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## Comparison of Corporate Sustainable Performance of Deposit Money Banks with Entropy-Topsis Method

*Mevduat Bankalarının Kurumsal Sürdürülebilirlik Performanslarının Entropi-Topsis Yöntemi ile Karşılaştırılması*

### Abstract

Banks are the building blocks of the economic system and are of great importance in achieving sustainable development. Banks are expected to integrate sustainability into their corporate strategies, respect the environment, contribute to society at a higher level and emphasize transparency in their relations with stakeholders. The study aims to analyze the corporate sustainability performance of conventional banks operating in Türkiye. In this context, the corporate sustainability performance of 5 deposit banks operating in Türkiye is categorized according to 14 indicators within the scope of environmental, social and economic dimensions. Since the importance levels of each indicator used in the research may be different, firstly, the importance weights of the 14 indicators were calculated by entropy method, which is one of the objective weighting methods. Then, the corporate sustainability performance of the banks was obtained using the Topsis method, which is one of the multi-criteria decision-making methods. The Topsis method showed that İşbank has the best corporate sustainability performance among the five banks subject to the study.

**Keywords:** Banking Sector, Corporate Sustainability, Entropi, Topsis

### Öz

Bankalar, ekonomik sistemin yapı taşlarıdır ve sürdürülebilir kalkınma sürecinin başarılmasında büyük öneme sahiptirler. Bankalardan beklenen sürdürülebilirliği kendi kurumsal stratejilerine entegre etmeleri, çevreye saygılı olmaları, topluma daha üst düzeyde katkıda bulunmaları ve paydaşlarla ilişkilerde şeffaflığa önem vermeleridir. Çalışma, Türkiye’de faaliyet gösteren konvansiyonel bankaların kurumsal sürdürülebilirlik performanslarını analiz etmeyi amaçlamaktadır. Bu bağlamda Türkiye’de

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faaliyet gösteren 5 mevduat bankasının kurumsal sürdürülebilirlik performansı çevresel, sosyal ve ekonomik boyut kapsamında yer alan 14 göstergeye göre kategorize edilmiştir. Araştırmada kullanılan her bir göstergenin önem düzeylerinin farklı olabilmesi nedeniyle öncelikle 14 göstergenin önem ağırlıkları objektif ağırlıklandırma yöntemlerinden biri olan entropi yöntemiyle hesaplanmıştır. Ardından çok kriterli karar verme yöntemlerinden birisi olan Topsis yöntemi ile bankaların kurumsal sürdürülebilirlik performansı elde edilmiştir. Topsis yöntemi, araştırmaya konu olan beş banka arasında İş Bankası'nın en iyi kurumsal sürdürülebilirlik performansına sahip banka olduğunu göstermiştir.

**Anahtar Kelimeler:** Bankacılık Sektörü, Kurumsal Sürdürülebilirlik, Entropi, Topsis

## Introduction

After the United Nations (UN) announced the principles on Socially Responsible Investments (SRI), which include environmental, social and corporate governance factors in 2006, the concept of sustainability and efforts to harmonize company financial statements with sustainability principles have gained momentum. In this context of increased emphasis on sustainability, stock market indices consisting of companies that have socially responsible investments and comply with conditions such as global reporting, carbon transparency project and greenhouse gas protocol have started to be created. To achieve high sustainability standards in environmental, social and corporate governance, stock exchanges encourage companies to inform investors by reporting their sustainability performance and develop stricter listing rules on sustainability issues. In today's investment environment, where non-financial information as well as financial information is becoming more important and attractive to investors, sustainability issues are becoming increasingly important in emerging markets (Sustainable Stock Exchanges Initiative, 2016).

Environmental social responsibility aims to minimize the negativities experienced by businesses in the environment, to prefer environmentally friendly production technologies by exhibiting environmentally sensitive behaviors while carrying out their activities, and to use resources effectively and efficiently due to limited resources. It has been revealed that enterprises undertake additional costs in their annual reports for the activities related to environmental responsibility for these purposes.

The combination of environment and economy has led to the concept of sustainable development. The concept of sustainable development was

defined as “meeting the needs of humanity today without compromising the ability of future generations to meet their own needs” in the “Our Common Future” report published by the United Nations World Commission on Environment and Development in 1987. Studies on this subject have revealed that achieving sustainable development depends on ensuring both environmental, social and economic sustainability. This situation indicates that sustainable development can be achieved not only through the efforts of countries but also through the joint efforts of individuals and economic units (Gürarda, 2015, p. 11; Özçağ and Hatunoğlu, 2015, p. 309; Alagöz, 2006, p. 3).

While sustainability is important for all institutions, it is of particular importance for financial institutions, which play a key role in the stable and healthy growth of the economy. Banks are the main institutions that create environmental, social and economic impact through financing investments, funds disbursed and other financial products and services. In this respect, the analysis of sustainable banking practices, which is the way banks handle their financial products and services in a way that supports sustainable development, has become increasingly important in recent years.

The change in the Turkish Banking Sector since 2009, when the first corporate sustainability report was published, has been remarkable. Analyzing and evaluating the size and impact of the development in this area within the framework of corporate sustainability is of utmost importance for the future performance of the banking system. Since 2014, the BIST Sustainability Index is an important development for businesses aiming for sustainable development in Turkey and responsible investors seeking to make sustainable investments. It is seen that the banking sector has the highest weight in corporate sustainability reports in which they disclose many indicators related to corporate sustainability strategies in order to provide transparent information to their primary and secondary stakeholders.

