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AN INPUT-OUTPUT MODEL OF THE ECONOMIC STRUCTURE OF THE EARTHQUAKE AFFECTED REGION IN TÜRKİYE FOR EFFECTIVE AND EFFICIENT RECOVERY[1]

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Abstract

Türkiye is frequently exposed to earthquakes due to its location in one of the most active earthquake zones in the world. Following the recent earthquakes in the southeastern part of the country, the need to quickly recover from the losses in the local and regional economies of the affected areas makes it extremely important to analyze economic structure to ensure a planned economic development. In view of this, this study aims to investigate the key economic sectors that should be prioritized for investment in the reconstruction process of these places for an effective and efficient economic recovery. In doing so, a static explicit Input-Output (I-O) Model based on Leontief's work is adopted. The key sectors that require investment priority for the recovery and development of local economies in the shortest possible time have been identified using a categorical classification methodology based on the unbalanced growth model proposed by Hirschman.

Keywords: Earthquake, Economic Impact, Input-Output Model, Key Sectors, Recovery Strategies

JEL Classification:C67, R15

Article Type: Research Article

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Öz

Türkiye, dünyanın en aktif deprem kuşaklarından birinde yer alması nedeniyle sık sık depreme maruz kalmaktadır. Ülkenin güneydoğu kesiminde meydana gelen son depremlerin ardından, etkilenen bölgelerin yerel ve bölgesel ekonomilerindeki kayıpların hızla telafi edilmesi ihtiyacı, planlı bir ekonomik kalkınmanın sağlanması için ekonomik yapının analiz edilmesini son derece önemli hale getirmektedir. Bunu göz önünde bulunduran bu çalışma, etkili ve verimli bir ekonomik toparlanma için bu yerlerin yeniden yapılandırılması sürecinde yatırım için öncelik verilmesi gereken kilit ekonomik sektörleri araştırmayı amaçlamaktadır. Bunu yaparken, Leontief'in çalışmasına dayanan statik bir açık Girdi-Çıktı (I-O) Modeli benimsenmiştir. Yerel ekonomilerin mümkün olan en kısa sürede toparlanması ve kalkınması için yatırım önceliği gerektiren kilit sektörler, Hirschman tarafından önerilen dengesiz büyüme modeline dayanan kategorik bir sınıflandırma metodolojisi kullanılarak belirlenmiştir.

Anahtar Kelimeler: Deprem, Ekonomik Etki, Girdi-Çıktı Modeli, Kilit Sektörler, İyileştirme Stratejileri

JEL Sınıflandırması:C67, R15

Makale Türü: Araştırma Makalesi

I. INTRODUCTION

Disaster is generally defined as "a natural, technological or human-induced event that causes physical, economic and social losses for the whole or certain segments of the society, stops or interrupts social life and human activities, and the coping capacity of the affected society is not sufficient" (AFAD, 2014, p.23). The Disaster and Emergency Management Presidency (AFAD) categorizes disasters into two groups: natural disasters and man-made disasters. Natural disasters can develop slowly, such as severe cold, drought and famine, or suddenly, such as earthquakes, floods, floods, fires, landslides, rockfalls, avalanches, storms, tornadoes, volcanic eruptions, etc. Human-induced disasters are defined as nuclear, biological, chemical and industrial accidents, transportation accidents, accidents caused by overcrowding, migrants and displaced persons, etc. (Web 1, 2022).

Natural disasters are occurrences that almost every country in the world inevitably faces in one way or the other. In recent years, the most common natural disasters affecting humanityremain earthquakes, floods, landslides, and wildfires.Among them, earthquakes are more destructive events -physically, socially, and economically- than other disasters.Earthquakes cause significant damage to the economy of the affected region, depending on the magnitude and location of the earthquake and the level of development of the affected country.This damage is much greater in underdeveloped or developing countries.When an earthquake occurs, it causes huge costs in the economic structure of that region, including labour, income and production losses, debris removal costs, humanitarian aid costs and the costs involved in the reconstruction process (Karagoz, 2007).

As in many other countries, Türkiye is a country where natural disasters occur frequently due to its geological structure, geomorphological, and meteorological characteristics. The country’s location within one of the world’s most active earthquake zones puts earthquakes at the head of the aforementioned list of natural disasters. Having caused so much loss of lives and properties in Türkiye so far, these frequently occurring earthquakes are still expected in the coming years. The losses incurred due to quakes go beyond physical and social to economic losses. Post quakes reconstruction comes along with high costs which often leads not only to failure to reach targeted goals but also comes along with periods of economic contractions. In view of this, there is an urgent need for a planned redevelopment approach if the physical, social, and economic problems resulting from earthquakes are to be minimized.

In order to achieve quick recovery from earthquake impacts and to create a planned development, first, the economic impact of the earthquake should be determined. Even though most scientific studies on earthquakes are often handled of its social and physical effects with the economic dimension sufficiently explored.In light of this therefore, studies that explore the economic dimension/s of earthquakes gain importance of in understanding the economic impacts of these earthquakes. In understanding and determining the economic impact, it becomes a matter of utmost importance to analyze the economic structure and how the various (economic) sectors relate within the affected area. This study therefore adopts the I-O model to determine the economic impacts of the earthquakes in the stated regions. In the modern sense, the model is based on the work of Wassily Leontief (1936), which is a balanced model that evaluates the relations between all the units that make up the economic structure at the sectoral level. Several other types of I-O models exist such as the static and dynamic, open, semi-open, and closed, national, regional, and interregional. In this work, the national and regional open static I-O models are used.

First, national and international literature on the subject is presented. Next, the concepts and methods used are discussed. The definition and mathematical expression of the input-output model used as the method of the study are explained. Another method used in the study is the location quotient (LQ) method. Last, regional input-output tables were prepared for the earthquake-affected provinces of Adana, Adıyaman, Diyarbakır, Gaziantep, Hatay, Hatay, Kahramanmaraş, Kilis, Malatya, Osmaniye, and Şanlıurfa using the location quotient method. With the help of these tables, forward and backward linkage effects of sectors in the regional economy are calculated; Hirschman categories and key sectors are identified. The results of the study are presented and evaluations are made in line with the findings.

This work presents recommendations based on strategic approached that are geared towards mitigating the economic impacts the 7.7 mw earthquake that occurred in Gaziantep province Şehitkamil district and the 7.6 mw earthquake that occurred in Ekinözü district of Kahramanmaraş province on 6 February 2023 (KOERI, 2023) along the East Anatolian Fault Lines (EAF). Despite generally expressed as specific points (based on epicenters), earthquakes impact on a wide geography owing to the tectonic movements which occur along the fault line and over a wide area during earthquakes. Areas affected by earthquakes are shown in FigureI and Figure II.

Figure I: Initial Quake, 4:17 a.m. **Figure II: Large Aftershock, 1:24 p.m.**

Source: NYT, 2023

The 10 provinces most affected by earthquakes are Adana, Adıyaman, Diyarbakır, Gaziantep, Hatay, Kahramanmaraş, Kilis, Malatya, Osmaniye, and Şanlıurfa. Apart from the loss of lives and properties, it can reasonably be estimated that these provinces have also been negatively impacted in economic terms as previously indicated.

These earthquakes have already affected more than 15 million people, claimed the lives of more than 48,000 people, damaged more than half a million buildings, communications and energy structures, and caused significant economic losses.A total of 332 tent-cities and 360,167 tents have already installed, 1,440,668 citizens have been sheltered in these. A large number of temporary residential works is underway to build and install 189 container-cities and 90,914 container-homes. Currently 34,120 families have beensheltered in these containers (Republic of Türkiye Presidential Strategy and Budget Department, 2023).

Since February 6, the earthquakes have caused 1.739 trillion TL (56.9 billionUSD) of housing damage to the Turkish economy. The second largest loss was the destruction of public infrastructure and damage to public service facilities (242.5 billion TL, 12.9 billion USD). Damage to the non-residential private sector such as manufacturing, energy, telecommunications, tourism, health, education, small businesses and places of worship is estimated at 222.4 billion TL (11.8 billion USD). It is estimated that the damage caused by the earthquake in the form of severely damaged or demolished houses that had to be demolished urgently, amounted to822.9 billionTL, while the damage to moderately damaged

houses amounted to209 billionTL. Accordingly, the total economic damage to residential buildings amounted to 1,031.9 billion TL (54.7 billionUSD). Furthermore, taking into account losses in the insurance sector and macroeconomic impacts, the total damage of the earthquake on the Turkish economy is estimated at 2 trillion TL (103.6 billionUSD), which could amount to 9% of GDP in 2023(Republic of Türkiye Presidential Strategy and Budget Department, 2023).

II. LITERATURE

The I-O model was formally developed and used for the first time by Wassily Leontief. The first examples of input-output tables, which form the basis of interindustrial economics, were prepared for the US economy in 1919 and 1929. The first I-O model was "QuantitativeInput-Output relations in the Economics System of the United States" published by W. Leontief in 1936 (Aydogus, 2010). By the end of the 1950s, the studies were more related to intersectorallinkages, with progress made within the framework of the analysis of the forward and backward linkage coefficients. Chenery and Watanabe (1958) defined the forward and backward linkage coefficient in their study and compared the production structure of four countries, namely the USA, Japan, Norway, and Italy, using the I-O analysis method. On the other hand, Hirschman (1958) focused on identifying key sectors in line with the studies on forward and backward linkage coefficients. And accordingly, he categorized sectors into four categories as:*industries with high forward and backward linkage*;*industries with high backward linkage and low forward linkage*;*industries with high forward linkage and low backward linkage*; and *industries with low forward and backward linkage* so that he emphasized the need to prioritize those sectors with both high forward and backward linkage for investments.

Among the various economic models used to predict the effects of disasters, the most widely used model is the I-O method. Cochrane (1974, 1997), Wilson (1982), Kawashima et al. (1991), Boisvert (1992), Rose et al. (1997, 1998), Gordon and Richardson (1998), Okuyama et al. (1999, 2004, 2009, 2014, 2015), Hallegatte (2008), Wu et al. (2012), and Arto et al. (2014, 2015) come to mind as international studies.

The first I-O study prepared on a national scale in Türkiye was carried out by the State Planning Organization (SPO) for 1959. The study is a model prepared by consolidating the Turkish economy into 15 sectors. The second study by SPO, which is more comprehensive than the first study, is based on an open static model with 37 sectors prepared for 1963

(Korum, 1967). After the SPO, the input-output tables for the years 1968, 1973, 1979, 1985, and 1990 on a national scale were prepared by the State Institute of Statistics (SIS). Thereafter, tables for the years 1998, 2002, and 2012 were prepared by the SIS under its new name, Turkish Statistical Institute (TURKSTAT) (Aydogus, 2010).

In this study, since the economic effects of earthquakes are calculated at the regional level, studies based on the regional I-O model are emphasized in the literature. Studies on the regional I-O model are summarized in Table I.

