Standard Deviation (σ_j) and Creating the Linear Correlation Matrix

The linear correlation matrix of environmental criteria for 2021 is given in Table 4.11.

Table 4.11. The linear correlation matrix of environmental criteria for 2021

	CEN1	CEN2	CEN3	CEN4	CEN5
CEN1	1	0,7249	0,9693	0,6276	0,1123
CEN2	0,7249	1	0,7480	0,8973	0,0509
CEN3	0,9693	0,7480	1	0,5627	0,0990
CEN4	0,6276	0,8973	0,5627	1	0,0678
CEN5	0,1123	0,0509	0,0990	0,0678	1

Step 4: Calculating the Total Information Values of Each Criterion (q_j)

The total information values of each criterion (q_j) of environmental criteria for 2021 are given in Table 4.12.

Table 4.12. The total information values of each criterion (q_j) of environmental criteria for 2021

	CEN1	CEN2	CEN3	CEN4	CEN5
CEN1	0	0,2751	0,0307	0,3724	0,8877
CEN2	0,2751	0	0,2520	0,1027	0,9491
CEN3	0,0307	0,2520	0	0,4373	0,9010
CEN4	0,3724	0,1027	0,4373	0	0,9322
CEN5	0,8877	0,9491	0,9010	0,9322	0
$\boldsymbol{std\ (V)}$	0,3359	0,3795	0,3186	0,3314	0,3220
$\boldsymbol{q_i}$	0,5260	0,5992	0,5164	0,6113	1,1817

Step 5: Calculating the Criteria Weights (w_j)

The local weights of environmental sub-criteria for 2021 are given in Table 4.13.

Table 4.13. The local weights of environmental sub-criteria for 2021

	CEN1	CEN2	CEN3	CEN4	CEN5
$\boldsymbol{w_j}$	0,1531	0,1745	0,1504	0,1780	0,3441

Calculating the weights of Economic criteria for 2021:

Step 1: Constructing the Decision Matrix

The decision matrix of economic criteria for 2021 is given in Table 4.14.

Table 4.14. The decision matrix of economic criteria for 2021

	benefit	benefit	benefit
	CEC1	**CEC2**	**CEC3**
A1	113.065	1201	48.419.702
A2	35.282	5615	4.734.000
A3	71.101	2037	123.446.000
A4	48.900	66	5.794.311
A5	32.057	174,8	16.000.000
A6	150.971	47,5	3.000.000
A7	6.242	64	998.625
A8	7.494	11,75	38.600.000
A9	14.764	5,8	5.800.000
Max	**150.971**	**5.615**	**123.446.000**
Min	**6.242**	**6**	**998.625**

Step 2: Normalization of the Decision Matrix

The normalization matrix of economic criteria for 2021 is given in Table 4.15.

Table 4.15. The normalization matrix of economic criteria for 2021

	benefit	benefit	benefit
	CEC1	**CEC2**	**CEC3**
A1	0,7381	0,2131	0,3873
A2	0,2007	1,0000	0,0305
A3	0,4481	0,3621	1,0000
A4	0,2947	0,0107	0,0392
A5	0,1784	0,0301	0,1225
A6	1,0000	0,0074	0,0163
A7	0,0000	0,0104	0,0000
A8	0,0087	0,0011	0,3071
A9	0,0589	0,0000	0,0392

Step 3: Calculating Standard Deviation (σ_j) and Creating the Linear Correlation Matrix

The linear correlation matrix of economic criteria for 2021 is given in Table 4.16.

Table 4.16. The linear correlation matrix of economic criteria for 2021

	CEC1	**CEC2**	**CEC3**
CEC1	1	0,0048	0,1815
CEC2	0,0048	1	0,1472
CEC3	0,1815	0,1472	1

Step 4: Calculating the Total Information Values of Each Criterion (q_j)

The total information values of each criterion (q_j) of economic criteria for 2021 are given in Table 4.17.

Table 4.17. The total information values of each criterion (q_j) of economic criteria for 2021

	CEC1	CEC2	CEC3
CEC1	0	0,9952	0,8185
CEC2	0,9952	0	0,8528
CEC3	0,8185	0,8528	0
$std\ (V)$	0,3457	0,3318	0,3249
q_i	0,6269	0,6132	0,5430

Step 5: Calculating the Criteria Weights (w_j)

The local weights of economic sub-criteria for 2021 are given in Table 4.18.

Table 4.18. The local weights of economic sub-criteria for 2021

	CEC1	CEC2	CEC3
w_j	0,3516	0,3439	0,3045

The calculation of the weights of social, environmental, and economic criteria for 2021 using the CRITIC method is detailed above. The criteria weights (social, environmental, and economic) for 2022 and 2023 were calculated as described above, and the results are presented in Table 4.19.