In this study, the economic, social and environmental sustainability model, which are the three main dimensions of sustainability, is used. With the proposed model, the sustainability performances of deposit banks operating in Türkiye are measured and comparatively analyzed using the entropy-based TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) method. After the introduction where the general evaluation of the study is made, the concept of sustainability in the banking sector is mentioned in the first section. The third section

presents the related literature, the fourth section explains the scope of the study and the methods used, and the fifth section presents the findings of the study. In the conclusion section, banks are evaluated in terms of their corporate sustainability performance and discussions and recommendations are given. In this study, it is thought that the use of different indicators from the studies in the literature adds originality to the study, as well as the fact that the banks subject to the research are subjected to analysis with indicators from 2022.

### **Sustainability in The Banking Sector**

Banks are the leading financial institutions that have a significant impact on sustainable development by channeling savings in the financial system to investments. Good management of banks, their financial strength and efficiency within the system are also the basic assurance of the healthy growth of the real sector. It is observed that the sensitivity of banks, which play an important role in sustainable development and stable growth, to finance sustainable investments and to raise awareness of their customers on this issue has increased significantly in recent years compared to other sectors (Jeucken, 1999, p. 21). Moreover, it has become much more important for banks to move from a shareholder approach to a stakeholder approach, to focus on sustainable performance targets by acting prudently and with long-term goals in their decision-making processes.

Sustainable banking refers to banks' financial products and services that support sustainable development. As seen in the practices of developed countries, sustainability in Turkey was considered only from an economic perspective and perceived as sustainable growth until the 1970s. After the 1970s, the issue of environmental sustainability came to the agenda, especially with the emphasis on environmental issues in developed countries, and it started to be implemented and spread in these countries in the following two decades. In Turkey, the first legal regulation on this issue started with the enactment of the Environmental Law No. 2872 in 1983. With Article 10 of this law, investments whose activities may cause environmental problems were held responsible for preparing an Environmental Impact Assessment (EIA) Report. In 1993, the first EIA regulation was published in the Official Gazette No. 21489 (Aras et al., 2018, p. 48).

Awareness of sustainability issues in the financial sector in Turkey began in 2006 with the Banking System Ethical Principles Guidelines issued by the Banking Regulation and Supervision Agency (BRSA) and the

Banks Association of Turkey (BAT). The aim of these principles is to set a roadmap for the growth of the system, to improve service quality and to ensure that banks' relations with their stakeholders are conducted in accordance with ethical principles (TBB, 2006).

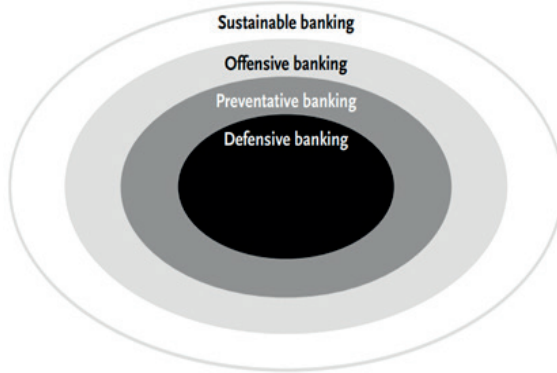
In 2014, the Banks Association of Turkey's Working Group on the Role of the Financial Sector in Sustainable Growth prepared a guide that includes good practices within the contribution of the banking and finance sector to sustainable development. In the Banking Sector Sustainability Guidelines, good sustainability practices in the banking and finance sector are structured under seven principles. These principles are listed as follows (Aras et al., 2018, p. 49)

- Management and study of social risk arising from banking activities,
- Managing the internal effects of the banking sector,
- Human rights and workers' rights,
- Stakeholder engagement and communication,
- Corporate governance,
- Capacity building and monitoring and
- Reporting

In this way, it is aimed to manage corporate sustainability activities more systematically in the Turkish Banking Sector. Although the financial sector has been actively involved in undertaking an intermediary mission to provide the financial resources required for sustainability from the very beginning, it is only recently that it has realized the steps it needs to take in relation to its own activities. Until the late 1990s, the financial sector, and banks in particular, saw themselves as more environmentally sensitive than other sectors. During this period, there were studies showing that banks, including their customers, were not concerned with environmental issues. Today, the financial sector has become an important part of sustainability, taking into account the importance of its intermediary role in the economic system (Garanti BBVA, 2021).

**Figure 1**

*A Representative Staging of Banking and Sustainable Development*



Source: Jeucken and Bouma, 1999, p. 20.

In the first stage, banks are not active on sustainability issues and even try to delay certain possible practices (e.g. on energy efficiency). In the second stage, banks implement sustainability practices that are mandated for them by the government or NGOs. In the third stage, in addition to their own internal issues, they also create sustainable products (environmental investment funds, financing sustainable energy, etc.). However, they are only active here when there is a win-win situation. In the fourth stage, sustainability permeates every aspect of the bank's functioning, and when the bank makes a decision, it focuses on the sustainability of the consequences of the decision rather than its high financial return (Jeucken and Bouma, 1999, p. 22).

### **Literature Review**

Since there is no accepted measurement method in the literature, two important international indices are accepted as indicators in sustainability reporting studies. Apart from these indices, called the Dow Jones Sustainability Indices (DJSI) and the Global Reporting Initiative (GRI), many different studies have been conducted locally. In some of these studies, measurements have been made with purely quantitative data, while in others, the data obtained through surveys, field studies and interviews have been quantified and measured.

