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Araştırma Makalesi

CORPORATE SUSTAINABILITY PERFORMANCE MEASUREMENT: AN APPLICATION ON HOME APPLIANCE FIRM

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Abstract

Firms that want to create long-term value can use corporate sustainability as a business approach while preventing risks that arise from the company's decision-making activities with unifying management standards and economic, environmental and social factors. Corporate sustainability performance measurement ensures the examination of sustainability's three dimensions, which are social, environmental and economic, on a corporate level. However, when assessing corporate sustainability performance, using too many criteria poses a problem because it is difficult to set all the criteria for a master criterion. Using multi-criteria decision-making (MCDM) modeling is an applicable approach to measure corporate sustainability. In this study, AHP (Analytic Hierarchy Process), which is one of the multi-criteria decision-making modelings, is used for weighting sustainability's three dimensions and three dimensions' sub-factors. Later, TOPSIS (Technical Order of Similarity to Ideal Solution) method was used to measure the supply chain sustainability performance of one of the white goods companies known and recognized in Turkey. The data are derived from the annual and sustainability reports of the well-known household appliances brand between 2010 and 2015. This study aimed to show that AHP and TOPSIS can be used in MCDM methods while measuring sustainability performance. The article ends with constraints of the study and future work ideas.

Keywords: *AHP, Corporate Sustainability, Multi-Criteria Decision Modelling, Sustainability Performance, TOPSIS, Turkey.*

Jel Code: *M14, L25, Q56*

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KURUMSAL SÜRDÜRÜLEBİLİRLİK PERFORMANS ÖLÇÜMÜ: BEYAZ EŞYA FİRMASI ÜZERİNE BİR UYGULAMA

Öz

Kurumsal sürdürülebilirlik, uzun vadeli değer yaratmayı hedefleyen, yönetim standartlarını ve ekonomik, çevresel ve sosyal faktörleri birleştirerek şirketin karar alma faaliyetlerinden kaynaklanan riskleri önleyen bir iş yaklaşımıdır. Kurumsal sürdürülebilirlik performans ölçümü, sürdürülebilirliğin sosyal, çevresel ve ekonomik olan üç boyutunun kurumsal düzeyde incelenmesini sağlar. Ancak, kurumsal sürdürülebilirlik performansını değerlendirirken, çok fazla ölçüt kullanmak bir sorun yaratmaktadır çünkü bir ana ölçüt için tüm alt kriterleri belirlemek gerçekten zor olabilmektedir. Çok kriterli karar verme (ÇKKV) modellemesinin kullanılması, kurumsal sürdürülebilirliği ölçmek için uygulanabilir bir yaklaşımdır. Bu çalışmada, ÇKKV modellemelerinden biri olan AHS (Analitik Hiyerarşi Süreci), sürdürülebilirliğin üç boyutu ve üç boyut alt faktörünü ağırlıklandırmak için kullanılmıştır. Daha sonra, Türkiye'de bilinen ve tanınan beyaz eşya firmalarından birinin tedarik zinciri sürdürülebilirlik performansını ölçmek için TOPSIS (İdeal Çözüm ile Benzerlik Yöntemi) yöntemi kullanılmıştır. Veriler, 2010-2015 yılları arasında tanınmış beyaz eşya markalarının yıllık ve sürdürülebilirlik raporlarından elde edilmiştir. Bu çalışma, sürdürülebilirlik performansını ölçerken AHS ve TOPSIS'in aynı anda kullanılabileceğini göstermeyi amaçlamıştır. Makale, çalışmanın kısıtları ve gelecekteki yapılabilecek çalışmalarla ilgili fikirler sunarak sona ermektedir.

Anahtar Kelimeler: *AHS, Kurumsal Sürdürülebilirlik, Çok Kriterli Karar Verme, Sürdürülebilirlik Performansı, TOPSIS, Türkiye.*

Jel Kod: *M14, L25, Q56*

INTRODUCTION

After World War II, a fast-growing industrialization process has started around the world. During this process, the urban population has increased, rising in production; developing technologies and science have gradually increased the welfare level of humanity. While an unrestrained development process was started, it also brought some problems to this century. In late 1960's scientists revealed that natural balance has been destroyed. This situation showed that both environmentalists and economist should come together and find solutions to this enormous environmental problem (Ozmehmet, 2008).

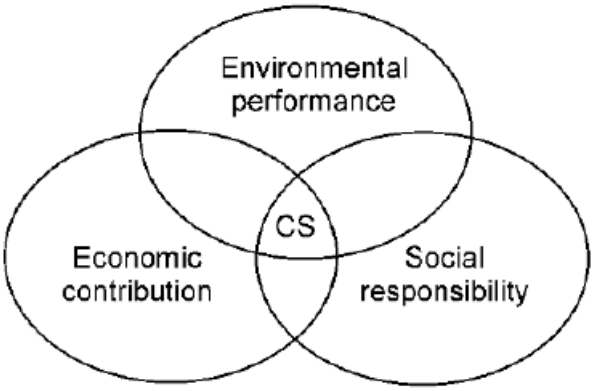
Towards the end of the 20th century, the concept of sustainable development has begun to show up against the environmental problems that have arisen. The most known and explicit expression of sustainability has been presented by the WCED as *"development which meets the needs of the present without compromising the ability of future generations to meet their own needs"* (1987). Sustainability aims to reduce raw materials and energy consumption as well as to prevent the generation of waste during the whole production process. To fulfill these requirements; cost and time efficiency, product and process quality, efficiency, raw material, and energy consumptions must be considered. The main

difficulty of sustainable development is to provide a good life today without jeopardizing future generations' needs.

To achieve this object, constant progress must be achieved in all dimensions of the triple bottom line. This concept is known as corporate sustainability or corporate social responsibility, which is shown in Figure 1. Elkington developed the concept of corporate sustainability. The triple bottom line shows that at the intersection of social, economic and environmental performance, organizations engage in activities not only affects the natural environmental and society positively but also results in long-term economic benefits and competitive advantage (Carter and Rogers, 2008).