The main criteria, social, environmental and economic, were assumed to have equal weight (0.333). The global weights of the criteria were obtained by multiplying the weights of the main criteria and the local weights of the sub-criteria. For example, the calculation for CS1 for 2021 was made as follows:

Global Weight (CS1-2021) = 0,333 * Local Weight (CS1-2021) = 0,333 * 0,1010 = 0,0336.

Table 4.19. Final weights of criteria

Main Criteria	Sub-criteria	2021 Local weight	2021 Global weight	2022 Local weight	2022 Global weight	2023 Local weight	2023 Global weight
Social (0,333)	**CS1**	0,1010	**0,0336**	0,1082	**0,0360**	0,1018	**0,0339**
	CS2	0,1052	**0,0350**	0,1092	**0,0364**	0,1009	**0,0336**
	CS3	0,1128	**0,0376**	0,1256	**0,0418**	0,1121	**0,0373**
	CS4	0,1237	**0,0412**	0,1275	**0,0425**	0,1191	**0,0397**
	CS5	0,1089	**0,0363**	0,1009	**0,0336**	0,0899	**0,0299**
	CS6	0,1051	**0,0350**	0,1161	**0,0387**	0,1246	**0,0415**
	CS7	0,1497	**0,0498**	0,1132	**0,0377**	0,1254	**0,0418**
	CS8	0,0911	**0,0303**	0,0895	**0,0298**	0,0947	**0,0315**
	CS9	0,1024	**0,0341**	0,1097	**0,0365**	0,1315	**0,0438**
Environmental (0,333)	**CEN1**	0,1531	**0,0510**	0,1400	**0,0466**	0,1400	**0,0466**
	CEN2	0,1745	**0,0581**	0,1612	**0,0537**	0,1589	**0,0529**
	CEN3	0,1504	**0,0501**	0,1633	**0,0544**	0,1599	**0,0533**
	CEN4	0,1780	**0,0593**	0,2313	**0,0770**	0,2405	**0,0801**
	CEN5	0,3441	**0,1146**	0,3042	**0,1013**	0,3006	**0,1001**
Economic (0,333)	**CEC1**	0,3516	**0,1171**	0,2590	**0,0863**	0,2944	**0,0980**
	CEC2	0,3439	**0,1145**	0,4112	**0,1369**	0,4566	**0,1521**
	CEC3	0,3045	**0,1014**	0,3298	**0,1098**	0,2489	**0,0829**

According to Table 4.19., the criterion with the highest weight in 2021 was CEC1-Revenue (TRY Million) with 0.1171, the criterion with the highest weight in 2022 was CEC2-R&D investments (TRY Million) with 0.1369, and the criterion with the highest weight in 2023 was CEC2-R&D investments (TRY Million) with 0.1521. According to Table 4.19., the criterion with the lowest weight with 0.0303 in 2021 was CS8-Average hours of training per employee, the criterion with the lowest weight with 0.0298 in 2022 was CS8-Average hours of training per employee, and the criterion with the lowest weight with 0.0299 in 2023 was CS5-The ratio of newly hired women employees to the total number of newly hired employees.

Considering the social criteria, the criterion with the highest weight in 2021 was CS7-Retention rate of female employees after their return from parental leave, the criterion with the highest weight in 2022 was CS4-The ratio of newly hired male employees to the total number of newly hired employees, and the criterion with the highest weight in 2023 was CS9-The number of work accidents. The environmental criterion with the highest weight in all years was CEN5-Greenhouse gas (GHG) emissions (tonnes of CO2 equivalent). While the economic criterion with the highest weight in 2021 was CEC1-Revenue (TRY Million), the economic criterion with the highest weight in 2022 and 2023 was CEC2-R&D investments (TRY Million).

4.5. Ranking of Alternatives Using the RAWEC Method

After determining the weights of 17 criteria, the corporate sustainability performance of 9 firms was evaluated separately for 2021, 2022 and 2023 using the RAWEC method.

Corporate sustainability performance of 9 firms for 2021 were evaluated as follows:

Step 1: Constructing the decision matrix

The formation of the decision matrix represents the initial step in all MCDM methods. In this step, nine firms are evaluated based on seventeen criteria, and an initial decision matrix is created.

The decision matrix of RAWEC for 2021 is given in Table 4.20.

Step 2: Normalization of the decision matrix

Using Equation (3.7), (3.8), (3.9) and (3.10), the decision matrix is normalized.

The calculation for alternative A1 criterion CS1 (benefit criterion) is done with Equations (3.7) and (3.8) as follows:

$$n_{11} = \frac{x_{11}}{x_{1\,max}} = \frac{40934}{40934} = 1$$

$$n'_{11} = \frac{x_{1\,min}}{x_{11}} = \frac{2335}{40934} = 0{,}0570$$

The normalization matrixes of RAWEC for 2021 are given in Table 4.21 and Table 4.22.