Hart and Ahuja (1996), in their study, investigated the impact of greenhouse gas emission reduction activities of enterprises on financial performance through the US case. Within the scope of the study, a

multiple regression analysis was conducted by utilizing the data of 127 manufacturing enterprises for the period 1989-1992. As a result of the study, it is revealed that emission reduction activities have a significant and negative effect on financial performance, and therefore, the efforts made by enterprises to prevent pollution and reduce emissions fall to the 'bottom level' within one or two years.

Russo and Fouts (1997) investigated the effect of corporate environmental performance on profitability on the US case. In the study, the data of 243 enterprises for the period 1991-1992 were analyzed with various methods. As a result of the study, it is revealed that there is a strong positive correlation between corporate environmental performance and profitability, and that the effect of environmental performance on profitability is strengthened as the industry growth increases, and therefore, in growing industries, the probability of being compensated for the environmental activities carried out by enterprises is higher.

Salama (2005) investigated the relationship between corporate environmental performance and financial performance. In the study, data were collected from a total of 201 British enterprises through questionnaires and the data were analyzed by OLS regression method. As a result of the study, it was revealed that there is a strong relationship between environmental performance and financial performance in enterprises.

Curran and Morran (2007) investigate whether financial performance is affected by the reputation that sustainability performance provides to the company. Using the case study method, the study examines the relationship between positive or negative sustainability-related announcements and stock price performance. The impact of inclusion in or deletion from the FTS4Good UK sustainability index on stock prices is analyzed. The results show that inclusion or deletion from the FTS4Good sustainability index affects daily returns as expected, but does not create a statistically significant and meaningful difference.

Moneva and Ortas (2009) used the least squares analysis technique in his study in which he examined whether the environmental sensitivity of the managers of 230 enterprises in Europe has an impact on the financial performance of the enterprises. As a result of the study, it was concluded that the financial performance of enterprises with high environmental sensitivity is also high.

Lioui and Sharma (2012) used regression analysis technique in their study to determine whether the ecological environmental responsibilities of

enterprises for the period 1991-2007 have any effect on their financial performance. As a result of the study, it was concluded that there is a negative relationship between environmentally friendly activities of enterprises and return on assets and Tobin's q value.

Chen et al. (2015), examined the sustainability reports of 75 enterprises using the content analysis method and compared the sustainability scores determined as a result of the content analysis with the financial performance indicators of the enterprises. As a result of the analysis, a significant and positive correlation was found between sustainable performance and return on equity.

Özkan et al. (2018) conducted a research on 35 enterprises in the BIST sustainability index in their study aiming to determine whether corporate social responsibility disclosures of enterprises within the scope of sustainability reports have an impact on their financial performance. According to the research findings, it was determined that corporate social responsibility disclosures of enterprises have a positive effect on profitability ratios.

Hang et al. (2019) examined the relationship between corporate environmental performance and financial performance. According to the results of the study, it was claimed that the financial performance of enterprises in the short term may increase their environmental performance but the effect will disappear in the long term; on the contrary, the environmental performance of enterprises has no effect on their financial performance in the short term but may have a significant effect in the long term.

Falope et al. (2019) investigated the impact of disclosures made by enterprises on pollution control and environmental protection costs on financial performance through the Nigerian construction industry. In this context, the financial statement data of 6 construction enterprises listed in the Nigerian Stock Exchange for the period 2011-2017 were analyzed using multiple linear regression method. The results of the study revealed that environmental cost management positively affects firms' profitability and increases corporate performance, large firms significantly report and disclose environmental information, and environmentally friendly organizations have a high level of corporate cooperation.

Liu (2020) tested the hypothesis that environmental performance will increase financial performance on 500 large enterprises operating in the USA. According to the results of this study, he found that there is a positive relationship between environmental and financial performance



and enterprises and sectors in general, but there is a negative relationship for some enterprises in the industrial sector.

Khanifah et al. (2020) analyzed the mediating effect of environmental performance on firm reputation and firm value of mining companies listed on the Indonesia Stock Exchange using structural equation modeling. According to this study, it was concluded that environmental performance has a positive and significant effect on firm reputation, whereas environmental performance has a negative and significant effect on firm value.

It is seen that the studies conducted to determine the corporate sustainability performance of banks generally focus only on sustainability reports, evaluate qualitative data through content analysis, and evaluate the proportional share of economic, social and environmental disclosures in sustainability. Some of the domestic and international studies on the banking sector are summarized below:

Hassan and Harahap (2010) analyzed the disclosures of social responsibility activities in the annual reports of participation banks operating in Bahrain, Bangladesh, Indonesia, Malaysia, Saudi Arabia, Kuwait and the UAE by content analysis method. In the study, it was stated that participation banks do not disclose their social responsibility activities sufficiently compared to traditional banks.

Kaya (2010), in his study investigating the role of Turkish banks in the sustainable development process, stated that the reasons that prevent the development of sustainable finance understanding in developing countries are the lack of legal regulations, unstable sustainable development policies, insufficient knowledge of financial institutions on sustainable finance and lack of awareness of the society on sustainable development.

Sobhani et al. (2011), in their study analyzing the social responsibility activities of participation banks operating in the Bangladesh stock exchange, stated that central bank practices, corporate culture and environmental impacts shape the social responsibility activities of banks. However, they emphasized that the religion factor is a very important factor behind the social responsibility practices of banks and affects the way the institutions do business.