Table I: Regional Input-Output Model Studies

Literature	Divitcioglu (1966)	Toraman (1973)	Ozturk (1978)	Ozyurt (1982)	Flegg et al. (1995)	Ersungur (1996)	Fritz et al. (2003)	Bazzazan et al. (2005)	IDA (2012)	WBDA (2014)	Sel (2015)	Demir (2019)
	Antalya	East Marmara	Eastern Anatolia	Trabzon	Avon	Erzurum	Upper Austria	Yazd	Izmir	West Blacksea	Sivas	Adana
Base Year	1963	1963	1968	1980	1984	1995	1995	2000	2008	2011	2014	2017
Number of Sectors	19	20	39	64	32	64	55	22	36	26	8	69
National Coefficient Used		X										
National Coefficient Converted to Regional Coefficient			X		X				X	X		
Directly Measured Coefficient	X			X		X	X	X			X	X
Primary Data	X		X	X	X	X	X	X	X	X	X	X
Secondary Data		X	X	X		X	X	X	X	X	X	
Interindustry Linkage				X		X	X		X	X	X	X
Multiplier Analysis				X	X	X		X	X	X	X	X

Source: The table was created by the authors

In these studies, made use of various methods such as the survey method, cross-industry location quotient (CILQ) method, location quotient (LQ) method, and data from official institutions were used to transform the national input-output table into a regional input-output table.

III. MATERIALS AND METHODS

This work makes use of the most current input-output table published by TURKSTAT in 2012. And as per this table, there is a total of 62 sectors in the Turkish economy.The 62 sectors are grouped into 18 subsectors in the regional input-output table. The reason for the grouping is that it is easier to compile the data and that the LQ method used in the study can be calculated with the employment data. Also, since the amount of employment is obtained from the most up-to-date SSI data for 2021 and these data are compiled by SSI in only 18 sectors, the national input-output table has been grouped in the same direction so that calculations can be made. These sectors, which are grouped based on the national input-output table of 2012 are shown in Table II.

Table II: Consolidated Sectors

Sector Code	NACE Code	Grouping	2012 Input-Output Table Sector Numbers
1	A	Agriculture, Forestry, and Fishing	1-3
2	B	Mining and Quarrying	4
3	C	Manufacturing Industry	5-23
4	D, E	Electricity, Gas, Steam, Water, and Sewage	24-26
5	F	Construction and Public Works	27
6	G	Wholesale and Retail Trade	28-30
7	H	Transportation and Storage	31-35
8	I	Accommodation and Food Service	36
9	J	Information and Communication	37-40
10	K	Finance and Insurance Activities	41-43
11	L	Real Estate Activities	44
12	M	Professional, Scientific, and Technical Activities	46-50
13	N	Administrative and Support Service Activities	51-54
14	O	Public Administration and Defense	55
15	P	Education Services	56
16	Q	Human Health and Social Work Activities	57-58
17	R	Culture, Art, Entertainment, Recreation, and Sports	59-60
18	S	Other Service Activities	61-63

Source: The table was created by the authors

Based on the aggregated national table, technical coefficients matrix, Leontief matrix, and Leontief inverse matrixfor 18 sectors were calculated for each individual province and one for theregion covering the 10 provinces (thereafter referred as ‘the region’). With the help

of these matrices, the linkages between the sectors that make up the economic structure of the affected by the earthquakes 10 provinces and the region has been determined.Total forward and backward linkage coefficients expressing interindustry linkages were calculated with the Leontief inverse matrix. Thus, the structure of the regional economy, which includes each province and the region, was analyzed and comparisons made.

III.I. The Input-Output (I-O) Model

The I-O model was developed by Wassily Leontief in the late 1920s and early 1930s. This analysis, which came to prominence in the United States during the Second World War, was originally designed to be applied at the national level (Isard, 1998). However, the I-O model is a flexible model which canshow variations according to the research topic or the researcher's goals. Depending on the nature of the study, it can be created at the national level as well as at the regional or interregional level.

In order to use the I-Omodel, an input-output table is needed. The economic activity of a region associated with a number, say n, of producing 'sectors.' These thought of as 'industries' and might include resource-based activities, manufacturing, and services. Each of the sectors in the region assumed produces a single, unique product. I-O model attempt to interconnections of an economy by recording, for a given period (say one year), the economic transactions that occur in the economy. These transactions can be seen of view of either the selling sector in the region or the buying sector in the region(Isard, 1998).The input-output table that forms the basis of the I-O model is shown in Table III.

Table III: Input-Output Table

		Interindustry Sales (Z)					Sales to Final Demand (Y)				Total Sales (X)
	z_{11}	z_{12}	…	z_{1j}	…	z_{1n}	c_1	i_1	g_1	e_1	x_1
	z_{21}	z_{22}	…	z_{2j}	…	z_{2n}	c_2	i_2	g_2	e_2	x_2
	…	…	…	…	…	…	…	…	…	…	…
	z_{i1}	z_{i2}	…	z_{ij}	…	z_{in}	c_i	i_i	g_i	e_i	x_i
	…	…	…	…	…	…	…	…	…	…	…
	z_{n1}	z_{n2}	…	z_{nj}	…	z_{nn}	c_n	i_n	g_n	$e_{n\_}$	x_n
Value Added	l_1	l_2	…	l_j	…	l_n					L
	ov_1	ov_2	…	ov_j	…	ov_n					OV
Imports	m_1	m_2	…	m_j	…	m_n					M
Total Outlays (X)	x_1	x_2	…	x_j	…	x_n	C	I	G	E	

Source: Isard et al., 1998

In Table III, the rows show the sectors that provide the product, and the columns contain the sectors that buy the product. The parameters in the relevant table are listed below with their notations:

z_{ij}: the amount of production of sector *i* that is consumed by sector *j*

Y_i: the value of sales of sector *i* goods to final consumers(households, exports, investment, and all levels of government)

x_i: the total value of goods produced by sector *i* (sector *i*'s gross output)

c_i: personal consumption expenditures of sector *i*

i_i: purchases of *i*goods as investments

g_i: government purchases of sector *i*

e_i: exports of sector *i*

l_j: payments for labor servicesof sector *j*

ov_j: payments for all other value added items of sector *j*

m_j: payments for imported inputs of sector *j*

Based on the input-output table, two equations are formed for the total production. The total production is shown as *row sum* of the input-output table in Equation (1), and the total production as *column sum* in Equation (2). Accordingly, both equations (total level of input and output of sectors)are equal to each other (Isard et al., 1998).

$$x_i = z_{i1} + z_{i2} + \ldots + z_{ij} + \ldots + z_{in} + c_i + i_i + g_i + e_i \text{for } \forall\, i \qquad (1)$$

$$x_j = z_{1j} + z_{2j} + \ldots + z_{ij} + \ldots + z_{nj} + l_j + ov_j + m_j \text{for } \forall\, j \qquad (2)$$

In order to calculate the direct and indirect effects of the changes on the final demand specific to the sectors, with the help of the input-output table, the proportional sizes of the values are found. With the help of these proportional values(a_{ij}), how much input from which sector is needed for a unit of service and products produced on the basis of each sector can then be calculated. Direct input coefficients are obtained by dividing the total amount of products produced by sector *i* and received by sector *j* (z_{ij}) bythe total production expenditures for products and services produced by sector *j*(x_j)(Isard et al., 1998). This calculation is shown in Equation (3).

$$a_{ij} = \frac{z_{ij}}{x_j} \qquad (3)$$

Starting from Equation (3), after determining the input coefficients in this way for each sector in the economy, a square matrix is formed from these coefficients. This matrix is called input coefficients matrix, technical coefficients matrix or technology matrix. In order to obtain the matrix, the interindustry relations section of the input-output table is used. The input coefficients matrix shows the *direct effects* of bring about in that sector of an increase in the final demand of any sector (Bocutoglu, 1990).

$$\mathbf{A} = \begin{bmatrix} a_{11} & a_{12} & \cdots & a_{1j} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2j} & \cdots & a_{2n} \\ \vdots & \vdots & \vdots & \vdots & \vdots & \vdots \\ a_{i1} & a_{i2} & \cdots & a_{ij} & \cdots & a_{in} \\ \vdots & \vdots & \vdots & \vdots & \vdots & \vdots \\ a_{n1} & a_{n2} & \cdots & a_{nj} & \cdots & a_{nn} \end{bmatrix} \quad (4)$$

In Equation (4), the input coefficients matrix, which directly shows the input coefficients, is expressed with the symbol **A** in the equation solution**.** The numbers in the indices of the coefficients indicate the relevant row and column. For example, the coefficient a_{12}shows the proportional value of the production of the sector in the 1st row and 2nd column of the table.

Equations (1) and (2), which form the basis of the input-output model are expressed as a matrix, and in Equation (5), they are expressed as a vector of sector-based production totals. Equation (6) shows the final demand vector on the basis of sector.

$$\mathbf{X} = \begin{bmatrix} x_1 \\ \vdots \\ x_j \\ \vdots \\ x_n \end{bmatrix} \quad (5)$$

$$\mathbf{Y} = \begin{bmatrix} y_1 \\ \vdots \\ y_j \\ \vdots \\ y_n \end{bmatrix} \quad (6)$$

The total production obtained from the sum of the row elements of the input-output table in Equation (1) is shown in Equation (7) in terms of the matrices specified in Equation (4), Equation (5), and Equation (6).

$$\mathbf{X} = \mathbf{AX} + \mathbf{Y} \quad (7)$$

For the solution of the model, the production vector must be isolated from the equation and created in terms of the input coefficients vector and the final demand vector (Aydogus, 2010).This process is illustrated in Equation (8).

$$\mathbf{X} - \mathbf{AX} = \mathbf{Y} \qquad (8)$$

For the solution of Equation (8), it is necessary to know that the product of any matrix with the diagonal elements 1 and the identity (**I**) matrix whose other elements are 0 is equal to itself. Equation (9) is obtained when X matrix is placed in common brackets.

$$(\mathbf{I} - \mathbf{A})\mathbf{X} = \mathbf{Y} \qquad (9)$$

The equation where$(\mathbf{I} - \mathbf{A})$isfoundis called Leontief matrix, named after Wassily Leontief who is regarded as the founder of the I-O model. Leontief matrix $(\mathbf{I} - \mathbf{A})$shows the final demand for one unit of production of sectors (Ersungur, 1996).

If both sides of Equation (9) are multiplied by the Leontief inverse matrix$(\mathbf{I} - \mathbf{A})^{-\mathbf{1}}$, Equation (10) is formed, since the product of a matrix inverse and itself is equal to the unit matrix, and the product of the unit matrix and a vector does not change the value of the vector (Aydogus, 2010).

$$\mathbf{X} = (\mathbf{I} - \mathbf{A})^{-\mathbf{1}}\mathbf{Y} \qquad (10)$$

Leontief inverse matrix $(\mathbf{I} - \mathbf{A})^{-\mathbf{1}}$forms the basis of input-output analysis by establishing the relationship between final demand and output levels. This matrix, expressed in Equation (11), shows both the direct and indirect effects of the sectors within the economic structure.

$$(\mathbf{I} - \mathbf{A})^{-\mathbf{1}} = \begin{bmatrix} \beta_{11} & \beta_{12} & \cdots & \beta_{1j} & \cdots & \beta_{1n} \\ \beta_{21} & \beta_{22} & \cdots & \beta_{2j} & \cdots & \beta_{2n} \\ \vdots & \vdots & \vdots & \vdots & \vdots & \vdots \\ \beta_{i1} & \beta_{i2} & \cdots & \beta_{ij} & \cdots & \beta_{in} \\ \vdots & \vdots & \vdots & \vdots & \vdots & \vdots \\ \beta_{n1} & \beta_{n2} & \cdots & \beta_{nj} & \cdots & \beta_{nn} \end{bmatrix} \qquad (11)$$

The production and final demand vectors in Equation (10) are also considered as $\mathbf{\Delta X}$ and $\mathbf{\Delta Y}$ as marginal values or increments. The increases in the final demand of only one sector or all industries are written as Equation (12), assuming an increase of $\mathbf{\Delta Y}$ (Ersungur**,** 1996).

$$\Delta \mathbf{X} = (\mathbf{I} - \mathbf{A})^{-1} \Delta \mathbf{Y} (12)$$

In this way, input-output analysis is thus, used as a planning tool. Accordingly, the total production of industries in the economy can be calculated by multiplying the inverse Leontief matrix with the final demand vector (Ersungur, 1996).