From a business perspective, researchers often argue that corporate sustainability can improve the competitiveness of a company (Burke and Logsdon, 1996). In literature, there are different ways to measure corporate sustainability. These are reputation indices and databases, single- and multiple-issue indicators, content analysis of corporation publications, scales and analytical hierarchy process (AHP) (Turker, 2009). Each methodology has its own drawbacks. Also, it is observed that most of the time, only one of the multi-criteria decision modeling (MCDM) method is used to measure corporate sustainability (Oztel et al., 2012). To solve complicated engineering problems MCDM can be used (Rouyendegh and Erkan, 2012).

Figure 1: Corporate Sustainability (CS) and The Triple Bottom Line



For instance, to measure a sustainable supply chain management Erol et al. (2011) have used Multi-Attribute Utility Theory (MAUT). To measure corporate sustainability, analytical hierarchy process (AHP) has been used by (Singh et al., 2007; Goyal et al., 2015); while, analytical network process (ANP) has been used by Mendoza and Dalton (2005) and Babaie-Kafaky et al. (2009). Moreover, Diaz-

Balterio et al. (2011) used compromise programming (CP) to measure sustainable performance in the paper industry.

The aim of this study is threefold. First, in the literature studies related to measuring corporate sustainability performance (measuring CSP) are mainly conducted with using one or two out of three dimensions of sustainability. MCSP with all three dimensions is quite rare (Waddock and Graves, 1997; Klassen and McLaughlin, 1996; Ruf et al., 1998; Moore, 2001; Sarkis and Cordeiro, 2001; Gonzalez-Benito and Gonzalez-Benito, 2005; Filbeck and Gorman, 2004; Scholtents, 2008; Oztel et al., 2012). Since this an important gap in the literature, this study aims to fulfill it with by measuring three dimensions of sustainability at the same time. Second, since each of the multi-criteria decision models has its own drawbacks, using models together makes the results more reliable. Therefore, in this study, AHP and TOPSIS methods applied at the same time to measure CSP. Third, with measuring same years for all dimensions, it is aimed to see how interchanges take place between the sustainability dimensions and which trends the firm has followed.

For these purposes, first sustainability data are gathered. Data, which is used in methodology, are gathered from a Turkish household appliance firm's sustainability reports. While choosing the firm the most important requirement is that whether the firm realizing sustainability reports according to GRI G3 and GRI 4 standards and realizing reports at least five years. So, according to these requirements, a Turkish household appliance firm is chosen. All of the reports are available in public. After setting criteria and sub-criteria, assessment form is prepared to weight the criteria and sub-criteria according to experts' opinions. Experts, who are studying sustainability, environment, social issues and logistics, are chosen to evaluate assessment form. Moreover, these experts consist of academicians and engineers who work in logistics, environmental issues and economics, and human resources. Each of the experts filled the assessment form according to their specialty area. Then, the AHP procedure is performed based on geometric means of these four experts' opinions and weights for each criterion and sub-criterion are identified. Later, using weights TOPSIS is applied for each year and criteria to rank each year for corporate, economic, environmental and social sustainability performance. Thus, this study contributes to corporate sustainability measurement literature by using corporate publications, AHP, and TOPSIS methodology at the same time.

The paper is structured as follows. In the second part, an existing literature review is conducted. The third part explains the methodology. Fourth part gives the results and fifth part presents a conclusion, suggestions for further study and limitations of this study.

LITERATURE REVIEW

To implement sustainability as a strategy, firms need sustainability management tools. Many studies have been conducted about sustainability management tools; however, studies related to the application of corporate practice is rather limited (Windolph et al., 2014b).

Corporate sustainability and sustainability management have taken attention in the literature (Banerjee, 2001; Figge et al., 2012; Lee and Saen, 2012; Windolph et al., 2014a; Scherer and Palazzo, 2011). Using corporate sustainability in firms' daily routine considered an important task while also considering social and environmental issues (Epstein, 2008). Such integration requires both embedding sustainability issues in the firm strategy and handling new practices and choosing and applying special management measurements. An integration like this requires not only embedding sustainability issues in firm strategy (Waddock et al., 2002; McWilliams et al., 2006; Haugh and Talwar, 2010; Boiral, 2011). To manage this, sustainability management tools that are related to environmental, social and economic have been proposed (Epstein, 2008; Husted and Allen, 2007; Tencati et al., 2004; Waddock et al., 2002).

During the measurement of corporate sustainability mostly used methods have been ranged as (1) reputation indices and databases; (2) single- and multiple-issue indicator; (3) content analysis of corporation publications; (4) scales; (5) analytical hierarchy process (AHP) (Turker, 2009; Chen and Fan, 2011).

One of the very common methods for evaluating corporate sustainability is reputation indices and databases. Some of the most popular examples of this method are The Kinder Lydenberg and Domini (KLD) Database, the Fortune Index and Canadian Social Investment Database (CSID). These indices have their own sub-factors. KDL's has eight dimensions; while CSID has seven dimensions. One of the main problems with these databases is assessment can be conducted for only a limited area; meaning that these databases are formed to assess firms in some countries (Turker, 2009).

Single- and multiple-issue indicators are another measurement tool. The pollution control performance and corporate crime are some of the sub-dimensions of indicators. The biggest drawback about these indicators is that they are unidimensional (Turker, 2009). Thus, researchers can use a combination of indicators.

Content analysis of corporate publications is another way of measuring corporate sustainability. During the last decade, the importance of sharing information related to environmental, community, employee and consumer issues has been increased (Gray et al., 1995). Based on this increase, information about corporate sustainability has become more readily accessible. Using content analysis on measuring corporate sustainability enables an objective rating of companies after social features are selected (Ruf et al., 1998). However, there is a danger of

being misinformed by a company (McGuire et al. 1988). Companies can give wrong information related to their corporate sustainability to create a more favorable image. Thus, using corporate publication in measuring corporate sustainability can be a drawback (Turker, 2009).