Khan et al. (2011) analyzed the corporate sustainability reports of large commercial banks in Bangladesh within the framework of GRI principles. The results showed that community-related disclosures were the most

comprehensive. This was followed by disclosures on environmental issues.

In Özçelik and Öztürk's (2014) study, ratios related to economic, environmental and social performances of three private banks from their 2011 sustainability reports were grouped into three financial, two social and four environmental ratios and their sustainability performances were investigated with Grey relational analysis. According to the results of the analysis, banks that stand out in terms of sustainability performance are ranked.

Weber (2016) analyzed the sustainability performance of banks in China and investigated the relationship between their sustainability performance and financial indicators. As a result of the analysis, it was found that sustainability performance has a strong relationship with total assets and net profit among financial indicators.

Nobanee and Elili (2016) investigated the measurement of corporate sustainability disclosures of 16 banks traded on the Dubai and Abu Dhabi stock exchanges between 2003 and 2013 with dynamic panel data analysis and found that the disclosures of these banks are not at an adequate level compared to banks operating in other emerging markets. They also stated that the level of disclosure of corporate sustainability criteria of traditional banks is higher than that of participation banks. The growth rate of short-term deposits, which is taken as a financial performance indicator, has a significant and positive interaction with the corporate sustainability indicators of traditional banks, while there is no effect on banking performance in participation banking.

Aras et al (2018), in their study on the sustainability valuation of the Turkish banking sector within the scope of public and private bank differentiation, presented recommendations for public and private sector banks in order to ensure a sustainable banking system with a multidimensional sustainability approach and to support the healthier functioning of the financial system.

Ecer (2019) used the Entropy-ARAS integrated model to analyze the corporate sustainability performance of private capital banks in Turkey. In his study, he argued that the most important dimension in determining the sustainability performance of private capital banks is the social dimension, and that banks that want to achieve high performance targets in terms of corporate sustainability should first reduce staff turnover and directly reduce greenhouse gas consumption.

In his study, Bektaş (2022) analysed the sustainability performance of state-owned banks operating in Turkey for the years 2014-2021. MEREC and ARAS methods were used in the study. As a result of the study, it was found that Vakıf Bank was the bank with the best performance in the relevant period in terms of performance. The second and third best performing banks are Halk Bank and Ziraat Bank, respectively.

Say and Doğan (2023) tried to determine the relationship between banks' corporate governance practices and sustainability report compliance score. In this context, 2013-2018 data of 10 private, foreign and public banks operating in Turkey were utilised. As a result of the study, it was determined that the average economic, environmental, social and total sustainability report compliance scores of public banks were lower than private and foreign banks.

### **Scope and Methodology of the Research**

The scope of the research consists of banks that made sustainability reporting in the Turkish Banking sector in 2023. There are multiple reasons for choosing the banking sector in the research. The main reason is that the sustainability performance of the banking sector has the power to directly affect and direct the real sector, the entire financial markets and the economy. From this point of view, it is seen that the sustainability reports published by banks have become extremely important as it is understood that banks should be more sensitive in financing sustainable investments and raising awareness of their customers on this issue. The second reason for focusing on the banking sector is that when the distribution of corporate sustainability reports by sector is analyzed, it is the banking sector that publishes the highest number of reports.

### ***Purpose of the Study***

The purpose of the study is to analyze the corporate sustainability performance of deposit banks in Turkey. In the study, the three dimensions of sustainability are economic, social and environmental. The study is based on the sustainability reports of İşbank, Garanti BBVA, Akbank, Yapı Kredi and Vakıfbank, which are deposit banks operating in Turkey, published in 2022. The reason for choosing these banks is that the data on the variables used in the study are available for these banks. There is no uniform standardized data sharing in the integrated annual report published by the banks.

**Data Set**

In the process of creating the data set of the study, first of all, in order to determine the most appropriate variables that will serve the purpose of the study, the applications carried out within the scope of the studies on the subject in the literature were examined. Within the scope of the reviewed studies, it has been observed that different variables can be used in measuring both financial performance and environmental investments. However, in general (Khan, 2011; Sobhani et al., 2012; Ozcelik and Avci Ozturk, 2014; Goyal et al., 2015; Aras et al., 2016; Rebai et al., 2016), capital adequacy ratio (CAR), return on assets (ROA), return on equity (ROE) and non-performing loans (NPL) ratios are preferred to measure financial performance. Water consumption per employee, energy consumption per employee, electricity consumption per employee, paper consumption per employee and greenhouse gas emission data were used as indicators of environmental performance. In parallel with the studies in the literature mentioned above, total number of branches and employees, total number of customers, total number of ATMs and training hours per employee were used as variable data sets for social performance. A summary of the data set used in the study is shown in Table 1.