The input-output model helps to determine how important the sectors are to each other by taking into account the intersectoral exchanges of intermediate goods. In the input-output tables, it is shown how much input each sector in the economy receives from other sectors to produce and how much of the outputs produced in the sector are used in which sectors(Aydogus, 2010).The exchange of goods between sectors is what backward and forward linkages, or economic "connectedness"(Miller and Blair, 2009).

The direct backward linkage of sector j – the amount by which sector j production depends on interindustry inputs – is given the sum of the elements in the jth column of the directinput coefficients matrix is shown in Equation (13) (Miller and Blair, 2009). $\mathrm{BL(d)_j} = \sum_{i=1}^{n} a_{ij} (13)$

The direct forward linkageof sector j is given the sum of the row elements of the input coefficients matrix and is shown in Equation (14) (Miller and Blair, 2009).$\mathrm{FL(d)_i} = \sum_{j=1}^{n} a_{ij} (14)$

However, the direct linkage reflect *only direct exchanges* between sectors. The linkages between the sectors gives more accurate results when the total linkages are calculated.

To capture both direct and indirect linkages in an economy, column sums of the Leontief inverse matrix, were proposed as a total backward linkage measureand it is shown in Equation (15) (Miller and Blair, 2009).

$$\mathrm{BL(t)_j} = \sum_{i=1}^{n} l_{ij} (15)$$

The total forward linkage, is given the sum of the row elements of the Leontief inverse matrix and it is shown in Equation (16) (Miller and Blair, 2009).

$$\mathrm{FL(t)_i} = \sum_{j=1}^{n} l_{ij} (16)$$

Hirschman's unbalanced growth model is based on interindustry linkages. He argues that the linkages have the quality of feeding and stimulating each other's production of the

sectors, and that these should be taken into account in investment decisions. Sectors with high linkages are chosen as the key sector because they increase production, employment, and income more than investments made in other sectors (Altan, 1996). According to Hirschman, priority is given to the sectors with the highest total linkages while making development decisions. For this reason, it makes more sense to consider the ones with high backward linkage. Because entrepreneurs know that there is a buyer to whom they can sell goods, which creates a safer harbor in making investment decisions (Savas, 1987). In view of this, sectors are divided into four groups according to their backward and forward linkages by Hirschman (Hirschman, 1958):

- Category I: Industries with high backward and forward linkages
- Category II: Industries with high backward linkage and low forward linkage
- Category III: Industries with high forward linkage and low backward linkage
- Category IV: Industries with low backward and forward linkages

Accordingly, *industries with high forward and backward linkages*in category Iare the key sectors with the highest investment priorities for the economy. Both linkages are above the average value. By producing intermediate goods and receiving inputs to a significant extent, it affects both the sectors where goods are purchased and sold (Iloglu, 1993). CategoryII sectors are those *with high backward linkage and low forward linkage.* It consists of sectors with a backward linkage above the average and a forward linkage below the average. If there are still unused resources after directing resources to key sectors, they should be redirected to these sectors (Yilanci, 2008). Category III sectors consist of those *with high forward linkage and low backward linkage.* They include sectors with a forward linkage above the average and a backward linkage below the average. These sectors need to be stimulated by the key sector. Generally, by producing intermediate goods, the production of the sectors that demand these goods increases and new industries emerge. CategoryIVsectorsare those*with low forward and backward linkages.* Both forward and backward linkages of the sectors in this category are low. Also, both linkages are below the average value. These sectors also need to be stimulated by the key sectors. It has no direct effects on other sectors (Yilanci, 2008).

III.II. Location Quotient (Lq) Method

Location quotient (LQ) method is preferred as a method in this study since it is one of the most frequently used techniques in creating a regional I-O model. This method is

calculated as the ratio of the share of any sector in the region to its share in the country according to a certain indicator -such as the number of enterprises, the number of employees, turnover, gross investments, among others- and shows the concentration level of the sector in terms of the country average regarding the said indicator. The indicator determined for this study is the number of employment. The calculation of LQ according to the employment is shown in Equation (17) (Isard et al., 1998).

$$LQ_i^J = \frac{E_i^J / E^J}{E_i / E} \quad (17)$$

LQ_i^J: location quotient in sector *i* based on employment in a given region*J*

E_i^J: employment in activity *i* in a given region *J*

E^J: total employment in a given region *J*

E_i: employment in activity *i* in the nation

E : total employment in the nation

When that location quotient is greater than 1, it indicates that the sector is concentrated in the region above the country average. The coefficient being equal to 1 indicates that the concentration level of the sector in the region is equal to the country average. And when that the coefficient is less than 1, it indicates that the sector is less concentrated in the region than the country average. While preparing the regional input-output table, in cases where the LQ values calculated for the sector are greater than or equal to 1, the sector values in the national coefficients table are written in the same way in the regional table. In cases where the LQ value is less than 1, the calculated LQ value is multiplied by the sector values in the national table and written in the regional table (Miller and Blair, 2009). These values are calculated using Equation (18).

$$\begin{matrix} (LQ_i^J)a_{ij} & \text{if} \quad LQ_i^J < 1 \\ a_{ij} & \text{if} \quad LQ_i^J \geq 1 \end{matrix} \quad (18)$$

Thus, by converting national input-output tables into regional input-output tables, the relationships between industries in the local economy can then be analyzed.

IV. ANALYSIS AND RESULTS

The Gross Domestic Product (GDP) and Per Capita GDP values of the 10 provinces and the region in general which is determined as the study area are shown in Table IV according to the 2021 TURKSTAT data, and the highest GDP values in the region belong to the provinces of Gaziantep and Adana. The ratio of the GDP of the region to the country corresponds to 9%.

Table IV: 2021 GDP and Per Capita GDP Values of 10 Provinces and the Region

Provinces	GDP (thousand TRY)	Population	Per Capita GDP (TRY)	Percentage Within the Region	Percentage Countrywide
Adana	141,672,580	2,263,373	62,594	21%	1.95%
Adıyaman	23,236,012	632,148	36,757	3%	0.32%
Diyarbakır	62,494,019	1,791,373	34,886	9%	0.86%
Gaziantep	148,588,413	2,130,432	69,746	22%	2.05%
Hatay	101,461,596	1,670,712	60,730	15%	1.40%
Kahramanmaraş	63,004,412	1,171,298	53,790	9%	0.87%
Kilis	7,006,880	145,826	48,050	1%	0.10%
Malatya	38,831,203	808,692	48,017	6%	0.54%
Osmaniye	30,945,765	553,012	55,959	5%	0.43%
Şanlıurfa	57,589,407	2,143,020	26,873	9%	0.79%
Region-wide	674,830,287	13,309,886	50,701	100%	9.31%
Türkiye	7,248,788,983	84,680,273	85,602		100%

Source: TURKSTAT, 2021

Per capita GDP is obtained by dividing the GDP value by the population is mapped and shown in Figure III. The highest per capita GDP is in Gaziantep, Adana, and Hatay provinces.

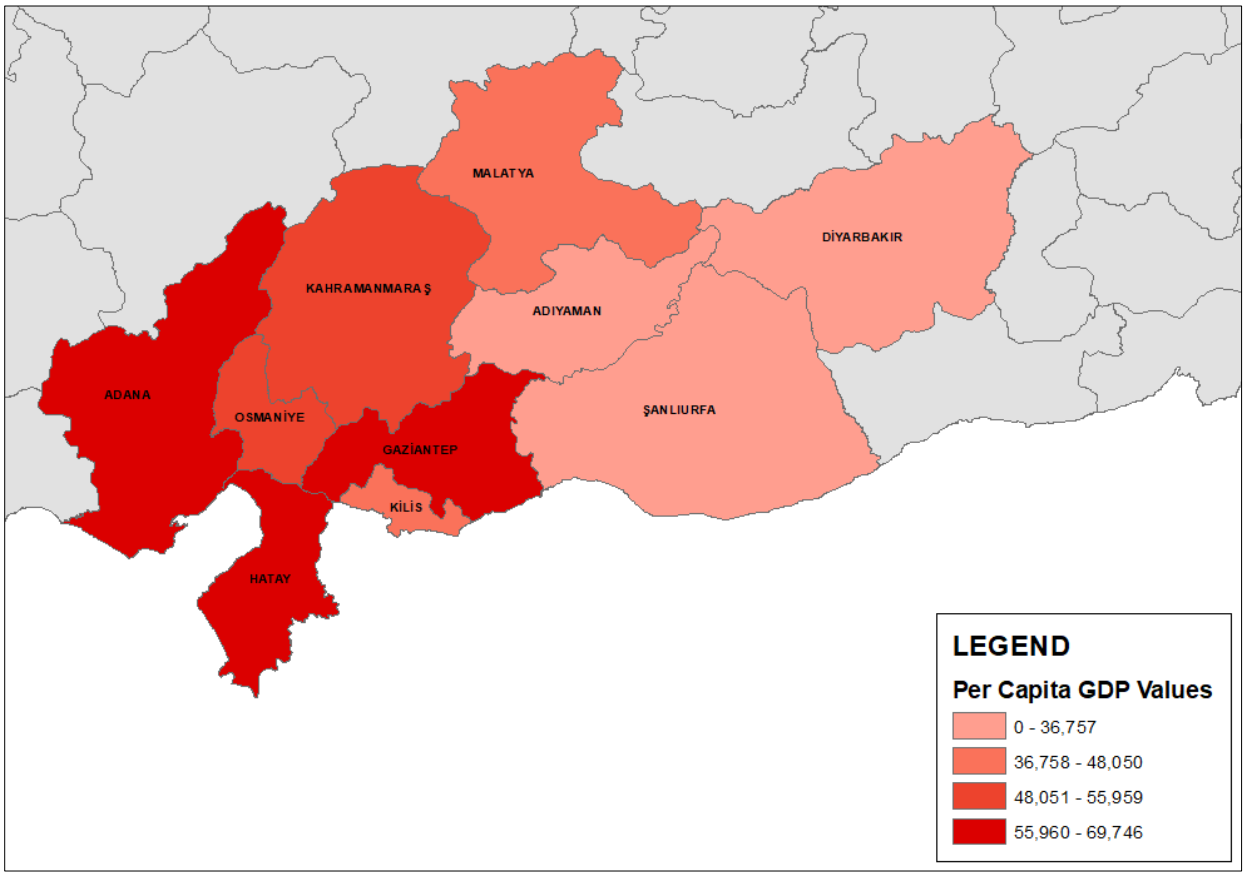

Figure III: Per Capita GDP Values of 10 Provinces

Source: The figure was created by the authors

The GDP values of the sectors included in the economy of 10 provinces in TURKSTAT data are shown in Table V. Accordingly, the sectors of industry, services, public administration, education, human health and social work activities come to the fore.