The other method is scaled that measure the corporate sustainability viewpoint of individuals. In the literature, scales have been developed for measuring corporate sustainability properly. These scales are developed by Aupperle (1984) and Quazi and O'Brien (2000). Aupperle (1984) scale is applicable for managers to investigate their socially responsible behaviors not for organizations. In Quazi and O'Brien (2000) study, a two-dimensional model is developed as a scale for measuring corporate responsibility. While this scale is useful for testing managers' corporate sustainability perceptions especially for managers who have different background characteristics, not helpful for organizational participation.

The last method is using AHP for measuring corporate sustainability since both sustainability and MCDM problems have similar complex quantitative and qualitative issues (Chen and Fan, 2011). Arrington et al. (1982) mentioned to measure social performance, AHP can be used. Moreover, Ruf et al. (1998) proposed the AHP can measure corporate social responsibility while both considering individuals opinion and judgment of the stakeholder.

METHODOLOGY

Assessing Criteria

In this study, Turkey's one of the most well-known household appliance firm's data is used to measure CSP. The data, which covers the years between 2010 and 2015, are derived from the annual and sustainability reports of the firm. After collecting data, assessment sub-criteria have been set. Sub-criteria assigned if they are regularly included in the last 6 years' reports. The assessment criteria distinguish three corporate sustainability domains including economic, environmental and social. The summary of criteria and sub-criteria are summarized in Table 1.

Table 1: Assessment Criteria

Criteria	Sub-Criteria
Economic	E1: Net Sales
	E2: Operating Margin
	E3: Net Profit
	E4: Investment Expenditures
	E5: Corporate Governance Evaluation Score
	E6: End-year Market Value
Environment	EN1: Expenditures on Environment Protection and Investment
	EN2: Amount of Discharged Water
	EN3: Direct Energy Consumption
Social	S1: Percentage of Woman Employee
	S2: Turnover Rate
	S3: Accident Frequency Rate
	S4: Accident Severity Rate

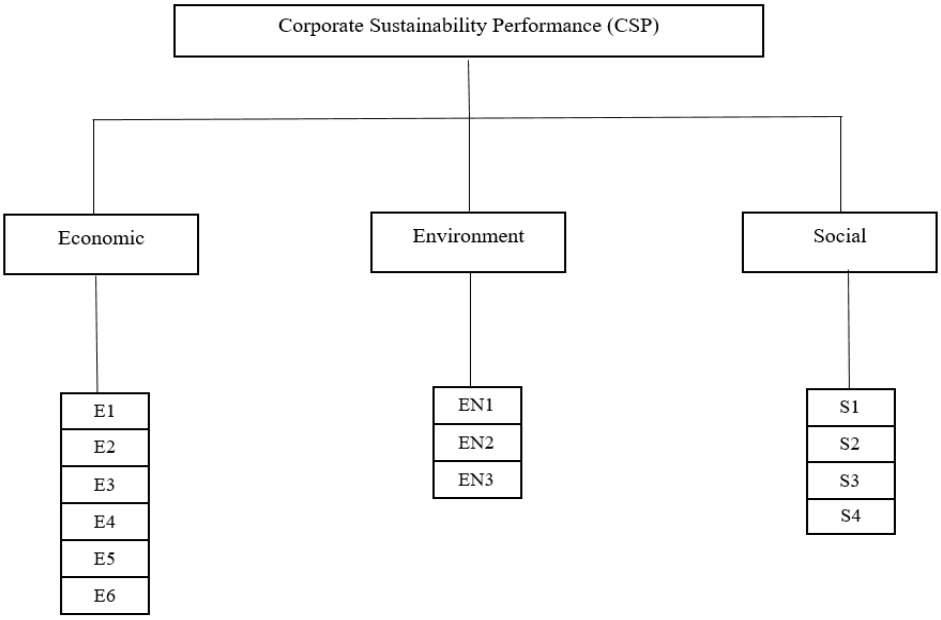
Source: Compiled by authors

According to this table, economic criteria involves net sales, operating margin, net profit, investment expenditures, corporate governance evaluation score and end-year market value as sub-criteria. Environment criteria include three sub-criteria that are expenditures on environment protection and investment, amount of discharged water and decreasing rate of direct energy consumption. Third criteria involve four sub-criteria, which are percentage of woman employee, turnover rate, accident frequency rate, and accident severity rate.

Hierarchical Structure

Figure 2 shows the hierarchical structure; at the outset, it is presented at the top of the hierarchy to assess the best alternative when deciding on the overall objective, corporate sustainability. The second level has three main criteria for achieving the overall goal. The third level includes sub-criteria of the three main criteria. These sub-criteria have an important role during the expert's evaluation of binary comparisons.

Figure 2: The Hierarchical Structure for Selecting the Best Alternatives



Analytical Hierarchy Process

AHP is the multi-criteria decision-making tool, which is developed by Saaty in 1971. One of the most common methods used in the MCDM problem is AHP (Saaty, 1981). AHP transforms a complicated system into a hierarchical system. For each element, a pair-wise comparison is made to form a comparison matrix with using a nominal scale. The eigenvector of the matrix refers to the relative weights of the elements. With using eigenvalue, the consistency ratio is measured. Lastly, to reach an overall valuation for the alternative will be added if the consistency rate is approved. The mathematical notation of AHP is explained below.