**Table 1**

*Sustainability Criteria List*

Social Performance Indicators	Total Number of Branches
	Total Number of Employees
	Total Number of Customers (Million)
	Total Number of ATMs
	Training Hours per Employee
Economic Performance Indicators	Capital Adequacy Ratio
	Return on Assets (ROA)
	Return on Equity (ROE)
	Non-Performing Loans (NPL)

Environmental Performance Indicators	Water Consumption per Employee (m3)
	Energy Consumption per Employee (MWh)
	Electricity Consumption per Employee (MWh)
	Paper Consumption per Employee (kg)
	Greenhouse Gas Emissions (tCO <sub>2</sub> e)

In this study, the corporate sustainability performances of Isbank, Garanti BBVA, Vakifbank, Akbank and Yapi Kredi Bank, are analyzed. The economic, social and environmental data used in the analysis were compiled from the Engtre Annual Reports of the banks for 2022. These data used in performance measurement are presented in Table 2. On the other hand, some of the data in Table 2 are readily available in the integrated annual reports, while in some others, the necessary data were obtained by making some calculations and used in the analysis.

**Table 2**

*Data Used in the Analysis*

	Environmental Performance Indicators					Social Performance Indicators					Economic Indicators			
	Water Consumption per Employee (m3)	Energy Consumption per Employee (MWh)	Electricity Consumption per Employee (MWh)	Paper Consumption per Employee (kg)	Greenhouse Gas Emissions (tCO <sub>2</sub> e)	Total Number of Branches	Total Number of Employees	Total Number of Customers (Million)	Total Number of ATMs	Training Hours per Employee	Capital Adequacy Ratio	Return on Assets (ROA)	Return on Equity (ROE)	Non-performing Loans ratio (NPL)
KOD	C1	C2	C3	C4	C5	S1	S2	S3	S4	S5	E1	E2	E3	E4
	min	min	min	min	min	max	max	max	max	mx	max	max	max	min
GARANTI	12,56	8,69	5	39,36	1,02	838	18544	23,1	5450	42,1	16,8	5,4	51	2,6
AKBANK	14,54	40,22	4,91	16,82	1,21	770	12717	10,8	5900	33	23,2	6,2	54,7	2,8
IS BANKASI	12,14	7,23	5,25	41,29	0,94	1131	23309	22,8	6169	43	24,4	5,3	58,2	3
VAKIFBANK	12,79	23,78	13,93	64,38	0,76	949	16961	26,4	4148	46,5	15,19	1,79	30,22	2,13
YAPI KREDI	14,58	31,07	18,54	56,7	0,94	801	15431	21,4	4721	49	19,5	5,4	56,6	3,4

**Methodology of the Study**

In the study, the data in the sustainability reports published by the banks included in the analysis, indicators in economic, social and environmental

dimensions were categorised and the importance weights of the criteria were weighted using the entropy method, which is an objective method. The weighted data were then analysed by applying the TOPSIS method, which is also frequently used in other studies in the literature, to calculate the sustainability performance of the banks.

*Entropy Method*

In decision problems, the determination of criterion weights can be subjective since it depends on the decision maker and objective since it depends on the characteristics of the alternatives themselves. In this context, the entropy method is preferred in the literature because it includes both subjective and objective judgments at the same time. The entropy method is based on a weighting process based on direct data and is also an objective weighting method (Cinar, 2004, p. 55; Meyliana and Budiardjo, 2015, p. 1676).

The concept of entropy was first introduced by Shannon (1948). While information represents the degree of orderliness, entropy refers to disorder. If an object has low entropy, the change in the index value is high and its weight is large. In the opposite case, i.e. when an object has a high entropy value, the change in the index value is small and hence its weight is also small. Therefore, the entropy value can be calculated based on the change in the index value. Thus, the weighting of all indexes is calculated and then an objective result of comprehensive evaluation is obtained (Wei, 2016; Sun, 2014). The following steps are followed to calculate the criteria importance weights in the entropy method (Li et al., 2011, 2090; Sun, 2014, p. 1591):

Let the  $m \times n$  decision matrix  $D$  of a decision making problem with  $m$  alternatives and  $n$  criteria be given as follows:

$$D = \begin{Bmatrix} x_{11} & x_{12} & \dots & x_{1n} \\ x_{21} & x_{22} & \dots & x_{2n} \\ \dots & \dots & \dots & \dots \\ x_{m1} & x_{m2} & \dots & x_{mn} \end{Bmatrix} \tag{1}$$

Where  $x_{ij}$  : is the success value of alternative  $i$  with respect to criterion  $j$  and is  $i=1,2,\dots, m$  and  $j=1,2,\dots, n$ .

At this stage, firstly, since the criteria have different scales, the normalization process is performed and this process is performed using the following

equation.

$$r_{ij} = \frac{x_{ij}}{\sqrt[p-1]{\sum_{j=1}^m x_{pj}^p}} \quad i = 1, 2, \dots, m \text{ ve } j = 1, 2, \dots, n \quad (2)$$

The entropy value for each criterion of the normalized decision matrix obtained by Equation (2) is calculated by the formula in Equation (3) below.

$$e_j = -k \sum_{i=1}^m r_{ij} \ln r_{ij}, \quad j = 1, 2, \dots, n. \quad (3)$$

Here k is a constant defined by that guarantees that  $0 \leq e_j \leq 1$ . Using the entropy value, the degree of differentiation  $d_j$  values for each criterion;

$$d_j = 1 - e_j, \quad j = 1, 2, \dots, n$$

calculated in the form of the following formula. Finally, the weight values of each criterion were calculated with the help of the formula below, by proportioning the degree of differentiation of each criterion to the total degree of differentiation.

$$w_j = \frac{d_j}{\sum_{j=1}^n d_j}, \quad j = 1, 2, \dots, n. \quad (4)$$

Where  $w_j$  is the weight of the  $j$  criterion.