Table 4.20. Decision matrix of RAWEC for 2021

					Social							Enviromental				Economic	
	CS1	**CS2**	**CS3**	**CS4**	**CS5**	**CS6**	**CS7**	**CS8**	**CS9**	**CEN1**	**CEN2**	**CEN3**	**CEN4**	**CEN5**	**CEC1**	**CEC2**	**CEC3**
Benefit/cost	**Benefit**	**Benefit**	**Benefit**	**Benefit**	**Benefit**	**Cost**	**Benefit**	**Benefit**	**Cost**	**Cost**	**Cost**	**Cost**	**Cost**	**Cost**	**Benefit**	**Benefit**	**Benefit**
A1	40934	0,2604	0,033	0,639	0,361	0,129	0,04	18,7	13	671.037	135.899	3.298	29.818	5.214	113.065	1201	48.419.702
A2	9460	0,208	0,1443	0,795	0,205	0,0552	0,05	33,7	41	85.109	1.806	466	487.614	15.481	35.282	5615	4.734.000
A3	13724	0,19	0,17	0,73	0,27	0,093	0,0001	62	123	2.326.504	96.659	8.902	1.069.294	77.013	71.101	2037	123.446.000
A4	2335	0,076	0,053	0,69	0,31	0,024763	0,5	42,2	12	8.908.580	253.809	25.301	11.033.306	1.838.003	48.900	66	5.794.311
A5	22.589	0,228	0,115	0,678	0,322	0,2121	0,53	22,2	494	23.610.903	1.691.314	41.361	45.878.355	5.743.237	32.057	174,8	16.000.000
A6	5893	0,09	0,032	0,81	0,19	0,05	0,04	28	75	25.483.151	37.740	25.079	15.530.000	6.299.649	150.971	47,5	3.000.000
A7	4962	0,135	0,158	0,874	0,126	0,14	0,43	16	12	475.871	165.540	138	4.767.835	108.998	6.242	64	998.625
A8	11300	0,1	0,13	0,927	0,073	0,059	0,0294	36,9	27	136.902	11.367	3.804	95.285	21.065.942	7.494	11,75	38.600.000
A9	4099	0,04	0,0075	0,87	0,13	0,0034	0,0001	35,14	9	60.442.676	1.372.388	124.846	22.080.283	6.079.120	14.764	5,8	5.800.000
max	**40934**	**0,2604**	**0,17**	**0,927**	**0,361**	**0,2121**	**0,53**	**62**	**494**	**60442676**	**1691314**	**124846**	**45878355**	**21065942**	**150971**	**5615**	**123446000**
min	**2335**	**0,04**	**0,0075**	**0,639**	**0,073**	**0,0034**	**0,0001**	**16**	**9**	**85109**	**1806**	**138**	**29818**	**5214**	**6242**	**5,8**	**998625**

Table 4.21. The normalization matrix (n_{ij}) of RAWEC for 2021

	CS1	**CS2**	**CS3**	**CS4**	**CS5**	**CS6**	**CS7**	**CS8**	**CS9**	**CEN1**	**CEN2**	**CEN3**	**CEN4**	**CEN5**	**CEC1**	**CEC2**	**CEC3**
Benefit/cost	**Benefit**	**Benefit**	**Benefit**	**Benefit**	**Benefit**	**Cost**	**Benefit**	**Benefit**	**Cost**	**Cost**	**Cost**	**Cost**	**Cost**	**Cost**	**Benefit**	**Benefit**	**Benefit**
A1	1,0000	1,0000	0,1941	0,6893	1,0000	0,0264	0,0755	0,3016	0,6923	0,1268	0,0133	0,0418	1,0000	1,0000	0,7489	0,2139	0,3922
A2	0,2311	0,7988	0,8488	0,8576	0,5679	0,0616	0,0943	0,5435	0,2195	1,0000	1,0000	0,2961	0,0612	0,3368	0,2337	1,0000	0,0383
A3	0,3353	0,7296	1,0000	0,7875	0,7479	0,0366	0,0002	1,0000	0,0732	0,0366	0,0187	0,0155	0,0279	0,0677	0,4710	0,3628	1,0000
A4	0,0570	0,2919	0,3118	0,7443	0,8587	0,1373	0,9434	0,6806	0,7500	0,0096	0,0071	0,0055	0,0027	0,0028	0,3239	0,0118	0,0469
A5	0,5518	0,8756	0,6765	0,7314	0,8920	0,0160	1,0000	0,3581	0,0182	0,0036	0,0011	0,0033	0,0006	0,0009	0,2123	0,0311	0,1296
A6	0,1440	0,3456	0,1882	0,8738	0,5263	0,0680	0,0755	0,4516	0,1200	0,0033	0,0479	0,0055	0,0019	0,0008	1,0000	0,0085	0,0243
A7	0,1212	0,5184	0,9294	0,9428	0,3490	0,0243	0,8113	0,2581	0,7500	0,1788	0,0109	1,0000	0,0063	0,0478	0,0413	0,0114	0,0081
A8	0,2761	0,3840	0,7647	1,0000	0,2022	0,0576	0,0555	0,5952	0,3333	0,6217	0,1589	0,0363	0,3129	0,0002	0,0496	0,0021	0,3127
A9	0,1001	0,1536	0,0441	0,9385	0,3601	1,0000	0,0002	0,5668	1,0000	0,0014	0,0013	0,0011	0,0014	0,0009	0,0978	0,0010	0,0470