While the criteria a_1, a_2,……., a_n and weights w_1, w_2,….., we, pairwise comparison for *n* number criteria's weights will be compared in a matrix as below (Saaty, 1990).

$$A=\begin{bmatrix} a11 & a12 & \dots & a1p \\ a21 & a22 & \dots & a2p \\ . & . & . & . \\ . & . & . & . \\ . & . & . & . \\ . & . & . & . \\ an1 & an2 & \dots & an \end{bmatrix} d \qquad (1)$$

Here, $a_{ij} = \frac{1}{aji}$ becomes $a_{ij} = \frac{aik}{ajk}$ according to the rule of opposing. In real problems, $\frac{wi}{}$ll results in not known, generally. This is why in AHP $a_{ij} \approx \frac{wi}{}$th the equation is found in a_{ij} value (Tzengh and Huang, 2011). The general form of the weight matrix is shown below.

$$W=\begin{array}{c} \\ W1 \\ . \\ . \\ . \\ Wi \\ . \\ . \\ . \\ Wn \end{array}\begin{array}{c} \begin{array}{cccccc} W1 & & & Wj & & Wn \end{array} \\ \begin{bmatrix} w1/w1 & \dots & w1/wj & \dots & w1/wn \\ . & & . & & . \\ . & & . & & . \\ . & & . & & . \\ wi/w1 & \dots & wi/wj & \dots & wi/wn \\ . & & . & & . \\ . & & . & & . \\ . & & . & & . \\ wn/w1 & \dots & wn/wj & \dots & wn/wn \end{bmatrix} \end{array} \qquad (2)$$

Value of W and *w* multiplied;

$$W.\ w=\begin{array}{c} \\ W1 \\ . \\ . \\ . \\ Wi \\ . \\ . \\ . \\ Wn \end{array}\begin{array}{c} \begin{array}{cccccc} W1 & & & Wj & & Wn \end{array} \\ \begin{bmatrix} w1/w1 & \dots & w1/wj & \dots & w1/wn \\ . & & . & & . \\ . & & . & & . \\ . & & . & & . \\ wi/w1 & \dots & wi/wj & \dots & wi/wn \\ . & & . & & . \\ . & & . & & . \\ . & & . & & . \\ wn/w1 & \dots & wn/wj & \dots & wn/wn \end{bmatrix} \end{array} \begin{bmatrix} w1 \\ . \\ . \\ . \\ wi \\ . \\ . \\ . \\ wn \end{bmatrix} = n \begin{bmatrix} w1 \\ . \\ . \\ . \\ wi \\ . \\ . \\ . \\ wn \end{bmatrix} \qquad (3)$$

or can be shown as below

$$(W\text{-}nI)\ w = 0 \quad (4)$$

The result of the equation above is the eigenvalue. λ_{Maks} provides the equation of relative weights $Aw = \lambda_{Maks}\, w$ is used for finding eigenvector w. λ_{Maks} is obtained by the equation of $(A - \lambda_{Maks}\, I)\ w = 0$. Also, two factors used to verify the subjective perceptions consistency and relative weights. These factors are Consistency Index (CI) and Consistency Rate (CR). To calculate Consistency Index (CI) the formula is shown at below.

$$CI = \frac{(\lambda \text{Maks} - \text{n})}{(n-1)} \quad (5)$$

λ_{Maks} is the biggest eigenvalue and *n* is the number of criteria. For a reliable result, CI must be smaller than 0,1 (Tzengh and Huang, 2011).

For Consistency Rate (CR) the following formula is used.

$$CR = \frac{CI}{RI} \quad (6)$$

RI means Random Index. For different number of *n* RI values are shown in Table 2 (Tzengh and Huang, 2011).

Table 2: Random Index

n	1	2	3	4	5	6	7	8	9	10
RI	0	0	0,58	0,90	1,12	1,24	1,32	1,41	1,45	1,49

Source: Tzengh and Huang, 2011

Mathematical Notation of TOPSIS

TOPSIS is developed by Hwang and Yoon (1981). TOPSIS is an advantageous method for calculating and sorting against various contradictory criteria. The best alternatives must have the shortest distance from the ideal point. The non-ideal point is the combination of the worst performance values. The proximity to each of these performance poles is calculated in the Euclidean sense with a weight depending on each criterion (Bilbao-Terol et al., 2014).

The first step of the TOPSIS is forming an evaluation matrix composing of m alternatives and n criteria. The matrix is shown below.

Factors

$$A_{ij} = \begin{bmatrix} a11 & a12 & \dots & a1p \\ a21 & a22 & \dots & a2p \\ . & . & . & . \\ . & . & . & . \\ . & . & . & . \\ . & . & . & . \\ am1 & am2 & \dots & amp \end{bmatrix} \text{ Decision Criteria} \quad (7)$$

The second step of TOPSIS is normalizing the matrix.

$$n_{ij} = \frac{aij}{\sqrt{\sum_{i=1}^{m} aij^2}} \quad (i=1,\ldots,m \text{ ve } j=1,\ldots..,p) \tag{8}$$

Normalized matrix is shown as below.

$$N = \begin{bmatrix} n11 & n12 & \ldots & n1p \\ n21 & n22 & \ldots & n2p \\ \ldots & \ldots & \ldots & \ldots \\ \ldots & \ldots & \ldots & \ldots \\ \ldots & \ldots & \ldots & \ldots \\ nm1 & nm2 & \ldots & nmp \end{bmatrix} \tag{9}$$

The third step of TOPSIS is the calculation of the weighted- normalized decision matrix

$$V = \begin{bmatrix} W1N11 & W2N12 & \ldots & WnN1p \\ W1N21 & W2N22 & \ldots & WnN2p \\ . & . & . & . \\ . & . & . & . \\ . & . & . & . \\ W1Nm1 & W2Nm2 & \ldots & WnNmp \end{bmatrix} = \begin{bmatrix} V11 & V12 & \ldots & V1p \\ V21 & V22 & \ldots & V2p \\ . & . & . & . \\ . & . & . & . \\ . & . & . & . \\ Vm1 & Vm2 & \ldots & Vmp \end{bmatrix} \tag{10}$$

The fourth step is determination of the best (A^*) and worst alternatives (A^-) with given formula.