### **TOPSIS Method**

TOPSIS method is one of the Multi-Criteria Decision Making (MCDM) techniques developed by Hwang and Yoon in 1981 and widely used for ranking purposes (Ömürbek, Demirci, and Akalin, 2013, p. 119). The aim of this method is to determine the alternative that is closest to the ideal solution and farthest away from the non-ideal (anti-ideal; negative ideal) solution among a large number of alternatives (Karaatlı, Ömürbek, and Köse, 2014, p. 27). With the TOPSIS method, 8 different stages are followed in the ranking process of alternatives according to certain criteria. These are explained below respectively (Özdemir, 2014, p. 133).

**Step 1:** Setting objectives and defining evaluation criteria.

**Step 2:** Creating the Decision Matrix (A): Decision matrices with alternatives in the rows and evaluation criteria in the columns are created. The decision matrix A shows the actual value of alternative i in the decision

matrix A according to criterion j (Rao, 2008, p. 445).

$$A = \begin{pmatrix} a_{11} & a_{12} & \dots & a_{1n} \\ a_{21} & a_{22} & \dots & a_{2n} \\ \dots & \dots & \dots & \dots \\ a_{m1} & a_{m2} & \dots & a_{mn} \end{pmatrix} \quad (5)$$

**Step 3:** Creating the Normalized Decision Matrix (R): After the decision matrix is created, the normalized decision matrix (R) is obtained using formula (1) (Mahmoodzadeh et al., 2007, p. 335).

$$r_{ij} = \frac{a_{ij}}{\sqrt{\sum_{k=1}^m a_{kj}^2}} \quad (6)$$

**Step 4:** Constructing the Weighted Normalized Decision Matrix (V): First, the relative weight values ( $\omega_{ij}$ :  $i:1,2,\dots,N$ ) of the evaluation criteria are determined according to the objective. Then, the elements in each column of the R matrix are multiplied by the relevant  $\omega_{ij}$  value to form the V matrix. The weighted normalized decision matrix  $V_{ij} = (\omega_{ij} \times R_{ij})$  (Rao, 2008, p. 446).

**Step 5:** Generation of Ideal ( $A^*$ ) and Negative Ideal ( $A^-$ ) Solutions: The ideal solution consists of the best performance values of the weighted normalized decision matrix, while the negative ideal solution consists of the worst values. Ideal solutions can be calculated using equations 2 and 3. In both formulas, benefit J (maximization) and cost J' (minimization) are shown (Yurdakul and Ic, 2005, p. 4612).

$$A^* = \{(max_i v_{ij} | j \in J), (min_i v_{ij} | j \in J')\} \quad (7)$$

$$A^- = \{(min_i v_{ij} | j \in J), (max_i v_{ij} | j \in J')\} \quad (8)$$

The values obtained from equation 2 can be represented as  $d_j^+$  and the values obtained from equation 3 can be represented as  $d_j^-$ .

**Step 6:** Calculation of Segregation Measures: The distance of alternative J from the ideal solution is the ideal separation as ideal separation ( $d_j^+$ ) and the distance of alternative J from the negative ideal solution is calculated as negative ideal separation ( $d_j^-$ ) by using equations 10 and 11 (Mahmoodzadeh et al., 2007, p. 336).



$$S_i^+ = \sqrt{\sum_{j=1}^n (v_{ij} - v_j^+)^2} \quad (9)$$

$$S_i^- = \sqrt{\sum_{j=1}^n (v_{ij} - v_j^-)^2} \quad (10)$$

**Step 7:** Calculation of Relative Proximity to the Ideal Solution: The relative proximity to the ideal solution is calculated by using equation (12) (Olson, 2004).

$$(C_i^*) = \frac{S_i^-}{S_i^- + S_i^+} \quad 0 \leq C_i^* \leq 1 \quad (11)$$

Here, the value indicates the success of the alternative in the sector and higher values indicate higher success.

**Step 8:** Alternatives are ranked according to their relative closeness to the ideal solution.

### Analysis Findings

Firstly, the importance weights of 14 criteria under the economic, social and environmental dimensions were determined by entropy method. The weights obtained using the entropy method are shown in Table 3.

According to the findings, the most important indicator in assessing the sustainability performance of banks was energy consumption per employee with 27.7%. It was followed by electricity consumption per employee with 26.3%, paper consumption per employee with 12.2% and return on assets (ROA) with 9.9%. On the other hand, the indicators with the lowest importance weights were water consumption per employee with 0.04%, training hours per employee with 1.3% and number of ATMs with 1.6%. In terms of the dimensions considered in the measurement of sustainability performance, the environmental dimension ranked first with 68.6%, followed by the economic dimension with 17.9% and the social dimension with 13.4% importance level.

After finding the importance weights of 14 indicators, the second stage of the analysis was started. At this stage, the Topsis method was used. In the Topsis method, an initial decision matrix is created first. For the

criterion that is better to be higher in the decision matrix, the highest value received by the alternatives according to the relevant criterion is selected. On the contrary, for the criteria for which lower is better, the lowest value of the alternatives according to the relevant criterion is taken into consideration. In addition, the inverses of the criteria for which lower is better are included in the initial matrix. The initial decision matrix created in the study is shown in Table 4.