Table 4.22. The normalization matrix (n'_{ij}) of RAWEC for 2021

	CS1	**CS2**	**CS3**	**CS4**	**CS5**	**CS6**	**CS7**	**CS8**	**CS9**	**CEN1**	**CEN2**	**CEN3**	**CEN4**	**CEN5**	**CEC1**	**CEC2**	**CEC3**
Benefit/cost	**Benefit**	**Benefit**	**Benefit**	**Benefit**	**Benefit**	**Cost**	**Benefit**	**Benefit**	**Cost**	**Cost**	**Cost**	**Cost**	**Cost**	**Cost**	**Benefit**	**Benefit**	**Benefit**
A1	0,0570	0,1536	0,2273	1,0000	0,2022	0,6082	0,0025	0,8556	0,0263	0,0111	0,0804	0,0264	0,0006	0,0002	0,0552	0,0048	0,0206
A2	0,2468	0,1923	0,0520	0,8038	0,3561	0,2603	0,0020	0,4748	0,0830	0,0014	0,0011	0,0037	0,0106	0,0007	0,1769	0,0010	0,2109
A3	0,1701	0,2105	0,0441	0,8753	0,2704	0,4385	1,0000	0,2581	0,2490	0,0385	0,0572	0,0713	0,0233	0,0037	0,0878	0,0028	0,0081
A4	1,0000	0,5263	0,1415	0,9261	0,2355	0,1168	0,0002	0,3791	0,0243	0,1474	0,1501	0,2027	0,2405	0,0872	0,1276	0,0879	0,1723
A5	0,1034	0,1754	0,0652	0,9425	0,2267	1,0000	0,0002	0,7207	1,0000	0,3906	1,0000	0,3313	1,0000	0,2726	0,1947	0,0332	0,0624
A6	0,3962	0,4444	0,2344	0,7889	0,3842	0,2357	0,0025	0,5714	0,1518	0,4216	0,0223	0,2009	0,3385	0,2990	0,0413	0,1221	0,3329
A7	0,4706	0,2963	0,0475	0,7311	0,5794	0,6601	0,0002	1,0000	0,0243	0,0079	0,0979	0,0011	0,1039	0,0052	1,0000	0,0906	1,0000
A8	0,2066	0,4000	0,0577	0,6893	1,0000	0,2782	0,0034	0,4336	0,0547	0,0023	0,0067	0,0305	0,0021	1,0000	0,8329	0,4936	0,0259
A9	0,5697	1,0000	1,0000	0,7345	0,5615	0,0160	1,0000	0,4553	0,0182	1,0000	0,8114	1,0000	0,4813	0,2886	0,4228	1,0000	0,1722

Step 3: Calculating the deviation from the criterion weight

Using Equation (3.11) and (3.12), the deviation from the criterion weight was calculated.

The calculation for alternative A1 is done as follows:

$$v_{ij} = \sum_{i=1}^{17} w_j \ .(1 - n_{ij})$$
$$= 0{,}0336\,.(1-1) + 0{,}035\,.(1-1) + 0{,}0376\,.(1-0{,}1941) + 0{,}0412\,.(1-0{,}6893) + 0{,}0363\,.(1-1) + 0{,}035\,.(1-0{,}0264) + 0{,}0498\,.(1-0{,}0755) + 0{,}0303\,.(1-0{,}3016) + 0{,}0341\,.(1-0{,}6923) + 0{,}051\,.(1-0{,}1268) + 0{,}0581\,.(1-0{,}0133) + 0{,}0501\,.(1-0{,}0418) + 0{,}0593\,.(1-1) + 0{,}1146\,.(1-1) + 0{,}1171\,.(1-0{,}7489) + 0{,}1145\,.(1-0{,}2139) + 0{,}1014\,.(1-0{,}3922) = 0{,}48579$$

$$v'_{ij} = \sum_{i=1}^{17} w_j \ .(1 - n'_{ij})$$
$$= 0{,}0336\,.(1-0{,}057) + 0{,}035\,.(1-0{,}1536) + 0{,}0376\,.(1-0{,}2273) + 0{,}0412\,.(1-1) + 0{,}0363\,.(1-0{,}2022) + 0{,}035\,.(1-0{,}6082) + 0{,}0498\,.(1-0{,}0025) + 0{,}0303\,.(1-0{,}8556) + 0{,}0341\,.(1-0{,}0263) + 0{,}051\,.(1-0{,}0111) + 0{,}0581\,.(1-0{,}0804) + 0{,}0501\,.(1-0{,}0264) + 0{,}0593\,.(1-0{,}0006) + 0{,}1146\,.(1-0{,}0002) + 0{,}1171\,.(1-0{,}0552) + 0{,}1145\,.(1-0{,}0048) + 0{,}1014\,.(1-0{,}0206) = 0{,}87062$$

The deviation from the criterion weights of alternatives for 2021 are given in Table 4.23.