$$\Rightarrow \quad A^* = \{\max Vij \mid j = 1, \ldots, p\,; i = 1, \ldots, m\}$$

$$A^* = \{V1*, V2*, \ldots\ldots, Vn*\} \text{maximum value of each column} \tag{11}$$

$$\Rightarrow \quad A^- = \{\min Vij \mid j = 1, \ldots, p\,; i = 1, \ldots, m\}$$

$$A^- = \{v1-, v2-, \ldots, vn-\} \text{ minimum value of each column} \tag{12}$$

The fifth step of the TOPSIS is the calculation of the distance between the target alternative *i* and the best condition A^*

$$S_i^* = \sqrt{\sum_{j=1}^{n} (Vij - Vj*)^2} \tag{13}$$

And the distance between the alternative *i* and the worst condition A^-

$$S_i^- = \sqrt{\sum_{j=1}^{n} (Vij - Vj-)^2} \tag{14}$$

The last step is to measure the resemblance of the worst condition

$$C_i^* = \frac{(Si-)}{(Si-)+(Si+)} \quad (15)$$

$C_i^* = 1$ if and only if the alternative solution has the best condition and;

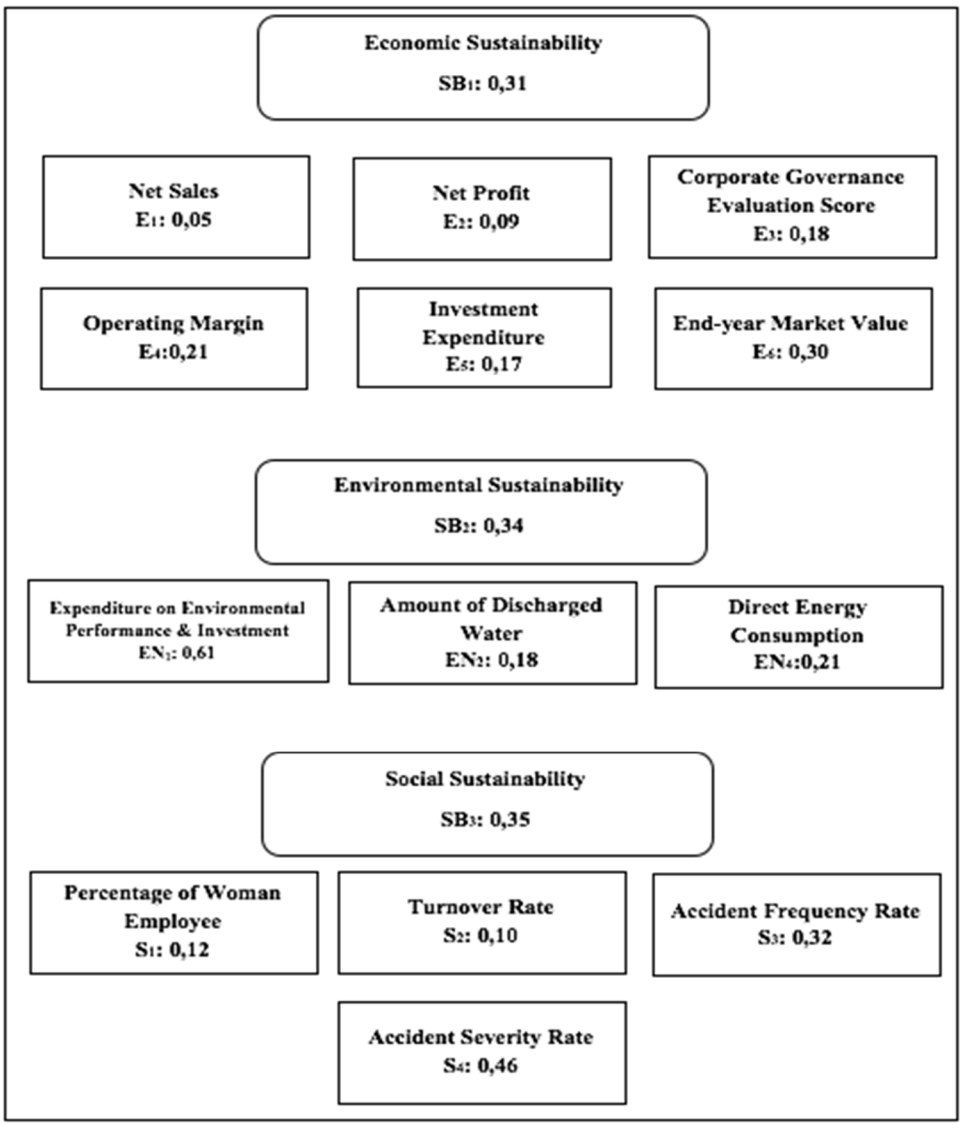
$C_i^* = 0$ if and only if the alternative solution has the worst condition.

RESULTS

In this study, Turkey's one of the most well-known household appliance firm is used for measuring corporate sustainability performance. The data are derived from the annual and sustainability reports of the firm between 2010 and 2015. After gathering criteria and sub-criteria, an assessment form is prepared according to Saaty's 1-9 scale to weighting each of them. Prepared assessment form sent four experts, who are studying sustainability, environment, social issues and logistics. In this form, each criterion compared with each other (Saaty, 1990). After comparing criterion, each criterion's sub-criteria compared within. The AHP procedure is performed based on geometric means of these four experts' opinions. Excel packaged program is used for calculations with using formulas explained above. Results are shown in Figure 3.

The consistency ratio is calculated as 0,03 in this study. This value shows that the evaluations in the binary comparison matrices are consistent. After the calculations, it is seen that the experts gave the most importance to social sustainability compared to other dimensions with 0,35 points. Second important dimension according to experts is environmental sustainability with 0,34 points. Economic dimension has 0,31 point and became third in the rank. End-year market value is on the top rank in economic sustainability with 0,30 points; while expenditure on environmental performance and investment is on the top with 0,61point in environmental sustainability. Moreover, in social sustainability according to experts' assessment the most important sub-criteria accident severity rate with 0,46 point. Since AHP results are leaned on experts' assessments, the same research can have different results with the different expert selection.