**Table 3**  
Entropy Weights

	Environmental Performance Indicators					Social Performance Indicators					Economic Performance Indicators			
	C1	C2	C3	C4	C5	S1	S2	S3	S4	S5	E1	E2	E3	E4
<i>e<sub>j</sub></i>	0.9981464	0.8895534	0.8951885	0.9512659	0.993079	0.9935766	0.9874255	0.9771744	0.9936307	0.9947373	0.9899697	0.9605843	0.9855203	0.9927874
<i>d<sub>i</sub></i>	0.0018536	0.1104466	0.1048115	0.0487341	0.006921	0.0064234	0.0125745	0.0228256	0.0063693	0.0052627	0.0100303	0.0394157	0.0144797	0.0072126
<i>w<sub>i</sub></i>	0.0046648	0.2779504	0.2637693	0.1226444	0.0174175	0.0161652	0.0316449	0.0574432	0.0160291	0.0132441	0.0252423	0.0991938	0.0364398	0.0181514
<b>TOTAL</b>	<b>68,64%</b>					<b>13,45%</b>					<b>17,90%</b>			

**Table 4**

Initial Matrix

Weights	Min	Min	Min	Min	Min	Max	Max	Max	Max	Max	Max	Max	Max	Max	Min
	0.47%	27.80%	26.39%	12.26%	1.74%	1.62%	3.16%	5.74%	1.60%	1.32%	2.52%	9.92%	3.64%	1.82%	
	C1	C2	C3	C4	C5	S1	S2	S3	S4	S5	E1	E2	E3	E4	
GARANTI	12,56	8,69	5	39,36	1,02	838	18544	23,1	5450	42,1	16,8	5,4	51	2,6	
AKBANK	14,54	40,22	4,91	16,82	1,21	770	12717	10,8	5900	33	23,2	6,2	54,7	2,8	
IS BANKASI	12,14	7,23	5,25	41,29	0,94	1131	23309	22,8	6169	43	24,4	5,3	58,2	3	
VAKIFBANK	12,79	23,78	13,93	64,38	0,76	949	16961	26,4	4148	46,5	15,19	1,79	30,22	2,13	
YAPI KREDI	14,58	31,07	18,54	56,7	0,94	801	15431	21,4	4721	49	19,5	5,4	56,6	3,4	

**Table 5**  
*Normalized Decision Matrix*

	Min	Min	Min	Min	Min	Max	Max	Max	Max	Max	Max	Max	Max	Min
<b>Weights</b>	0.47%	27.80%	26.38%	12.26%	1.74%	1.62%	3.16%	5.74%	1.60%	1.32%	2.52%	9.92%	3.64%	1.82%
	C1	C2	C3	C4	C5	S1	S2	S3	S4	S5	E1	E2	E3	E4
<b>GARANTI</b>	0.420374	0.15182	0.20171	0.377058	0.463192	0.413028	0.467309	0.479071	0.457253	0.437176	0.373165	0.477196	0.445638	0.412663
<b>AKBANK</b>	0.486643	0.702671	0.198079	0.161131	0.549472	0.379513	0.320469	0.223981	0.495008	0.34268	0.515323	0.547892	0.477968	0.444406
<b>IS BANKASI</b>	0.406317	0.126313	0.211796	0.395547	0.426863	0.55744	0.587387	0.472849	0.517577	0.446522	0.541978	0.468359	0.508551	0.476149
<b>VAKIFBANK</b>	0.428072	0.415453	0.561964	0.616743	0.345123	0.467737	0.427417	0.547509	0.348015	0.482867	0.337403	0.158182	0.264062	0.338066
<b>YAPI KREDİ</b>	0.487982	0.542814	0.747941	0.543171	0.426863	0.394792	0.388861	0.443814	0.39609	0.508827	0.433138	0.477196	0.494571	0.539636

**Table 6**  
*Weighted Normalized Decision Variables*

	Min	Min	Min	Min	Min	Max	Max	Max	Max	Max	Max	Max	Max	Min
<b>Weights</b>	0.47%	27.80%	26.38%	12.26%	1.74%	1.62%	3.16%	5.74%	1.60%	1.32%	2.52%	9.92%	3.64%	1.82%
	C1	C2	C3	C4	C5	S1	S2	S3	S4	S5	E1	E2	E3	E4
<b>GARANTI</b>	0.001961	0.042199	0.053205	0.046244	0.008068	0.006677	0.014788	0.027519	0.007329	0.00579	0.00942	0.047335	0.016239	0.00749
<b>AKBANK</b>	0.00227	0.195308	0.052247	0.019762	0.009957	0.006135	0.010141	0.012866	0.007935	0.004538	0.013008	0.054347	0.017417	0.008067
<b>IS BANKASI</b>	0.001895	0.035109	0.055865	0.048512	0.007435	0.009011	0.018588	0.027162	0.008296	0.005914	0.013681	0.046458	0.018531	0.008643
<b>VAKIFBANK</b>	0.001997	0.115475	0.148229	0.07564	0.006011	0.007561	0.013526	0.031451	0.005578	0.006395	0.008517	0.015691	0.009622	0.006136
<b>YAPI KREDİ</b>	0.002276	0.150875	0.197284	0.066617	0.007435	0.006382	0.012305	0.025494	0.006349	0.006739	0.010933	0.047335	0.018022	0.009795
<b>A*</b>	0.001895	0.035109	0.052247	0.019762	0.006011	0.009011	0.018588	0.031451	0.008296	0.006739	0.013681	0.054347	0.018531	0.006136
<b>A-</b>	0.002276	0.195308	0.197284	0.07564	0.009957	0.006135	0.010141	0.012866	0.005578	0.004538	0.008517	0.015691	0.009622	0.009795

After creating the initial matrix, the normalized decision matrix is obtained. The normalized decision matrix is the matrix obtained by dividing each value in the column by the sum of that column and is given in Table 5. In the next stage, the weights calculated by the entropy method were included in the analysis and the weighted normalized decision matrix was found (Table 6).