Table 4.23. The deviation from the criterion weights of alternatives for 2021

	v_{ij}	v'_{ij}
A1	0,48579	0,87062
A2	0,53269	0,86627
A3	0,61967	0,83478
A4	0,76959	0,78535
A5	0,75784	0,63087
A6	0,77200	0,74420
A7	0,74301	0,62382
A8	0,76571	0,61287
A9	0,83385	0,40049

Step 4: Calculating the value of the RAWEC method

Using Equation (3.13), Q_i values of RAWEC was calculated.

The calculation for alternative A1 is done as follows:

$$Q_1 = \frac{0{,}87062 - 0{,}48579}{0{,}87062 + 0{,}48579} = 0{,}2837$$

Q_i values and rankings for 2021 are given in Table 4.24.

Table 4.24. Q_i values and rankings for 2021

	Q_i	Rank
A1	0,2837	**1**
A2	0,2384	**2**
A3	0,1479	**3**
A4	0,0101	**4**
A5	-0,0914	**7**
A6	-0,0183	**5**
A7	-0,0872	**6**
A8	-0,1109	**8**
A9	-0,3511	**9**

According to the results obtained from the RAWEC method (Table 4.24), the firms with the best corporate sustainability performance in 2021 is A1, which has the highest Q_i value (0,2837). It is seen that firms A2 ranked second in the corporate sustainability performance ranking in 2021 with a Qi value of 0,2384. In the 2021 corporate sustainability performance ranking, firm A3 ranks third with a Q_i value of 0,1479, and firm A4 ranks fourth with a Q_i value of 0,0101. According to the results, the firm with the worst corporate sustainability performance in 2021 is A9, which has the lowest Q_i value (-0,3511). As a result, the corporate sustainability performance ranking of the firms calculated with the RAWEC method was A1>A2>A3>A4>A6>A7>A5>A8>A9.

The corporate sustainability performances of the firms in 2022 and 2023 were calculated as stated above and the final results are presented in Table 4.25.

Table 4.25. Q_i values and rankings for 2021, 2022 and 2023

	2021		**2022**		**2023**	
	Qi	**Rank**	**Qi**	**Rank**	**Qi**	**Rank**
A1	0,2837	**1**	0,1741	**2**	0,0985	**3**
A2	0,2384	**2**	0,2395	**1**	0,2944	**1**
A3	0,1479	**3**	0,1522	**3**	0,1651	**2**
A4	0,0101	**4**	-0,0086	**5**	-0,0860	**8**
A5	-0,0914	**7**	-0,0955	**8**	-0,0756	**7**
A6	-0,0183	**5**	0,0710	**4**	0,0640	**4**
A7	-0,0872	**6**	-0,0585	**6**	-0,0050	**6**
A8	-0,1109	**8**	-0,0802	**7**	-0,0010	**5**
A9	-0,3511	**9**	-0,3268	**9**	-0,3569	**9**

According to the final results, significant changes were observed in the firm rankings between 2021 and 2023. A2, in particular, demonstrated strong performance throughout the period,

ranking second in 2021 and rising to the leading position in 2022 and 2023. This demonstrates that the firm has steadily increased its sustainability strength and gained an advantage over other alternatives. A1, on the other hand, had the highest Qi value in 2021 (ranked first) but gradually declined in the rankings in subsequent years (ranking second in 2022 and third in 2023). This decline indicates a weakening of the sustainability performance of A1 compared to other alternatives. A3 maintained a relatively stable position throughout the analysis period, ranking third, third, and second, respectively. This trend indicates that A3 has maintained its sustainability performance and improved over time. Ranking shifts are frequent among the mid-ranking firms A4, A5, A6, and A7. A4 experienced a significant decline,
falling from 4th place in 2021 to 8th place in 2022 and 2023. A6 maintained a relatively stable position throughout the analysis period, ranking 5th, 4th, and 4th, respectively. A7 maintained its 6th position throughout the analysis period. A5 maintained a relatively stable position throughout the analysis period, ranking 7th, 8th, and 7th, respectively. The development of A8 during this period is particularly striking. A8, which ranked 8th in 2021, rose to 7th in 2022 and significantly improved its performance in 2023, settling in 5th place. This rise demonstrates the steady improvement in sustainability performance of A8. A9, ranked lowest, performed poorly throughout the period. A9 held the bottom spot for three years and showed no signs of improvement.