Figure 3: Hierarchical Structure of Performance Assessment Criteria



Source: Compiled by authors

After finding weights of dimensions and sub-criteria, firstly selected indicators represented in Table 3, 4 and 5 are used in the TOPSIS method in order to interpret the company's overall economic, environmental and social sustainability performance based on the years between 2010 and 2015.

Table 3: Economic Sustainability Indicators (W_E = 0,31)

Years	W_{E1}=0,05	W_{E2}=0,09	W_{E3}=0,18	W_{E4}=0,21	W_{E5}=0,17	W_{E6}=0,30
2010	3,487	321	276	127	8,55	2,572
2011	3,633	278	233	157	8,59	1,692
2012	4,581	326	237	209	9,11	3,362
2013	4,395	338	247	207	9,28	2,796
2014	4,307	352	220	159	9,41	3,593
2015	4,692	383	296	217	9,48	2,971

Table 4: Environmental Sustainability Indicators (W_{EN} = 0,34)

Years	W_{EN1}=0,61	W_{EN2}=0,18	W_{EN3}=0,21
2010	4.443.260	824.673	0,329
2011	6.333.821	951.242	0,317
2012	13.801.490	986.362	0,356
2013	12.071.962	948.303	0,408
2014	25.507.371	819.334	0,409
2015	16.394.359	892.120	0,437

Table 5: Social Sustainability Indicators (W_S = 0,35)

Years	W_{S1}=0,12	W_{S2}=0,10	W_{S3}=0,32	W_{S4}=0,64
2010	9,42	90,4	91,59	91,5
2011	9,67	86,9	94,27	92,2
2012	9,68	91	95,00	91,5
2013	9,96	91,3	92,55	90,7
2014	10,93	84	93,31	91,2
2015	11,42	81,5	96,29	96,00

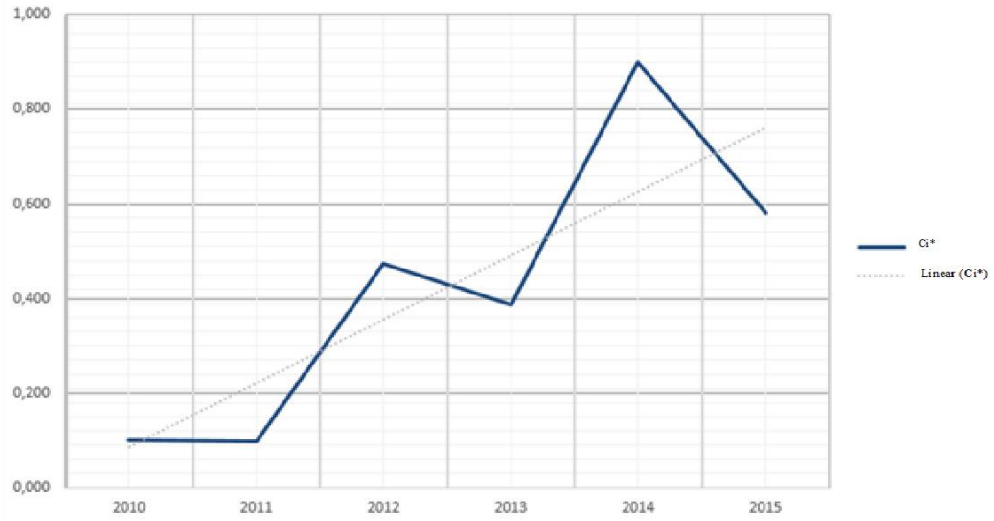
These data are transferred to decision matrices and respectively; normalized and weighted normalized decision matrices are obtained. In a subsequent step, positive and negative ideal solutions are determined and finally distances from positive and negative solutions and relative closeness to the ideal solution are calculated for each year.

Table 6: The closeness coefficients for corporate sustainability and its sub-dimensions

Years	Corporate Sustainability (C_i^*)	Economic Sustainability (C_i^*)	Environmental Sustainability (C_i^*)	Social Sustainability (C_i^*)
2010	0,1018	0,3982	0,007663	0,231385
2011	0,0999	0,1420	0,093927	0,318099
2012	0,4722	0,7924	0,444528	0,352047
2013	0,3864	0,6216	0,365743	0,28074
2014	0,8990	0,7004	0,959644	0,405947
2015	0,5811	0,7368	0,569388	0,776394

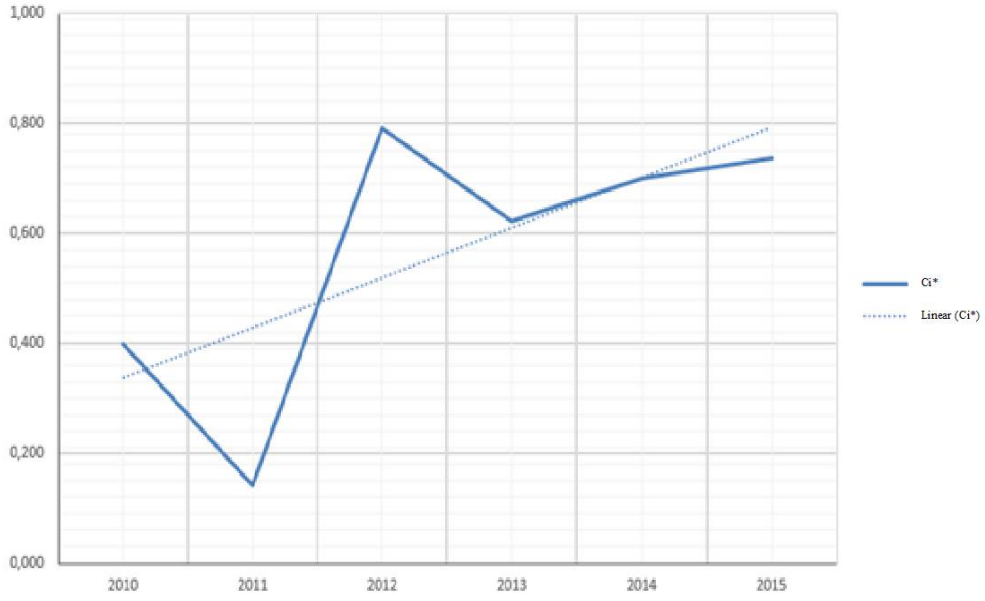
Based on the closeness coefficients (Ci*) in Table 6, trends of the company's corporate sustainability and its sub-dimensions' performances by years is shown in Figure 4, 5 and 6.