Table V: 2021 GDP Values of 10 Provinces and the Region by Sectors

Industries	Adana	Adıyaman	Diyarbakır	Gaziantep	Hatay	Kahramanmaraş	Kilis	Malatya	Osmaniye	Şanlıurfa	Region-wide	Türkiye
Agriculture, forestry, and fishing	10,208,479	3,051,387	8,748,301	5,129,481	5,417,056	5,594,743	984,387	3,683,770	2,494,150	11,954,732	57,266,486	401,805,954
Industry	40,811,795	5,528,508	7,047,039	67,634,889	34,006,357	25,526,896	1,115,360	9,148,529	12,851,755	7,454,519	211,125,65	1,888,148,628
Manufacturing industry	34,083,264	2,977,099	3,295,816	64,370,044	30,064,809	20,580,196	974,781	8,082,860	11,896,242	5,112,579	181,437,690	1,609,778,714
Building	6,402,174	1,043,590	4,490,251	6,396,756	3,504,000	3,013,742	520,073	2,540,967	1,005,974	2,952,971	31,870,498	367,218,833
Services	33,430,456	3,090,977	8,983,972	27,224,338	25,593,721	7,959,208	984,497	5,676,003	4,327,717	9,298,675	126,569,563	1,772,670,048
Information and communication	1,371,847	96,451	1,107,784	423,353	185,296	280,012	55,627	234,551	63,683	238,892	4,057,496	199,576,584
Finance and insurance activities	3,179,299	333,578	937,536	1,740,011	1,020,893	566,473	76,493	596,022	222,833	575,113	9,248,250	211,640,623
Real estate activities	5,866,329	1,693,664	4,064,139	5,715,300	4,754,904	2,986,190	493,921	2,784,245	1,720,868	2,866,531	32,946,091	358,675,847
Professional, administrative, and support service activities	5,493,009	626,916	2,557,138	3,909,846	2,624,950	1,317,158	164,282	1,197,32	447,886	2,098,582	20,437,086	345,474,812
Public administration, education, human health, and social work activities	17,392,110	5,049,643	16,958,608	13,556,882	12,660,768	8,528,149	1,800,990	8,158,457	4,279,205	12,784,629	101,169,440	769,000,822
Other service activities	2,514,928	260,764	981,563	1,123,062	949,564	560,107	69,271	699,382	254,751	1,266,441	8,679,831	166,979,807

Source:TURKSTAT, 2023

The national input-output table was then converted into a regional input-output table in order to make economic analyzes of the 10 provinces and the region affected by the earthquakes. LQ values calculated for 18 sectors according to 2021 by using equation (17) are shown in Table VI.

Table VI: LQ Values of 18 Sectors in 10 Provinces Affected by Earthquakes and Throughout the Region

Industries	Adana	Adıyaman	Diyarbakır	G.antep	Hatay	K.maraş	Kilis	Malatya	Osmaniye	Ş.urfa	Region-wide
Agriculture, Forestry, and Fishing	**2.24**	**1.09**	0.82	0.53	0.96	**1.18**	0.73	0.93	**1.27**	**2.37**	**1.31**
Mining and Quarrying	0.80	**3,52**	**1.37**	0.24	0.58	**1.51**	0.43	**1.02**	0.37	0.30	0.84
Manufacturing Industry	0.92	**1.03**	0.58	**1.52**	0.71	**1.46**	0.65	**1.14**	**1.18**	0.58	**1.03**
Electricity, Gas, Steam, Water, and Sewage	**1.23**	**1.52**	**1.68**	0.56	0.93	**2.79**	0.77	0.73	**1.32**	**1.16**	**1.23**
Construction and Public Works	0.91	**1.44**	**1.36**	**1.06**	**1.09**	**1.03**	**2.13**	**1.32**	**1.30**	**1.04**	**1.11**
Wholesale and Retail Trade	**1.06**	0.70	0.87	0.85	**1.07**	0.70	0.44	0.85	0.91	0.63	0.87
Transport and Storage	0.82	0.98	**1.17**	0.74	**1.94**	0.72	0.95	0.65	0.75	**1.12**	0.98
Accommodation and Food Service	0.66	0.55	0.61	0.45	0.72	0.50	0.48	0.73	0.45	0.37	0.56
Information and Communication	0.38	0.23	0.47	0.26	0.21	0.36	0.20	0.53	0.28	0.28	0.33
Finance and Insurance Activities	0.87	0.34	0.53	0.54	0.63	0.39	0.19	0.67	0.51	0.47	0.59
Real Estate Activities	0.88	**1.26**	**1.16**	0.79	0.66	0.91	0.28	0.86	0.25	0.47	0.81
Professional, Scientific, and Technical Activities	0.72	0.41	0.52	0.55	0.61	0.41	0.34	0.47	0.58	0.74	0.58
Administrative and Support Service Activities	**1.06**	0.99	**1.60**	**1.01**	**1.07**	0.66	**1.47**	0.96	0.91	**1.93**	**1.15**
Public Administration and Defense	0.88	**2.17**	**3.02**	**1.19**	**1.62**	**1.61**	0.66	**2.34**	0.57	**2.76**	**1.67**
Education Services	0.91	**1.34**	**1.91**	0.99	**1.46**	0.96	**3.31**	**1.04**	**1.75**	**2.18**	**1.32**
Human Health and Social Work Activities	**1.23**	**1.06**	**1.46**	**1.26**	**1.30**	0.99	**1.61**	**1.22**	**1.07**	**1.38**	**1.25**
Culture, Art, Entertainment, Recreation, and Sports	0.88	0.74	0.70	0.40	0.79	0.69	0.55	0.99	0.80	0.59	0.70
Other Service Activities	0.88	0.84	0.61	0.98	**1.33**	0.76	**1.93**	**1.11**	0.74	0.91	0.93

Source: The table was created by the authors

According to Table VI, the sectors with an LQ value equal to or above 1 are the sectors that have gained specialization in that province by concentrating above the country average. These sectors are expressed in bold font and darker tones in the relevant table for 10 provinces and the total region.

- Specialized sectors in **Adana**include**;**agriculture, forestry, and fishing;electricity, gas, steam, water, and sewage;wholesale and retail trade; administrative and support service activities; human health and social work activities.
- Specialized sectors in **Adıyaman**are**;** Agriculture, forestry, and fishing; mining and quarrying; manufacturing industry; electricity, gas, steam, water, and sewage; construction and public works; real estate activities; public administration and defense; educational services; human health and social work activities.
- In **Diyarbakır,**mining and quarrying; manufacturing industry; electricity, gas, steam, water, and sewage; construction and public works; transportation and storage; real estate activities; administrative and support service activities; public administration and defense; educational services; human health and social work activities sectors are specialized.
- In **Gaziantep,**manufacturing industry; construction and public works; administrative and support service activities; public administration and defense; human health and social work activities sectors are specialized.
- In **Hatay,**construction and public works; wholesale and retail trade; transportation and storage; administrative and support service activities; public administration and defense; educational services; human health and social work activities; other service activities sectors are specialized.
- In **Kahramanmaraş,** there is specialization inagriculture, forestry, and fishing; mining and quarrying; manufacturing industry; electricity, gas, steam, water, and sewage; construction and public works;public administration and defense sectors.
- In **Kilis,**there is specialization in construction and public works; administrative and support service activities; educational services; human health and social work activities; specializes in other service activities sectors.
- In **Malatya,** there is specialization in mining and quarrying;manufacturing industry; construction and public works; public administration and defense; educational services; human health and social work activities; specializes in other service activities sectors.

- In **Osmaniye**,agriculture, forestry, and fishing;manufacturing industry; electricity, gas, steam, water, and sewage; construction and public works; educational services; human health and social work activities sectors are specialized.
- In **Şanlıurfa,**agriculture, forestry, and fishing; electricity, gas, steam, water, and sewage; construction and public works; transportation and storage; administrative and support service activities; public administration and defense; educational services; human health and social work activities sectors are specialized.
- **Across the region,** agriculture, forestry, and fishing; manufacturing industry; electricity, gas, steam, water, and sewage; construction and public works; administrative and support service activities; public administration and defense; educational services; human health and social work activities sectors are specialized.

In creating the regional input-output table for the 10 provinces affected by the earthquakes and the region, where the LQ values calculated for each sector as specified in Equation (17) are equal to or greater than 1, the sector values in the national input coefficients matrix (**A** matrix in Table A.I) arewritten in the same way on the regional table. In cases where the LQ value is less than 1, the calculated LQ value is multiplied by the sector values in the national input coefficients matrix (**A**matrix) and written into the regional input coefficients matrix**.** By using this method, the 2021 regional input coefficients matrix (**A**matrix) was created for the 10 provinces and the region(Table A.II in appendix). Starting from the **A**matrix**,** the total forward and backward linkages were calculated by forming the matrix for the total of 10 provinces and regions with Equation (7, 8, 9, and 10) to determine the industrial linkagesfrom Leontief inverse matrix$(\mathbf{I}-\mathbf{A})^{-1}$.As an illustration, Table A.III in appendix provides regional Leontief inverse matrix.

According to Hirschman, priority is given to the sectors with the highest total backward linkage while making development decisions. Regarding these analyses,**the total backward linkage**of the sectors in the 10 provinces affected by the earthquakes and the region are shown together in Table VII. Accordingly, the sectors with the highest total backward linkage in each province are electricity, gas, steam, water, and sewerage, manufacturing industry sector, construction and public works. It was observed that this situation is the same throughout the region. The sectors with a total backward linkage above the average throughout the region are the manufacturing industry, electricity, gas, steam, water, and sewage, construction and public works, transportation and storage, accommodation

and food service activities,and other service activities. These are the sectors that demand the most intermediate inputs from other sectors and have priority in determining the key sectors.

Table VII: Affected by EarthquakesTotal Backward Linkage of Sectors in 10 Provinces and the Region

Industries	Adana	Adıyaman	Diyarbakır	G.antep	Hatay	K.maraş	Kilis	Malatya	Osmaniye	Ş.urfa	Region-wide
Agriculture, Forestry, and Fishing	1,613	1,647	1,412	1,436	1,495	1,627	1,350	1,594	1,618	1,433	1,660
Mining and Quarrying	1,650	1,698	1,507	1,490	1,512	1,650	1,367	1,620	1,582	1,408	1,708
Manufacturing Industry	**2,278**	**2,394**	**1,869**	**2,015**	**1,950**	**2,345**	**1,688**	**2,275**	**2,241**	**1,750**	**2,405**
Electricity, Gas, Steam, Water, and Sewage	**2,450**	**2,558**	**2,442**	**1,582**	**2,145**	**2,524**	**1,793**	**2,101**	**2,191**	**2,077**	**2,496**
Construction and Public Works	**2,143**	**2,259**	**1,785**	**2,090**	**1,898**	**2,220**	**1,706**	**2,213**	**2,186**	**1,720**	**2,289**
Wholesale and Retail Trade	1,569	1,577	1,459	1,469	1,467	1,522	1,323	1,523	1,477	1,392	1,597
Transport and Storage	**1,749**	**1,823**	**1,622**	**1,653**	**1,683**	**1,690**	**1,522**	**1,674**	**1,697**	**1,572**	**1,856**
Accommodation and Food Service	**1,847**	**1,900**	**1,567**	**1,709**	**1,632**	**1,867**	**1,441**	**1,836**	**1,810**	**1,498**	**1,913**
Information and Communication	1,422	1,374	1,351	1,331	1,314	1,375	1,225	1,425	1,353	1,292	1,416
Finance and Insurance Activities	1,452	1,308	1,330	1,314	1,336	1,303	1,168	1,377	1,296	1,280	1,379
Real Estate Activities	1,322	1,339	1,243	1,260	1,248	1,323	1,180	1,311	1,297	1,203	1,343
Professional, Scientific, and Technical Activities	1,536	1,480	1,417	1,420	1,443	1,447	1,299	1,491	1,450	1,384	1,531
Administrative and Support Service Activities	1,383	1,388	1,271	1,336	1,302	1,354	1,219	1,376	1,356	1,243	1,404
Public Administration and Defense	1,575	1,597	1,456	1,497	1,488	1,549	1,373	1,553	1,551	1,423	1,620
Education Services	1,250	1,261	1,220	1,188	1,216	1,234	1,164	1,218	1,223	1,195	1,266
Human Health and Social Work Activities	**1,685**	1,701	1,511	**1,584**	1,537	**1,664**	**1,406**	**1,668**	**1,641**	1,452	1,721
Culture, Art, Entertainment, Recreation, and Sports	1,604	1,569	1,480	1,446	1,506	1,519	1,357	1,572	1,530	1,436	1,591
Other Service Activities	**1,763**	**1,768**	1,524	**1,663**	**1,589**	**1,727**	**1,420**	**1,745**	**1,706**	**1,480**	**1,809**
Average	**1,683**	**1,702**	**1,526**	**1,527**	**1,542**	**1,663**	**1,389**	**1,643**	**1,623**	**1,458**	**1,722**