4.6. Sensitivity Analysis

In the final section of this thesis, a sensitivity analysis was conducted to demonstrate the validity and accuracy of the proposed CRITIC-RAWEC model. The reliability of the ranking results obtained through the RAWEC method was further validated by comparing them with several other MCDM ranking techniques—namely MARCOS, CRADIS, ARAS, COPRAS, TOPSIS, EDAS, SAW, and WASPAS—which are widely recognized and have been proven reliable in the literature. The rankings of alternatives for the years 2021, 2022, and 2023, derived from the proposed MCDM model and 7 different CRITIC-based MCDM methods, are presented in Table 4.26, Table 4.27 and Table 4.28.

Table 4.26. Comparative ranking of CRITIC-based MCDM methods in 2021

					2021				
	RAWEC	**MARCOS**	**CRADIS**	**ARAS**	**COPRAS**	**TOPSIS**	**EDAS**	**SAW**	**WASPAS**
A1	***1***	1	1	1	3	3	3	1	1
A2	***2***	2	2	2	1	2	2	2	2
A3	***3***	3	3	3	2	1	1	3	3
A4	***4***	7	7	8	5	5	5	7	6
A5	***7***	5	5	6	7	7	8	5	7
A6	***5***	8	8	7	6	4	6	8	8
A7	***6***	4	4	4	4	6	4	4	4
A8	***8***	6	6	5	8	8	7	6	5
A9	***9***	9	9	9	9	9	9	9	9
(r_s)	**-**	*0,75*	*0,75*	*0,72*	*0,90*	*0,92*	*0,87*	*0,75*	*0,78*

Table 4.27. Comparative ranking of CRITIC-based MCDM methods in 2022

					2022				
	RAWEC	**MARCOS**	**CRADIS**	**ARAS**	**COPRAS**	**TOPSIS**	**EDAS**	**SAW**	**WASPAS**
A1	***2***	2	2	2	2	4	4	2	2
A2	***1***	1	1	1	1	1	1	1	1
A3	***3***	3	3	4	3	2	2	3	3
A4	***5***	7	7	7	6	6	6	7	7
A5	***8***	8	8	8	8	8	8	8	8
A6	***4***	5	5	5	4	3	3	5	5
A7	***6***	6	6	6	5	5	5	6	6
A8	***7***	4	4	3	7	7	7	4	4
A9	***9***	9	9	9	9	9	9	9	9
(r_s)	**-**	*0,88*	*0,88*	*0,82*	*0,98*	*0,93*	*0,93*	*0,88*	*0,88*

Table 4.28. Comparative ranking of CRITIC-based MCDM methods in 2023

					2023				
	RAWEC	**MARCOS**	**CRADIS**	**ARAS**	**COPRAS**	**TOPSIS**	**EDAS**	**SAW**	**WASPAS**
A1	***3***	3	3	4	3	3	3	3	3
A2	***1***	1	1	1	1	1	1	1	1
A3	***2***	2	2	3	2	2	2	2	2
A4	***8***	9	9	7	6	6	6	9	8
A5	***7***	7	7	8	8	8	8	7	7
A6	***4***	5	5	6	4	4	4	5	5
A7	***6***	6	6	5	5	5	5	6	6
A8	***5***	4	4	2	7	7	7	4	4
A9	***9***	8	8	9	9	9	9	8	9
(r_s)	**-**	*0,97*	*0,97*	*0,85*	*0,92*	*0,92*	*0,92*	*0,97*	*0,98*

When the outcomes of all methods were examined and compared with those obtained from the RAWEC method, it was found that the results produced by RAWEC did not exhibit significant deviations from those of the other methods, indicating the robustness and validity of the ranking it generated. According to the results shown in Table 4.26. in 2021, A1 consistently ranks first across nearly all MCDM methods, followed closely by A2 and A3. A9, on the other hand, consistently occupies the lowest position, reflecting its weak overall standing. Mid-ranking alternatives such as A4, A5, A6, A7, and A8 demonstrate moderate stability across most methods. According to the results shown in Table 4.27. in 2022, A2 overtakes both A1 and A3 and secures the leading position across all methods, while A1 and A3 remain among the top three alternatives in most methods. Alternatives A4, A5, A6, A7 and A8 continue to show consistent mid-level rankings, and A9 again ranks lowest in all methods. According to the results shown in Table 4.28. in 2023, A2 maintains its dominance by ranking first in all methods, while A3 surpassed A1 and rose to second place in almost all methods. A1 preserves its strong position within the top three. Alternatives A5, A6, and A7 remain relatively stable across methods, exhibiting minimal ranking variation. As in previous years, A9 persistently occupies the lowest rank in almost all methods.