Figure 4: Company's Corporate Sustainability Performance by Years



When Table 6 and Figure 4 are analyzed together, it is seen that there is an increasing trend in firm's corporate sustainability performance especially, the most important performance increases occurred in the year of 2012 and 2014. However, for the year of 2015, a 35% decrease occurred in corporate sustainability performance compared to previous year. To be able to examine the changes in the mentioned years, it will be better to evaluate each dimension of the sustainability separately.

Figure 5: Economic Sustainability Performance by Years

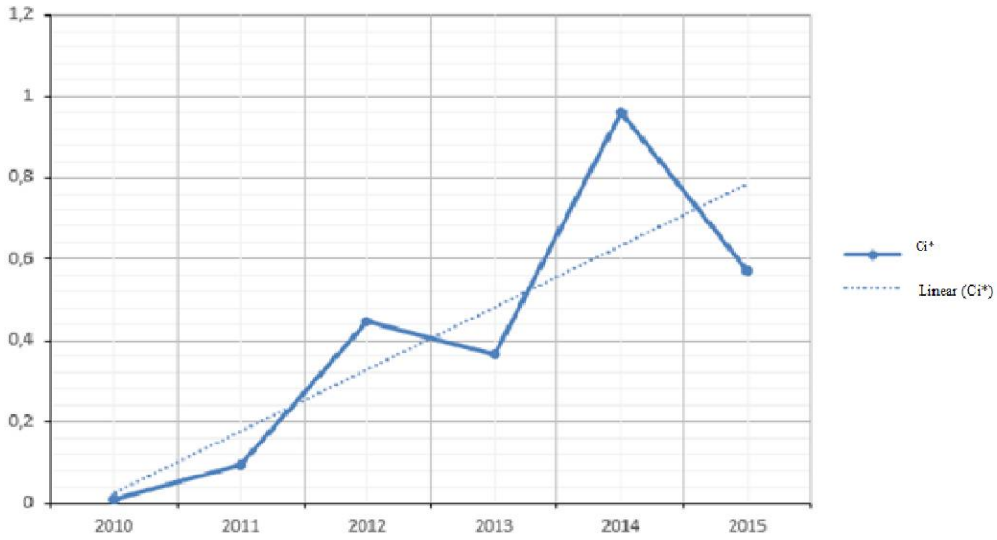


In the year 2012, there is a big increase in economic sustainability performance compared to the previous year. End-year market value, which is the highest weight (W_{E6} =0,30) in the economic dimension, can be the reason. This sub-criterion shows that investors perceive the company as producing value constantly in all its operations. In this sense, it can be said that in the year 2012, the end-year market value of the company increased 98,70% compared to previous year and this leads improvement in economic sustainability performance compared to previous year. Besides, in the year 2011, the world marked with a global crisis that shook world economically, politically and socially, and its effects continued in the following years. Despite this crisis, in the year 2011 and 2012 Turkish growth rate increased. As of 2012, the inspected firm increased its market share 6 % in Eastern Europe market; while decreased its market share 1% in Western Europe. However, overall as of 2012, the inspected firm increased its market share 2 % in the overall household market. Thus, it is possible to say that increases in the market share, positively affects a firm's economic sustainability performance.

When Table 6 examined, it is seen that corporate sustainability performance is significantly improved compared to the previous year; but not as good as the year 2012. However, this improvement wasn't reflected in economic sustainability performance. The end-year market value, which is the highest weight in the economic dimension, only increased by 28,5 % while there is a decrease

occurred in investment expenditure by 23,18 % and net profit by 10,93% and rest of the sub-criteria are almost same can be the main reason for this slow growth. In the year 2015, 35% of a decrease occurred in corporate sustainability performance while in economic sustainability performance 5,20 % increase occurred. At that time, the end-year market value decreased by 17,31 % while investment expenditure and net profit increased to 36,47% and 34,54%, respectively. During this time, the export volume of the firm and the market share in the domestic market increased by more than 7% and 6.7 %, respectively. Even though, the firm's domestic and foreign market share increased, this situation did not affect economic sustainability performance positively because 2015 can be considered as a tough year for Turkey. Turkey and other emerging countries are exposed to currency depreciation because of FED's interest rate decisions and an enormous amount of capital outflow (Deloitte, 2016).