Source: The table was created by the authors

The total forward linkage of the sectors in the 10 provinces affected by the earthquakes and the region are shown together in Table VIII. And accordingly, the sectors with the highest total forward linkage in each province are the manufacturing industry, electricity, gas, steam, water, and sewage, and transportation and storage sectors. It was observed that this situation is the same across the region. The sectors with a total forward linkage above the average throughout the region are agriculture, forestry, and fishing, mining and quarrying, manufacturing industry, electricity, gas, steam, water, and sewage, wholesale and retail trade, transportation and storage sectors. These are the sectors in which other sectors demand the most intermediate inputs.

Table VIII: Affected by EarthquakesTotal Forward Linkage of Sectors in 10 Provinces and the Region

Industries	Adana	Adıyaman	Diyarbakır	G.antep	Hatay	K.maraş	Kilis	Malatya	Osmaniye	Ş.urfa	Region-wide
Agriculture, Forestry, and Fishing	**1,733**	**1,788**	1,447	1,364	**1,589**	**1,776**	**1,399**	**1,716**	**1,762**	**1,555**	**1,789**
Mining and Quarrying	**1,793**	**2,053**	**1,839**	1,186	1,483	**2,040**	1,305	**1,900**	1,362	1,233	**1,878**
Manufacturing Industry	**5,034**	**5,681**	**3,126**	**5,277**	**3,740**	**5,563**	**3,289**	**5,551**	**5,430**	**3,041**	**5,697**
Electricity, Gas, Steam, Water, and Sewage	**2,777**	**2,832**	**2,594**	**1,728**	**2,434**	**2,816**	**2,009**	**2,094**	**2,765**	**2,538**	**2,833**
Construction and Public Works	1,438	1,488	1,478	1,459	1,474	1,485	**1,447**	1,476	1,478	**1,466**	1,491
Wholesale and Retail Trade	**1,915**	1,670	**1,691**	**1,735**	**1,824**	1,651	1,331	**1,786**	**1,820**	**1,474**	**1,846**
Transport and Storage	**1,990**	**2,235**	**2,133**	**1,808**	**2,150**	**1,846**	**1,977**	**1,752**	**1,861**	**2,069**	**2,257**
Accommodation and Food Service	1,132	1,100	1,110	1,082	1,135	1,090	1,080	1,135	1,085	1,069	1,108
Information and Communication	1,197	1,108	1,231	1,127	1,103	1,177	1,088	1,269	1,139	1,134	1,168
Finance and Insurance Activities	1,508	1,183	1,275	1,278	1,333	1,208	1,086	1,370	1,274	1,234	1,335
Real Estate Activities	1,440	1,472	1,460	1,365	1,310	1,424	1,114	1,415	1,120	1,207	1,398
Professional, Scientific, and Technical Activities	1,589	1,320	1,399	1,415	1,467	1,319	1,236	1,370	1,453	**1,547**	1,473
Administrative and Support Service Activities	1,445	1,432	1,424	1,415	1,423	1,283	**1,393**	1,416	1,388	1,410	1,445
Public Administration and Defense	1,028	1,029	1,029	1,028	1,029	1,029	1,017	1,030	1,017	1,028	1,030
Education Services	1,043	1,046	1,045	1,045	1,046	1,043	1,043	1,046	1,046	1,045	1,047
Human Health and Social Work Activities	1,068	1,068	1,068	1,068	1,068	1,068	1,068	1,068	1,068	1,068	1,068
Culture, Art, Entertainment, Recreation, and Sports	1,103	1,083	1,079	1,043	1,090	1,077	1,061	1,116	1,091	1,066	1,079
Other Service Activities	1,057	1,052	1,037	1,060	1,062	1,046	1,057	1,063	1,046	1,054	1,060
Average	**1,683**	**1,702**	**1,526**	**1,527**	**1,542**	**1,663**	**1,389**	**1,643**	**1,623**	**1,458**	**1,722**

Source: The table was created by the authors

The sectors for which their total forward and backward linkages were determined are categorized as per Hirschman's categorization in the following manner:

Category I*:sectors with high backward and forward linkages;*

Category II*: sectors with high backward linkage and low forward linkage;*

Category III*: sectors with high forward linkage and low backward linkage;*

Category IV *:sectors*with *low backward and forward linkages.*

Since the sectors in **Category I** and **Category II** have the quality of feeding and stimulating each other's production, these should be taken into account primarily in investment decisions. Accordingly, the sectors in **Category I and Category II** in each of the 10 provinces affected by the earthquakes and the regionare shown together in Table IX. Sectors in **Category I** in each province and across the region are manufacturing industry, electricity, gas, steam, water, and sewage, transportation and storage sectors. However, since the construction and public works sector in Kilis and Şanlıurfa provinces is also in **Category I**, it is classified as a key sector.

Sectors in **Category II** in Adana, Gaziantep, Kahramanmaraş, Malatya, and Osmaniye are construction and public works, accommodation and food service activities, human health and social work activities, and other service activities sectors. Category II sectors in Adıyaman, Hatay, and the region are construction and public works, accommodation and food service activities, and other service activities sectors. Construction and public works, accommodation and food service activities are the sectors in Category II in Diyarbakır. Category II sectors in Kilis include accommodation and food service activities, human health and social work activities, and other service activities. In Şanlıurfa, this category includes accommodation and food service activities, and other service activities sectors, these sectors are classified as key sectors.

Table IX: Affected by EarthquakesKey Sectors in Category I and Category II in 10 Provinces and the Region

Industries	Category I											Category II										
	Adana	Adıyaman	Diyarbakır	Gaziantep	Hatay	Kahramanmaraş	Kilis	Malatya	Osmaniye	Şanlıurfa	Region-wide	Adana	Adıyaman	Diyarbakır	Gaziantep	Hatay	Kahramanmaraş	Kilis	Malatya	Osmaniye	Şanlıurfa	Region-wide
Agriculture, Forestry, and Fishing																						
Mining and Quarrying																						
Manufacturing Industry	X	X	X	X	X	X	X	X	X	X	X											
Electricity, Gas, Steam, Water, and Sewage	X	X	X	X	X	X	X	X	X	X	X											
Construction and Public Works							X			X		X	X	X	X	X	X		X	X		X
Wholesale and Retail Trade																						
Transport and Storage	X	X	X	X	X	X	X	X	X	X	X											
Accommodation and Food Service												X	X	X	X	X	X	X	X	X	X	X
Information and Communication																						
Finance and Insurance Activities																						
Real Estate Activities																						
Professional, Scientific, and Technical Activities																						
Administrative and Support Service Activities																						
Public Administration and Defense																						
Education Services																						
Human Health and Social Work Activities												X			X		X	X	X	X		
Culture, Art, Entertainment, Recreation, and Sports																						
Other Service Activities												X	X		X	X	X	X	X	X	X	X

Source: The table was created by the authors

Within the scope of the study, 62 sectors in the 2012 National Input-Output table were aggregated into 18 sectors in order to categorize the data in line with the SSI data, so the key sectors handled in a very general category. However, the regional specialization coefficients (LQ) calculated for 99 sectors based on the SSI data for 10 provinces and the region are shown in Table A.IV in appendix. According to this table, it is observed that there is also a differentiation in the sub-sectors within the priority sectors determined in the 18 sectoral classification and those with high specialization values are highlighted in bold and dark tones. Sectors highlighted according to their level of specialization should be considered as sectors that should be given priority. Considering the region in general, in the *manufacturing industry sector,* which is one of the key sectors, food products manufacturing, beverage manufacturing, textile products manufacturing, leather and related products manufacturing, paper and paper products manufacturing, chemical products manufacturing, rubber and plastic products manufacturing, basic metal industry; in the *electricity, gas, steam, water, andsewage sector,* which is one of the key sectors, treatment and distribution of electricity, gas, steam, and air systems, water collection production distribution; in the *construction and public works sector,* which is one of the key sectors, construction of buildings, construction of non-building structures; *in the transportation and storage sector*, which is one of the key sectors, landtransportation and pipeline transportation activities stand out (Table A.IV).Identifying priority areaswithin these sub-sectors in the key sectors and prioritizing these areas in incentives would be the most appropriate strategy for a faster recovery locally and across the region. In addition, for the priority sub-sectors under the key sectors that were determined as a result of the I-O analysis in the policies for the provinces, the sectors above the value of 1 in descending order of LQ values of the relevant province in Table A.IV should be selected.

V. DISCUSSION

The economic structure of the provinces of Adana, Adıyaman, Diyarbakır, Gaziantep, Hatay, Kahramanmaraş, Kilis, Malatya, Osmaniye, Şanlıurfa, and the sectors in the region covering these provinces which were affected by two major earthquakes in the provinces of Kahramanmaraş and Gaziantep in the Southeastern Anatolia Region were analyzed with the I-O model. In the economies of these provinces and the region, it was found that the manufacturing industry in general, electricity, gas, steam, water, and sewage, transportation and storage,andthe mining and quarrying sectors are the sectors with high *total forward linkage*.These are the sectors from which other sectors demand the most intermediate

inputs.On the other hand, the sectors with the highest *total backward linkage*are electricity, gas, steam, water, and sewage,manufacturing industry,and construction and public works sectors. These sectors are the sectors that demand the most intermediate inputs from other sectors.

Despite the fact that it is not known at this stage how much the 10 provinces affected by the earthquakes suffered economically, when the pre-earthquake situation of the provinces is analyzed; however, the sectors that were evaluated as key sectors need to be prioritized at the initial phase in order to develop the economy of the region and bring the region to its pre-disaster state in a shorter time. According to the four categories determined by Hirschman, the first category which includes the manufacturing industry, electricity, gas, steam, water, and sewage, and transportation and storage sectors; and second category encompassing construction and public works in the category, accommodation and food service activities,and other service activities sectors are the key sectors. In case of any negative impact on the economy, transferring the available scarce resources to these sectors will enable the local economy of the provinces and the region to recover in a shorter time.

In order to compile the data used within the scope of this study so as to enhance its estimation, the sectors were discussed under 18 headings in a general framework. However, there are sectors that provide specialization by concentrating locally in 10 provinces and the region among the sub-sectors within these 18 titles. These sub-sectors are shown in Table A.IV in appendix. In the table, the sub-sectors with an LQ value above 1 in the region are colored, and these sectors with an LQ value above 1 in each province are expressed in bold. For additional details, a pre-implementation review of the sub-sectors under the main sector of the relevant table would be helpful for the right policies.