The relationship between the rankings produced by the RAWEC method and those generated by other methods is analyzed in detail using Spearman's rank correlation coefficient (r_s). According to the (Walters, 2009) correlation values greater than 0.8 indicate a very strong relationship. The findings of sensitivity analysis show that the RAWEC method exhibits a high correlation with other ranking methods over three years.

5. CONCLUSIONS

The sustainable use of natural resources has become a critical priority for both individuals and firms as global consumption continues to rise. Corporate sustainability, as the firms equivalent of sustainability, highlights the responsibility of firms to meet stakeholder needs without compromising future generations' ability to do the same. It requires a balanced consideration of economic, environmental, and social dimensions while pursuing financial objectives. Although firms contribute significantly to societal welfare by improving living standards, they also create adverse effects such as environmental degradation and labor issues. The growing awareness of these impacts has intensified stakeholder demand for transparency and accountability. Consequently, sustainability reporting has emerged as a vital tool for communicating the environmental, social, and economic performance of firms. Guided by the GRI standards, sustainability reports enable comparability and sectoral consistency. Through such reporting, firms aim to strengthen their brand reputation, gain competitive advantages, and enhance stakeholder trust. Therefore, evaluating and measuring corporate sustainability has become essential to understanding real contributions to sustainable development and guiding future strategies toward continuous improvement.

In this study, a hybrid MCDM model based on CRITIC and RAWEC was proposed for assessment of corporate sustainability performance of firms in 2021, 2022 and 2023. In the model, the corporate sustainability performance of 9 firms from different sectors was measured with 17 determined criteria.

When the criteria weights obtained with the CRITIC method are analyzed, it is seen that economic criteria generally have the highest weight, followed by environmental and social criteria. This suggests that economic criteria are particularly influential in the sustainability performance differences among companies.

Considering the economic dimension, the Revenue (CEC1) criterion had the highest weight in 2021, R&D investments (CEC2) appear to be the criterion with the highest weight in 2022 and 2023. The Revenue (CEC1) criterion having the highest weight in 2021 indicates that companies prioritize economic outputs and measuring financial stability in their corporate sustainability performance. On the other hand, the fact that the R&D investments (CEC2) criterion reached its highest level in 2022 and 2023 reveals that companies are turning to investments focused on innovation and long-term value creation in their sustainability strategies. This change highlights that economic performance alone is not sufficient for sustainability assessment and that innovative activities such as R&D play an increasingly critical role in corporate sustainability. It is observed that the R&D investments (CEC2) criterion is the criterion that shows the highest increase every year. This situation highlights that innovation has become a central criterion in the economic dimension of corporate sustainability performance and that firms use R&D investments as a strategic tool to support sustainable growth. The donations and social responsibility projects expenditures (CEC3) criterion ranked 4th in 2021, 2nd in 2022, and 4th again in 2023, indicating that firms consistently prioritize spending on social responsibility and social contributions in their corporate sustainability strategies. While the criterion's rise to second place in 2022 indicates that the focus on social responsibility projects was particularly prominent that year, the drop back to 4th place in 2023 reveals that this focus has decreased somewhat, but is still considered an important criterion.

In the context of environmental dimension, the Greenhouse gas (GHG) emissions (CEN5) criterion received the second-highest weight in 2021, the third in 2022, and the second-highest weight in 2023. This demonstrates that companies consistently prioritize environmental performance in their corporate sustainability strategies. It is observed that companies have adopted controlling greenhouse gas emissions and minimizing their environmental impacts as a strategic priority within the scope of their long-term sustainability goals. The Water Consumption (CEN4) criterion is the fifth highest weighted criterion in all years, and its weight appears to increase each year. In addition, the weight of the Water Consumption (CEN4) criterion is significantly higher than the weight of the other criteria that follow it, and this difference appears to increase over the years. This demonstrates that companies consistently view water consumption management as a priority in their sustainability strategies. The steady increase in weight demonstrates that companies are increasingly strengthening their efforts to use water resources effectively and reduce their water footprint, and that environmental responsibility plays a significant role in long-term sustainability goals. The fact that the Total Energy Consumption (CEN1), Total Waste (CEN2), and Total Hazardous Waste (CEN3) criteria share similar weights in sixth, seventh, and eighth places across all years demonstrates that companies regularly consider energy use and waste management in their environmental sustainability performance. This highlights that companies strategically adopt the goal of controlling their environmental impact and increasing resource efficiency, but that the weights of these criteria are not as high as the aforementioned economic and other environmental criteria.