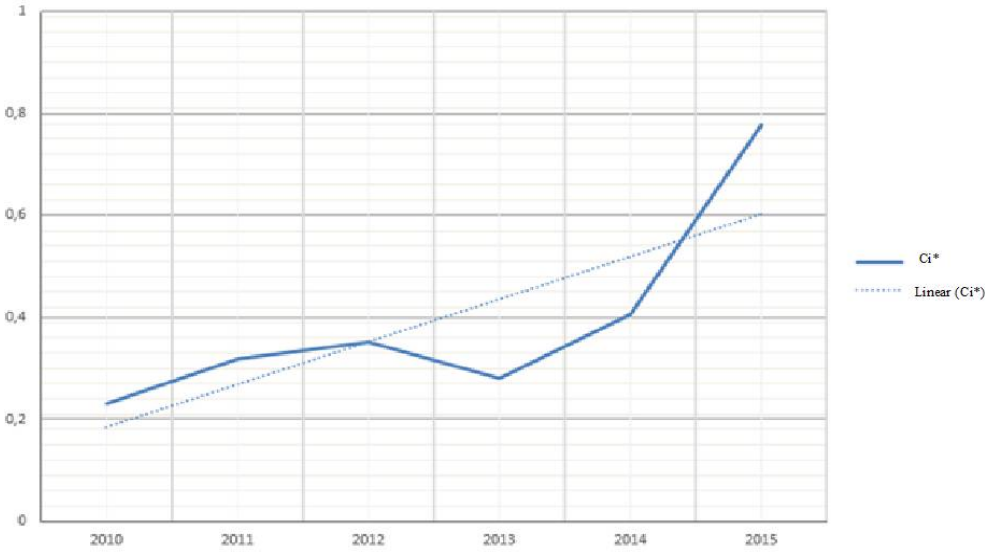
Figure 6: Environmental Sustainability Performance by Years



When Figure 6 is examined, it is seen that there is an increasing trend in environmental sustainability performance by years. In the year 2012, there is a sharp increase in both corporate sustainability performance and environmental sustainability performance compared to the previous year. Expenditure on environmental performance and investment, which is the highest weight (W_{EN1}= 0,61) in the environmental dimension, increased 95,40% compared to the previous year is the reason for this sharp increase. Moreover, while inspected firm increased its market share 2 % in the overall household market, it also increased its amount of discharged water by 3,69 % and direct energy consumption by 14,61%.

Likewise, in the year 2014 corporate sustainability increased by 132,66%, the biggest contributor to this increase comes from environmental sustainability (W_{EN}=0,34), which increased by 162,88%. In the year 2014, environmental performance and investment expenditures increased by 111,29% compared to the previous year. When financial reports are examined, market share is increased compared to the previous year; while, the amount of discharged water decreased by 13,60% and the amount of direct energy consumption hasn't been changed.

Figure 7: Social Sustainability Performance by Years



Social sustainability performance, which has the highest weight (W_S=0,35) in the corporate sustainability dimension, has gradually increased over years. Nevertheless, the significant increases in social sustainability performance in 2012 and 2014 are not as high as the increase in other sustainability dimensions. Accident severity rate (W_{S4}=0,46) and accident frequency rate (W_{S3} = 0,32) are the prominent determinants of the social sustainability performance.

In the year 2012, social sustainability performance increased by 10,67%. This increase caused by an improvement which is occurred in accident frequency rate with 14,6% and decline which is occurred in turnover rate by 31,29%. Moreover, in the same year, a negative increase happened in accident severity rate, which has also the highest weight in social sustainability performance (W_{S4}= 0,46), by 8,97% compared to the previous year.

In 2014, when there is a significant improvement in corporate sustainability performance, it is observed that social sustainability performance has

also improved by 44.59% over the previous year. Reason for this greatest share of performance increase is due to positive decreases in accident severity rate and accident frequency rate by 10,20% and 5,37%, respectively.

The important point is that, even though turnover rate doesn't have an important weight on overall social sustainability performance (W_{S2} =0,10), a negative increase in turnover rate, which is 83,90%, affected social sustainability performance. Thus, this negative upward trend continued in 2015.

Although the turnover rate is not regarded as having a high weight in this study, it has some main drawbacks. Those drawbacks are the loss of employee loyalty and enthusiasm towards the institution, the training of newly hired personnel because of leaving ones, the cost of recruiting, because of losing friends the sadness of the people who continue to work and the uncertainty of relationships between newcomers and former employees can be considered (Bibly, 2008).

CONCLUSION

In this study, Turkey's one of the well-known household appliance firm's corporate sustainability performance is measured with the using AHP and TOPSIS. To be able to that, sub-criteria were chosen and the importance level of sub-criteria was calculated using the AHP method. Then, each dimension of sustainability performance is computed by using TOPSIS.

Overall, 13 sub-criteria have been used for evaluation. According to experts' results, the most important dimension for sustainability becomes social sustainability dimension. In social sustainability dimension, it is seen that the most important sub-criteria are the accident severity rate and the accident frequency rate. However, especially in the social sustainability dimension, it is seen that even though sub-criteria do not have a high weight, it can still affect the overall result as it is in the turnover rate. Second important dimension, according to experts' opinions, is the environmental sustainability dimension. The most important sub-criteria in this dimension becomes the expenditure on environmental performance and investment. Lastly, according to experts' opinion, economic sustainability becomes the third dimension and end-year market value becomes the most important sub-criteria in this dimension.

Even though corporate sustainability performance shows a volatile trend, until the last year it generally increased. Reason for this decrease related to environmental sustainability performance when Figure 5,6 and 7 examined together, and this decrease is a good example of how each dimension is related to each other. Moreover, with this study, it is seen that even a sub-criterion has the lowest weight it can still affect the results of the dimension as it is seen in the social sustainability performance.

The study is completed by using one firm's data, which can be seen as a limitation. Since AHP is used as a weighting method in this study, weights become subjective, and even if the same study repeated one more time, results will not be the same unless using the same experts. Thus, as a future research idea instead of AHP, fuzzy AHP can be used to make results less subjective. As another future research idea, two or more companies, which will be in the same industry, can be compared to see deeply how Turkish firms obtain sustainable development philosophy. Moreover, the same study can be done to compare firms, which are located in different regions to see how each region adopts sustainability issues and uses in daily work routines. Furthermore, instead of AHP, different weighting methods can be fuzzy AHP, Entropy or fuzzy Entropy to weight the criteria and sub-criteria. Likewise, for the ranking instead of TOPSIS, fuzzy TOPSIS or MAUT or fuzzy MAUT or other multi-criteria decision methods can be used. In addition, enriching with interviews, which will be made with the target company, can be another research idea. Last but not least, the same study can be repeated after a few years with the same company to see whether the firm's company policy related to sustainability is changed.

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