In the last stage of the study, the closeness of the alternatives to the ideal solution was calculated. In this last stage, the performances of the variables were calculated and the importance ranks of the results in 2022 were determined. The performance results of the banks subject to the study are shown in Table 7 below.

**Table 7**

*Positive Ideal S(+) and Negative Ideal S(-) Discrimination Measure*

	Si+	Si-	Ci*	Ranking
<b>GARANTI</b>	0,029467	0,2153141	1,1585575	2
<b>AKBANK</b>	0,161592	0,1604426	-139,6099	5
<b>İŞ BANKASI</b>	0,030484	0,2185198	1,1621169	1
<b>VAKIFBANK</b>	0,142931	0,09575	-2,029413	4
<b>YAPI KREDİ</b>	0,19181	0,0575118	-0,428239	3

According to Ci\* values, which stands for sustainability performance, the banks subject to the research were ranked from best to worst. According to the results obtained, the bank with the best corporate sustainability performance is İşbank, as shown in Table 7. Garanti BBVA ranked second, Yapı Kredi Bank ranked third, Vakıfbank ranked fourth and Akbank ranked last.

According to the findings, İşbank is in the best position in 7 out of 14 indicators and consequently ranks first in the overall assessment. İşbank has achieved the highest performance value in terms of sustainability. According to the results obtained, it can be said that İşbank is a bank that respects nature and is managed with an environmentalist approach. In terms of social indicators, the bank is again the best bank in terms of total number of branches, total number of employees and total number of ATMs. On the other hand, the bank's capital adequacy ratio and return on equity indicators, which are economic indicators, are also the best performing banks among the banks subject to the research. İşbank is the

second worst performing bank among the surveyed banks only in the indicator of non-performing loans (NPL) ratio. Within the framework of the findings, if the bank takes steps to improve its economic indicators, its sustainability performance will reach higher levels.

## Results and Discussion

Today, stakeholders need to be able to use non-financial information as well as financial data in order to measure the corporate performance of firms and to forecast and analyze future risks. For this reason, it is becoming increasingly common for companies to prepare corporate sustainability reports and to present these reports in an integrated manner with financial reports. Banks are the leading financial institutions that have a significant impact on sustainable development by directing savings to investments. The good management, soundness and efficiency of banks within the system are also the basic assurance of the healthy growth of the real sector.

However, global developments and financial crises have shown that economic, social and environmental factors, which are the main indicators of corporate sustainability, are not sufficient to measure the performance of companies. Along with these indicators, a good managerial structure, the existence of corporate governance practices and sound financial indicators are important factors that complement corporate sustainability. This situation has made it necessary to consider managerial and financial factors in addition to the basic sustainability factors in measuring the sustainability performance of companies.

Measuring the corporate sustainability performance of banks is a difficult and complex CRM problem since many criteria and alternatives are involved in the decision process. In this study, entropy-based Topsis method is proposed to solve this problem. In this context, the corporate sustainability performance of 5 banks operating in Turkey is determined according to 14 indicators within the scope of economic, social and environmental dimensions. Since each indicator may have different levels of importance, firstly, the importance weights of 14 indicators were calculated by entropy method, which is one of the objective weighting methods. Then, the corporate sustainability performance of the banks was obtained using the Topsis method, which is one of the CRM methods.

According to the findings, the most important indicator in evaluating the sustainability performance of banks is energy consumption per employee with 27.7%. It was followed by electricity consumption per employee

with 26.3%, paper consumption per employee with 12.2% and return on assets (ROA) with 9.9%. On the other hand, the indicators with the lowest importance weights were water consumption per employee with 0.04%, training hours per employee with 1.3% and number of ATMs with 1.6%. In terms of the dimensions considered in the measurement of sustainability performance, the environmental dimension ranked first with 68.6%, followed by the economic dimension with 17.9% and the social dimension with 13.4% importance level. The Topsis method shows that İşbank has the best corporate sustainability performance among the five banks in the study. İşbank was followed by Garanti BBVA, Yapı Kredi Bank, Vakıfbank and Akbank, respectively. When the results of the study are compared with the literature, they are similar to the results of Özçelik and Öztürk (2014) and Ecer (2019).

It is possible to see from the practices of other countries that the regulation of voluntary practices with laws and principles for the development of sustainable banking practices contributes to the development of the process in the beginning. In addition, the development and implementation of sustainable development policies is of utmost importance. At the same time, raising awareness of financial institutions and all their stakeholders on sustainability will significantly accelerate and enable developments in this area. In this process, public banks are expected to be pioneers in the field of sustainability due to their inclusiveness and sensitivity arising from their public responsibilities.

Unfortunately, not all banks in Turkey publish sustainability reports. Therefore, it can be stated as a limitation of the study. In future studies, new indicators can be included in the analysis and different multi-criteria decision-making methods can be used to determine the sustainability performance of banks. In addition, fuzzy logic-based methods that better reflect the human mindset in evaluation systems can also be utilized for this purpose.

### **Declaration**

In all processes of the article, TESAM's research and publication ethics principles were followed.

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