With regard to the social dimension, the criterion The Number of work accidents (CS9) has steadily increased its weight annually, rising six places in 2023 compared to 2021 and becoming the highest-weighted social criterion, indicating that companies are increasingly prioritizing occupational health and safety in their social sustainability strategies. This trend demonstrates that employee safety and workplace risk management have become central criteria in corporate sustainability performance and that companies are adopting a strategic orientation to strengthen their social responsibilities. The fact that the Retention rate of women retention employees after their return from parental leave (CS7) criterion stood out as the social criterion with the highest weight in 2021 and the ratio of newly hired male employees to the total number of newly hired employees (CS4) criterion in 2022 shows that companies focus on different social priorities in their social sustainability strategies over the years. This shift highlights that firms focus not only on social contribution but also on workforce diversity and equal opportunity practices in their social sustainability performance. The fact that the average hours of training per employee (CS8) criterion was the lowest in 2021 and 2022, and the second lowest in 2023, indicates that companies give relatively limited priority to employee training within the scope of corporate sustainability.

The significantly higher weightings given to Revenue (CEC1), R&D investments (CEC2), Donations and social responsibility project expenditures (CEC3), and Greenhouse Gas (GHG) emissions (CEN5) criteria compared to other criteria across all years demonstrate that companies clearly define their strategic priorities across economic, environmental, and social dimensions when assessing sustainability performance. This highlights the multidimensional nature of the corporate sustainability approach and the companies' balanced and strong focus on financial success, innovation, long-term value creation, social contribution, and environmental responsibility.

Firms were ranked using the RAWEC method using the criteria weights obtained from the CRITIC method. According to these results, Aselsan A.Ş. (A2) consistently performed strongly throughout the period, achieving second place in 2021 and rising to the top in both 2022 and

2023. Arçelik A.Ş. (A1), which initially ranked first in 2021, experienced a gradual decline in subsequent years, falling to second place in 2022 and third place in 2023. Ford (A3) remained relatively stable throughout the analysis, ranking third in 2021 and 2022, and rising slightly to second place in 2023. Frequent ranking fluctuations were observed among the mid-tier firms A4, A5, A6, and A7. PETKİM Petrokimya Holding A.Ş. (A4) experienced a notable downturn, dropping from fourth place in 2021 to eighth in both 2022 and 2023. TÜPRAŞ-Türkiye Petrol Rafinerileri A.Ş. (A6) demonstrated relative stability, ranking fifth, fourth, and fourth over the three years, while SÜTAŞ Süt Ürünleri A.Ş. (A7) consistently maintained sixth place throughout the analysis period. Similarly, Türkiye Şişe ve Cam Fabrikaları A.Ş. (A5) showed only minor variations, ranking seventh, eighth, and seventh, respectively. The progress of Enerjisa Enerji Üretim A.Ş. (A8), however, stands out prominently. Initially positioned eighth in 2021, A8 improved to seventh in 2022 and achieved a substantial advancement in 2023 by reaching fifth place. Conversely, KARDEMİR Karabük Demir Çelik San. ve Tic. A.Ş. (A9) remained at the bottom of the ranking throughout the period, consistently occupying the lowest position for three consecutive years without any observable improvement.

In this thesis, a sensitivity analysis was conducted to test the accuracy and validity of the proposed MCDM model by comparing it with other ranking MCDM methods. In this analysis, the ranking results obtained with the RAWEC method were compared with other common MCDM methods (MARCOS, CRADIS, ARAS, COPRAS, TOPSIS, EDAS, SAW, and WASPAS). The analysis covered the years 2021, 2022, and 2023, and the ranking between the methods was assessed using the Spearman rank correlation coefficient (r_s).

Based on the 2021 results, the correlation coefficients between the RAWEC method and the other methods ranged from 0.72 to 0.92. A particularly high level of correlation was observed with the TOPSIS (r_s=0.92) and COPRAS (r_s=0.90) methods. This indicates that the RAWEC model exhibited strong ranking compatibility for 2021. In the 2022, correlation coefficients generally increased further, ranging from 0.82 to 0.98. The high correlation values obtained with COPRAS (r_s=0.98), TOPSIS (r_s=0.93), and EDAS (r_s=0.93) methods demonstrated that the ranking results of the RAWEC model were highly stable and reliable. As for the comparison with 2023, ranking consistency was generally maintained. Correlation coefficients ranged from 0.85 to 0.98, demonstrating a very high level of agreement, with nearly perfect agreement achieved with WASPAS (r_s=0.98), MARCOS (r_s=0.97), CRADIS (r_s=0.97), SAW (r_s=0.97), TOPSIS (r_s=0.92), COPRAS (r_s=0.92), and EDAS (r_s=0.92). Overall, a high level of correlation was observed between the RAWEC method and other methods, demonstrating that the CRITIC–RAWEC hybrid model produces stable, reliable, and repeatable results. These findings demonstrate that the RAWEC method not only has strong structural consistency but also maintains similar ranking trends when tested with different methods, confirming the robustness of the model.

Consequently, it is expected that the findings will contribute to the reshaping of firms sustainability strategies and serve as a reference for future corporate sustainability assessment studies.

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