It is clear that earthquakes cause a lot of structural damage at places where they occur. After the February 6, 2023 earthquakes, meeting the shelter needs of earthquake victims and renewing the building stock is a priority state policy. In order to keep the population in the earthquake zone, to prevent migration and to return the outgoing population, the sectoral structure should also be given importance. In future studies, calculations can be made In future studies, calculations can be made taking into account the post-earthquake economic impacts, but this is beyond the scope of this study. In this connection, as a future study, this work can be developed further in this light when more reliable information about the effects of earthquakes is obtained.

APPENDIX

Table A.I: National Input Coefficients Matrix (A Matrix)

Sector Code	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	0,165	0,004	0,072	0,000	0,000	0,001	0,000	0,041	0,000	0,000	0,000	0,002	0,004	0,012	0,002	0,001	0,003	0,001
2	0,003	0,059	0,061	0,183	0,016	0,003	0,002	0,001	0,000	0,000	0,011	0,002	0,001	0,000	0,000	0,003	0,000	0,003
3	0,118	0,134	0,366	0,021	0,309	0,085	0,136	0,237	0,053	0,019	0,065	0,059	0,088	0,086	0,025	0,137	0,048	0,185
4	0,008	0,030	0,050	0,431	0,002	0,016	0,003	0,028	0,011	0,009	0,021	0,008	0,003	0,021	0,025	0,027	0,022	0,014
5	0,002	0,003	0,002	0,017	0,159	0,010	0,002	0,006	0,007	0,003	0,019	0,008	0,003	0,045	0,005	0,006	0,035	0,006
6	0,028	0,036	0,057	0,009	0,047	0,025	0,052	0,048	0,008	0,007	0,013	0,017	0,023	0,028	0,005	0,025	0,011	0,040
7	0,015	0,060	0,037	0,008	0,020	0,065	0,213	0,015	0,014	0,011	0,005	0,043	0,015	0,031	0,029	0,010	0,024	0,032
8	0,000	0,002	0,002	0,001	0,001	0,008	0,002	0,008	0,005	0,007	0,000	0,049	0,010	0,006	0,005	0,012	0,008	0,009
9	0,001	0,004	0,004	0,004	0,001	0,020	0,004	0,005	0,155	0,032	0,001	0,056	0,007	0,010	0,008	0,026	0,009	0,031
10	0,001	0,011	0,010	0,017	0,009	0,022	0,015	0,008	0,013	0,158	0,013	0,014	0,007	0,007	0,007	0,010	0,021	0,015
11	0,000	0,004	0,007	0,002	0,003	0,059	0,011	0,048	0,022	0,041	0,013	0,017	0,013	0,009	0,010	0,023	0,025	0,028
12	0,003	0,027	0,011	0,007	0,031	0,042	0,014	0,014	0,049	0,046	0,004	0,109	0,021	0,026	0,004	0,026	0,058	0,062
13	0,002	0,005	0,005	0,011	0,006	0,015	0,007	0,006	0,024	0,013	0,014	0,013	0,038	0,046	0,017	0,041	0,042	0,017
14	0,000	0,000	0,000	0,001	0,001	0,002	0,000	0,000	0,002	0,006	0,000	0,000	0,000	0,005	0,000	0,001	0,003	0,001
15	0,000	0,000	0,000	0,000	0,000	0,001	0,000	0,000	0,001	0,004	0,000	0,002	0,002	0,013	0,012	0,001	0,002	0,002
16	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,062	0,001	0,001
17	0,000	0,000	0,000	0,000	0,000	0,001	0,000	0,002	0,008	0,000	0,000	0,004	0,001	0,000	0,000	0,001	0,085	0,000
18	0,000	0,000	0,001	0,000	0,000	0,004	0,001	0,002	0,003	0,002	0,000	0,005	0,001	0,000	0,000	0,001	0,001	0,026

Source: The table was created by the authors

Table A.II: Regional Input Coefficients Matrix for the Region (A matrix)

Sector Code	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	0,165	0,004	0,072	0,000	0,000	0,001	0,000	0,041	0,000	0,000	0,000	0,002	0,004	0,012	0,002	0,001	0,003	0,001
2	0,002	0,050	0,051	0,154	0,014	0,003	0,001	0,001	0,000	0,000	0,009	0,001	0,001	0,000	0,000	0,003	0,000	0,003
3	0,118	0,134	0,366	0,021	0,309	0,085	0,136	0,237	0,053	0,019	0,065	0,059	0,088	0,086	0,025	0,137	0,048	0,185
4	0,008	0,030	0,050	0,431	0,002	0,016	0,003	0,028	0,011	0,009	0,021	0,008	0,003	0,021	0,025	0,027	0,022	0,014
5	0,002	0,003	0,002	0,017	0,159	0,010	0,002	0,006	0,007	0,003	0,019	0,008	0,003	0,045	0,005	0,006	0,035	0,006
6	0,025	0,032	0,050	0,007	0,041	0,022	0,045	0,042	0,007	0,006	0,011	0,015	0,020	0,025	0,004	0,022	0,010	0,035
7	0,015	0,059	0,037	0,008	0,020	0,064	0,209	0,014	0,014	0,011	0,005	0,042	0,015	0,030	0,028	0,010	0,023	0,031
8	0,000	0,001	0,001	0,000	0,001	0,005	0,001	0,004	0,003	0,004	0,000	0,028	0,006	0,004	0,003	0,007	0,004	0,005
9	0,000	0,001	0,001	0,001	0,000	0,007	0,001	0,002	0,051	0,011	0,000	0,019	0,002	0,003	0,003	0,009	0,003	0,010
10	0,001	0,007	0,006	0,010	0,005	0,013	0,009	0,005	0,007	0,094	0,008	0,008	0,004	0,004	0,004	0,006	0,013	0,009
11	0,000	0,003	0,006	0,002	0,003	0,048	0,009	0,039	0,018	0,033	0,011	0,014	0,010	0,008	0,008	0,019	0,020	0,023
12	0,002	0,016	0,006	0,004	0,018	0,024	0,008	0,008	0,029	0,027	0,002	0,063	0,012	0,015	0,003	0,015	0,034	0,036
13	0,002	0,005	0,005	0,011	0,006	0,015	0,007	0,006	0,024	0,013	0,014	0,013	0,038	0,046	0,017	0,041	0,042	0,017
14	0,000	0,000	0,000	0,001	0,001	0,002	0,000	0,000	0,002	0,006	0,000	0,000	0,000	0,005	0,000	0,001	0,003	0,001
15	0,000	0,000	0,000	0,000	0,000	0,001	0,000	0,000	0,001	0,004	0,000	0,002	0,002	0,013	0,012	0,001	0,002	0,002
16	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,062	0,001	0,001
17	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,001	0,005	0,000	0,000	0,003	0,001	0,000	0,000	0,001	0,059	0,000
18	0,000	0,000	0,001	0,000	0,000	0,003	0,001	0,002	0,002	0,002	0,000	0,005	0,001	0,000	0,000	0,001	0,001	0,024

Source: The table was created by the authors

Table A.III: Regional Leontief Inverse Matrix for the Region $(\mathbf{I} - \mathbf{A})^{-1}$

Sector Code	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1,219	0,030	0,146	0,017	0,057	0,018	0,027	0,088	0,011	0,006	0,013	0,017	0,021	0,033	0,008	0,027	0,018	0,033
2	0,024	1,082	0,119	0,300	0,065	0,023	0,026	0,042	0,013	0,008	0,026	0,016	0,015	0,023	0,013	0,032	0,019	0,034
3	0,254	0,277	1,683	0,171	0,647	0,196	0,310	0,442	0,123	0,062	0,136	0,155	0,174	0,211	0,067	0,282	0,147	0,361
4	0,043	0,086	0,162	1,791	0,070	0,052	0,040	0,096	0,035	0,027	0,052	0,035	0,024	0,061	0,053	0,081	0,060	0,065
5	0,005	0,008	0,010	0,038	1,194	0,016	0,006	0,012	0,012	0,006	0,025	0,014	0,006	0,058	0,008	0,012	0,048	0,012
6	0,048	0,057	0,102	0,038	0,092	1,042	0,079	0,075	0,019	0,014	0,023	0,032	0,034	0,046	0,012	0,045	0,026	0,064
7	0,041	0,102	0,102	0,055	0,077	0,099	1,290	0,053	0,031	0,024	0,018	0,071	0,034	0,060	0,043	0,037	0,048	0,071
8	0,001	0,003	0,003	0,002	0,003	0,006	0,003	1,006	0,004	0,006	0,001	0,031	0,007	0,005	0,003	0,009	0,007	0,007
9	0,001	0,003	0,005	0,005	0,003	0,009	0,004	0,004	1,056	0,013	0,001	0,022	0,004	0,005	0,003	0,012	0,005	0,013
10	0,005	0,013	0,017	0,025	0,015	0,019	0,017	0,012	0,011	1,106	0,011	0,013	0,008	0,009	0,007	0,012	0,019	0,016
11	0,005	0,010	0,018	0,009	0,014	0,055	0,019	0,047	0,023	0,040	1,014	0,020	0,015	0,014	0,011	0,027	0,027	0,032
12	0,007	0,024	0,019	0,017	0,033	0,032	0,017	0,017	0,036	0,034	0,006	1,073	0,017	0,022	0,005	0,023	0,044	0,047
13	0,006	0,011	0,016	0,026	0,015	0,021	0,014	0,013	0,030	0,018	0,017	0,018	1,042	0,053	0,020	0,051	0,051	0,024
14	0,000	0,001	0,001	0,002	0,001	0,002	0,001	0,001	0,002	0,007	0,000	0,001	0,000	1,006	0,000	0,002	0,004	0,001
15	0,000	0,001	0,001	0,001	0,001	0,001	0,001	0,001	0,001	0,004	0,000	0,003	0,002	0,013	1,012	0,001	0,002	0,002
16	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	1,066	0,001	0,001
17	0,000	0,000	0,000	0,000	0,000	0,001	0,000	0,002	0,006	0,000	0,000	0,003	0,001	0,000	0,000	0,001	1,063	0,000
18	0,001	0,001	0,002	0,001	0,001	0,004	0,002	0,003	0,003	0,002	0,000	0,006	0,001	0,001	0,001	0,002	0,002	1,026

Source: The table was created by the authors

For the 10 provinces affected by the earthquakes and the region, location quotient (LQ) values for 2021 for 99 sectors included in the 2021 Social Security Institution (SSI) data are presented in Table A.IV and the employment values from which these values are calculated are presented in Table A.V. Sectors with LQ values of at 1 and more than 1are shown in bold font as they are sectors that show specialization by concentrating locally. The sectors identified as key sectors in this study are shown in light orange background color.

Table A.IV: Location Quotient (LQ) Values of 99 Sectors in 10 Provinces and the Region Affected by Earthquakes

Industries	Industries	Adana	Adıyaman	Diyarbakır	G.antep	Hatay	K.maraş	Kilis	Malatya	Osmaniye	Ş.urfa	Region-wide
Agriculture, Forestry, and Fishing	Crop and animal production, hunting and related service activities	**2.81**	**1.27**	**2.96**	0.68	**1.02**	0.96	0.76	**1.15**	0.65	**3.47**	**1.56**
	Forestry and logging	**1.80**	0.87	0.79	0.07	0.73	**1.55**	0.90	0.34	**3.68**	0.43	0.90
	Fishing and aquaculture	0.37	0.23	0.12	0.42	**1.16**	**2.01**	-	0.72	0.02	0.22	0.59
Mining and Quarrying	Mining of coal and lignite	0.43	0.08	-	-	0.00	**4.27**	-	0.27	-	-	0.54
	Extraction of crude petroleum and natural gas	0.23	**26.60**	**53.21**	-	**1.29**	-	-	-	-	**2.52**	**3.61**
	Mining of metal ores	**1.71**	**3.94**	-	0.37	0.63	0.09	-	**2.12**	0.10	-	0.82
	Other mining and quarrying	0.71	**1.98**	**3.40**	0.34	0.92	0.91	**1.01**	0.63	0.81	0.52	0.76
	Mining support service activities	0.66	**17.80**	**19.34**	0.05	0.38	0.29	-	**2.61**	0.04	0.68	**1.94**
Manufacturing Industry	Manufacture of food products	**1.15**	0.60	**1.75**	**1.49**	0.64	0.90	**1.40**	**1.41**	0.93	0.65	**1.03**
	Manufacture of beverages	**3.14**	0.34	**1.99**	0.12	0.47	0.60	-	0.98	**3.00**	0.73	**1.12**
	Manufacture of tobacco products	**1.05**	**1.48**	0.08	0.01	0.09	-	-	0.81	-	-	0.34
	Manufacture of textiles	**1.47**	**1.70**	**1.09**	**6.75**	0.23	**7.86**	**1.13**	**2.16**	**2.86**	0.62	**3.01**
	Manufacture of wearing apparel	0.77	**3.93**	**3.66**	0.25	0.07	0.51	0.32	**3.25**	0.34	**1.25**	0.94
	Manufacture of leather and related products	0.57	0.02	0.06	**2.86**	0.60	0.14	0.02	0.68	0.30	**3.82**	**1.26**
	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	**1.21**	0.14	**1.26**	0.81	**1.03**	0.43	0.25	0.53	0.75	0.16	0.72
	Manufacture of paper and paper products	**1.28**	0.06	**1.27**	**3,52**	0.14	**1.70**	0.08	0.33	**1.19**	0.11	**1.33**
	Printing and reproduction of recorded media	0.48	0.11	0.75	0.60	0.31	0.20	0.03	0.42	0.04	0.13	0.36
	Manufacture of coke and refined petroleum products	0.67	-	0.05	0.09	**1.04**	0.02	**1.04**	0.20	**1.00**	0.34	0.37
	Manufacture of chemicals and chemical products	**3.48**	0.09	**1.29**	**2.39**	0.62	0.46	0.93	0.16	**1.69**	0.31	**1.50**

Industries	Industries	Adana	Adıyaman	Diyarbakır	G.antep	Hatay	K.maraş	Kilis	Malatya	Osmaniye	Ş.urfa	Region-wide
Manufacturing Industry	Manufacture of basic pharmaceutical products and pharmaceutical preparations	0.45	0.67	**1.18**	0.17	-	0.08	-	0.01	0.01	0.83	0.29
	Manufacture of rubber and plastic products	**1.18**	0.16	**1.07**	**2.67**	0.57	0.37	**1.85**	0.36	0.50	0.52	**1.08**
	Manufacture of other non-metallic mineral products	0.66	**1.13**	**2.63**	0.38	0.58	**1.04**	**1.06**	0.79	0.63	0.94	0.72
	Manufacture of basic metals	0.75	0.04	**1.36**	0.33	**6.66**	0.55	0.01	0.19	**8.29**	0.16	**1.43**
	Manufacture of fabricated metal products, except machinery and equipment	**1.02**	0.33	0.92	0.39	0.57	**1.59**	0.16	0.47	**1.15**	0.23	0.67
	Manufacture of computer, electronic and optical products	0.28	-	0.77	0.24	0.05	0.01	0.03	0.08	0.00	0.53	0.20
	Manufacture of electrical equipment	0.37	0.23	0.85	0.16	0.11	0.05	0.25	0.37	0.20	0.50	0.26
	Manufacture of machinery and equipment n.e.c.	0.86	0.06	0.50	0.54	0.82	0.33	0.19	0.42	0.63	0.19	0.51
	Manufacture of motor vehicles, trailers and semi-trailers	0.47	0.08	0.25	0.09	0.65	0.01	0.05	0.04	0.25	0.05	0.22
	Manufacture of other transport equipment	0.20	0.00	0.02	0.22	0.01	0.01	0.28	0.01	0.00	0.00	0.09
	Manufacture of furniture	0.80	0.50	**2.00**	0.68	0.96	0.48	0.11	0.55	0.48	0.39	0.66
	Other manufacturing	0.67	0.06	**1.02**	0.77	0.19	**1.55**	**3.80**	0.22	0.20	0.48	0.64
	Repair and installation of machinery and equipment	0.86	0.39	**1.66**	0.38	0.57	0.62	0.06	0.44	0.29	0.52	0.56
Electricity, Gas, Steam, Water, and Sewage	Electricity, gas, steam and air conditioning supply	**1.49**	**1.66**	**5.21**	0.58	**1.17**	**4.62**	**1.17**	**1.06**	**1.72**	**2.11**	**1.66**
	Water collection, treatment and supply	**1.73**	0.29	**6.73**	0.82	**1.10**	**5.01**	-	0.54	**1.66**	0.06	**1.54**
	Sewerage	**1.60**	**1.53**	**7.38**	0.03	0.12	0.65	-	**1.00**	0.03	0.05	0.84
	Waste collection, treatment and disposal activities; materials recovery	0.96	**1.59**	**2.04**	0.63	0.84	0.87	0.58	0.28	**1.21**	0.57	0.79
	Remediation activities and other waste management services	0.93	-	**14.20**	0.01	0.36	0.04	-	-	-	-	0.80
Construction and Public Works	Construction of buildings	0.90	**1.67**	**3.60**	**1.21**	**1.15**	**1.18**	**2.11**	**1.49**	**1.48**	**1.25**	**1.21**
	Civil engineering	**1.05**	**1.46**	**4.77**	0.61	0.78	0.69	**3,53**	**1.29**	**1.27**	**1.10**	**1.04**
	Specialised construction activities	**1.08**	0.65	**2.93**	0.87	**1.28**	0.92	0.69	0.76	0.83	0.61	0.94
Wholesale and Retail Trade	Wholesale and retail trade and repair of motor vehicles	**1.22**	0.78	**3.46**	0.83	**1.27**	0.67	0.22	0.84	0.95	0.60	0.96
	Wholesale trade, except of motor vehicles and motorcycles	**1.16**	0.36	**2.14**	**1.03**	0.89	0.52	0.27	0.63	0.61	0.60	0.84
	Retail trade, except of motor vehicles and motorcycles	**1.10**	0.87	**2.31**	0.72	**1.14**	0.80	0.58	0.97	**1.08**	0.70	0.90

Industries	Industries	Adana	Adıyaman	Diyarbakır	G.antep	Hatay	K.maraş	Kilis	Malatya	Osmaniye	Ş.urfa	Region-wide
Transport and Storage	Land transport and transport via pipelines	0.93	**1.47**	**4.42**	0.94	**2.29**	0.77	**1.40**	0.80	**1.11**	**1.74**	**1.25**
	Water transport	0.52	-	-	0.02	0.30	-	-	0.04	-	0.01	0.15
	Air transport	0.40	-	-	0.01	-	0.27	-	-	-	-	0.11
	Warehousing and support activities for transportation	0.79	0.19	**1.33**	0.39	**1.86**	0.20	0.17	0.39	0.25	0.35	0.61
	Postal and courier activities	**1.00**	0.66	**2.40**	0.61	0.60	**2.63**	0.90	0.83	0.42	0.62	0.94
Accommodation and Food Service	Accommodation	0.41	0.48	**1.06**	0.40	0.60	0.26	0.84	0.50	0.28	0.41	0.42
	Food and beverage service activities	0.81	0.58	**1.87**	0.45	0.77	0.59	0.36	0.81	0.52	0.39	0.62
Information and Communication	Publishing activities	0.59	0.64	**2.68**	0.41	0.57	0.28	0.93	0.52	**1.03**	0.75	0.59
	Motion picture, video and television programme production, sound recording and music publishing activities	0.30	0.19	**1.05**	0.14	0.18	0.11	0.04	0.13	0.10	0.06	0.19
	Programming and broadcasting activities	0.18	0.04	**2.70**	0.21	0.22	0.26	0.14	0.53	0.24	0.34	0.32
	Telecommunications	0.57	0.25	**2.70**	0.53	0.53	0.30	0.50	0.19	0.83	0.65	0.55
	Computer programming, consultancy and related activities	0.29	0.19	0.52	0.19	0.10	0.32	0.03	0.67	0.08	0.18	0.24
	Information service activities	0.83	0.06	**1.79**	0.21	0.11	**1.10**	0.15	0.47	0.10	0.16	0.47
Finance and Insurance Activities	Financial service activities, except insurance and pension funding	0.69	0.30	**1.13**	0.49	0.47	0.32	0.16	0.62	0.46	0.46	0.50
	Insurance, reinsurance and pension funding, except compulsory social security	**1.46**	0.30	**1.28**	0.30	0.64	0.37	0.03	0.83	0.41	0.51	0.65
	Activities auxiliary to financial services and insurance activities	**1.05**	0.41	**1.98**	0.68	0.86	0.52	0.30	0.68	0.65	0.55	0.74
Real Estate Activities	Real estate activities	0.94	**1.26**	**3.16**	0.77	0.66	0.91	0.28	0.86	0.26	0.50	0.82
Professional, Scientific, and Technical Activities	Legal and accounting activities	**1.04**	0.51	**1.39**	**1.00**	**1.20**	0.55	0.31	0.69	0.72	0.50	0.82
	Activities of head offices; management consultancy	0.58	0.21	0.67	0.41	0.14	0.13	0.22	0.13	0.09	0.16	0.30
	Architectural and engineering activities; technical	0.77	0.66	**3.06**	0.60	0.73	0.74	0.68	0.77	0.66	0.98	0.78
	Scientific research and development	0.29	0.05	0.33	0.16	0.06	0.18	-	0.13	0.02	0.15	0.16
	Advertising and market research	0.77	0.04	0.79	0.35	0.14	0.11	0.07	0.25	0.08	0.09	0.32
	Other professional, scientific and technical activities	0.97	0.43	0.95	0.52	**1.07**	0.29	0.07	0.84	0.63	0.32	0.63

Industries	Industries	Adana	Adıyaman	Diyarbakır	G.antep	Hatay	K.maraş	Kilis	Malatya	Osmaniye	Ş.urfa	Region-wide
Professional, Scientific, and Technical Activities	Veterinary activities	**1.15**	0.90	**1.84**	0.48	0.57	0.63	0.15	0.67	0.85	**1.08**	0.76
	Rental and leasing activities	**1.10**	**1.48**	**2.44**	**1.03**	**1.38**	0.52	0.20	0.52	0.37	**1.07**	0.97
	Employment activities	0.73	0.02	0.87	0.09	0.31	0.48	0.61	0.30	**2.07**	**3.26**	0.72
	Travel agency, tour operator and other reservation service and related activities	0.24	0.66	0.89	0.19	0.57	0.29	0.08	0.25	0.11	0.31	0.30
Administrative and Support Service Activities	Security and investigation activities	**1.00**	0.59	**5.37**	**1.26**	0.59	0.75	**1.40**	0.82	0.53	0.89	**1.03**
	Services to buildings and landscape activities	**1.41**	0.55	**3.85**	**1.29**	**1.45**	0.56	**1.20**	0.85	**1.12**	**2.75**	**1.35**
	Office administrative, office support and other business support activities	0.90	**1.64**	**4.38**	0.53	0.96	0.71	**1.79**	**1.14**	0.91	**1.91**	**1.04**
Public Administration and Defense	Public administration and defence; compulsory social security	0.93	**2.18**	**8.23**	**1.16**	**1.62**	**1.62**	0.66	**2.33**	0.58	**2.92**	**1.69**
Education Services	Education	0.97	**1.35**	**5.22**	0.96	**1.47**	0.96	**3.32**	**1.04**	**1.77**	**2.31**	**1.34**
Human Health and Social Work Activities	Human health activities	**1.35**	0.99	**3.76**	**1.25**	**1.27**	0.98	**1.49**	**1.17**	**1.05**	**1.39**	**1.25**
	Residential care activities	0.95	**1.18**	**2.55**	0.55	**1.25**	**1.14**	**1.46**	**1.97**	**1.84**	0.78	**1.02**
	Social work activities without accommodation	**1.01**	**1.90**	**7.47**	**1.36**	**1.70**	**1.08**	**3.10**	**1.14**	0.90	**2.78**	**1.60**
Culture, Art, Entertainment, Recreation, and Sports	Creative, arts and entertainment activities	0.59	0.42	**1.69**	0.04	0.14	0.11	0.12	-	-	0.25	0.26
	Libraries, archives, museums and other cultural activities	0.68	0.80	**1.31**	0.28	**1.20**	0.75	**3.05**	0.95	0.65	0.46	0.67
	Gambling and betting activities	**2.39**	**1.21**	**3.68**	0.48	0.62	0.28	0.46	**1.01**	0.48	0.44	**1.02**
	Sports activities and amusement and recreation activities	0.90	0.77	**1.83**	0.47	0.93	0.87	0.43	**1.24**	**1.07**	0.75	0.79
Other Service Activities	Activities of membership organisations	0.71	**1.35**	**1.30**	**2.09**	**2.30**	0.87	**5.26**	**1.32**	0.67	**2.23**	**1.45**
	Repair of computers and personal and household goods	**1.10**	0.91	**2.38**	0.67	**1.36**	0.69	0.81	**1.62**	**1.57**	0.81	0.99
	Other personal service activities	0.99	0.52	**1.52**	0.42	0.77	0.73	0.55	0.74	0.41	0.29	0.64

Source: The table was created by the authors using SSI 2021 data

Table A.V: 2021 Employment Values of 99 Sectors in 10 Provinces and the Region Affected by Earthquakes

Industries	Industries	Adana	Adıyaman	Diyarbakır	G.antep	Hatay	K.maraş	Kilis	Malatya	Osmaniye	Ş.urfa	Region-wide	Türkiye
Agriculture, Forestry, and Fishing	Crop and animal production, hunting and related service activities	6,864	613	1,424	1,762	1,415	1,180	107	988	290	4,249	18,892	115,903
	Forestry and logging	1,449	139	125	63	334	631	42	95	547	174	3,599	38,305
	Fishing and aquaculture	108	13	7	130	194	296	-	74	1	32	855	13,878
Mining and Quarrying	Mining of coal and lignite	345	13	-	-	2	1,742	-	77	-	-	2,179	38,349
	Extraction of crude petroleum and natural gas	11	249	498	-	35	-	-	-	-	60	853	2.252
	Mining of metal ores	1,242	564	-	290	261	33	-	539	14	-	2,943	34.446
	Other mining and quarrying	973	538	924	499	722	630	80	305	205	360	5,236	65.405
	Mining support service activities	162	868	943	13	53	36	-	226	2	85	2,388	11,732
Manufacturing Industry	Manufacture of food products	12,484	1,294	3,758	17,341	3,974	4,941	878	5,398	1,868	3,555	55,491	516,398
	Manufacture of beverages	1,180	25	148	47	100	114	-	130	208	137	2,089	17,859
	Manufacture of tobacco products	140	39	2	2	7	-	-	38	-	-	228	6,357
	Manufacture of textiles	15,485	3,523	2,266	75,868	1,361	41,742	683	7,974	5,543	3,266	157,711	499,569
	Manufacture of wearing apparel	10,923	11,078	10,298	3,837	560	3,676	265	16,290	883	8,939	66,749	677,395
	Manufacture of leather and related products	857	5	18	4,620	515	106	2	363	83	2,900	9,469	71,685
	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	1,854	41	381	1,325	905	336	22	286	212	120	5,482	72,995
	Manufacture of paper and paper products	2003	19	392	5,882	129	1,343	7	181	342	83	10,381	74,222
	Printing and reproduction of recorded media	495	23	153	657	185	102	2	152	7	66	1,842	48,937
	Manufacture of coke and refined petroleum products	134	-	2	19	119	2	12	14	37	34	373	9.521
	Manufacture of chemicals and chemical products	7,842	40	574	5,756	795	522	121	123	702	348	16,823	107,120
	Manufacture of basic pharmaceutical products and pharmaceutical preparations	339	99	176	137	-	30	-	2	1	315	1,099	35,754
	Manufacture of rubber and plastic products	6,132	160	1,105	14,884	1,681	972	554	659	483	1,367	27,997	247,522
	Manufacture of other non-metallic mineral products	3,304	1,118	2,607	2,062	1,662	2,633	306	1,390	585	2,379	18,046	238,127
	Manufacture of basic metals	3,027	35	1,078	1,418	15,295	1,117	3	271	6,153	318	28,715	191.351

Industries	Industries	Adana	Adıyaman	Diyarbakır	G.antep	Hatay	K.maraş	Kilis	Malatya	Osmaniye	Ş.urfa	Region-wide	Türkiye
Manufacturing Industry	Manufacture of fabricated metal products, except machinery and equipment	9,143	577	1,620	3,709	2,938	7,192	84	1,470	1,905	1,030	29,668	425,733
	Manufacture of computer, electronic and optical products	328	-	180	298	37	4	2	34	1	315	1,199	56,275
	Manufacture of electrical equipment	1,436	178	643	647	239	104	55	498	142	968	4,910	182.995
	Manufacture of machinery and equipment n.e.c.	3,762	54	430	2,508	2,030	718	49	646	509	419	11,125	207,473
	Manufacture of motor vehicles, trailers and semi-trailers	2,361	79	252	487	1,858	27	15	66	234	129	5,508	238,098
	Manufacture of other transport equipment	319	1	5	381	6	6	26	5	1	4	754	77,560
	Manufacture of furniture	3,179	393	1,566	2,876	2,167	961	25	763	350	776	13,056	188,677
	Other manufacturing	1,152	19	347	1,421	191	1,349	376	131	64	412	5,462	81.673
	Repair and installation of machinery and equipment	2,890	257	1,106	1,369	1,090	1,065	12	527	183	890	9,389	160,289
Electricity, Gas, Steam, Water, and Sewage	Electricity, gas, steam and air conditioning supply	3,646	805	2,525	1,521	1,638	5,731	165	914	779	2,600	20,324	116.618
	Water collection, treatment and supply	366	12	282	187	133	537	-	40	65	6	1,628	10,079
	Sewerage	753	142	687	17	32	154	-	165	3	12	1,965	22,390
	Waste collection, treatment and disposal activities; materials recovery	1,777	581	742	1,246	888	812	62	184	411	529	7,232	87,711
	Remediation activities and other waste management services	126	-	381	1	28	3	-	-	-	-	539	6,456
Construction and Public Works	Construction of buildings	19,305	7,049	15,198	27,633	14,036	12,732	2,598	11,222	5,838	13,391	129,002	1,016,670
	Civil engineering	7,116	1,947	6,353	4,379	2,987	2,353	1,373	3,061	1,574	3,739	34,882	320,772
	Specialised construction activities	6,636	789	3,565	5,731	4,491	2,853	244	1,638	944	1,905	28,796	293,236
Wholesale and Retail Trade	Wholesale and retail trade and repair of motor vehicles and motorcycles	6,481	815	3,639	4,700	3,855	1,798	66	1,568	928	1,608	25,458	252,960
	Wholesale trade, except of motor vehicles and motorcycles	19,138	1,163	6,995	18,118	8,387	4,360	253	3,669	1,872	4,989	68,944	784,830
	Retail trade, except of motor vehicles and motorcycles	33,882	5,292	14,071	23,765	20,018	12,506	1,031	10,486	6,146	10,928	138,125	1.466.382
Transport and Storage	Land transport and transport via pipelines	12,169	3,805	11,418	13,091	17,105	5,100	1,055	3,656	2,665	11,429	81,493	620,859
	Water transport	189	-	-	9	63	-	-	5	-	2	268	17,411

Industries	Industries	Adana	Adıyaman	Diyarbakır	G.antep	Hatay	K.maraş	Kilis	Malatya	Osmaniye	Ş.urfa	Region-wide	Türkiye
Transport and Storage	Air transport	243	-	-	5	-	82	-	-	-	-	330	28,792
	Warehousing and support activities for transportation	4,973	235	1,647	2,643	6,672	625	62	871	290	1,111	19,129	298,361
	Postal and courier activities	1,666	218	795	1,097	571	2,224	87	491	129	520	7,798	79,542
Accommodation and Food Service	Accommodation	2,302	534	1,183	2,422	1932	733	271	992	292	1,157	11,818	267,742
	Food and beverage service activities	12,737	1,783	5,768	7,453	6,887	4,666	321	4,436	1,511	3,055	48,617	743,975
Information and Communication	Publishing activities	318	68	286	235	174	75	29	99	102	203	1,589	25,634
	Motion picture, video and television programme production, sound recording and music publishing activities	117	15	82	58	40	21	1	18	7	12	371	18,786
	Programming and broadcasting activities	46	2	133	56	32	33	2	46	11	42	403	11,847
	Telecommunications	377	33	350	370	200	100	19	43	101	215	1,808	31,192
	Computer programming, consultancy and related activities	851	109	298	603	158	466	5	678	45	268	3,481	137,868
	Information service activities	390	6	166	107	30	260	4	78	9	38	1,088	22,303
Finance and Insurance Activities	Financial service activities, except insurance and pension funding	1,281	112	416	972	504	297	17	405	159	430	4,593	88,385
	Insurance, reinsurance and pension funding, except compulsory social security	759	31	131	164	189	96	1	151	39	132	1,693	24,697
	Activities auxiliary to financial services and insurance activities	1,280	99	476	887	599	317	21	291	146	337	4,453	57,736
Real Estate Activities	Real estate activities	3,237	859	2,152	2,824	1,302	1,593	55	1,038	164	869	14,093	163,940
Professional, Scientific, and Technical Activities	Legal and accounting activities	3,781	362	993	3,860	2,473	1,014	64	873	480	909	14,809	172.228
	Activities of head offices; management consultancy activities	2,521	178	571	1,922	354	282	56	199	69	354	6,506	206.110
	Architectural and engineering activities; technical testing and analysis	2,915	493	2,274	2,401	1,564	1,406	147	1,015	457	1,860	14,532	178,718
	Scientific research and development	99	3	22	58	11	31	-	15	1	25	265	16,034
	Advertising and market research	973	10	197	474	103	67	5	111	19	56	2015	59,735
	Other professional, scientific and technical activities	1,001	87	194	572	630	151	4	303	119	165	3,226	49,037

Industries	Industries	Adana	Adıyaman	Diyarbakır	G.antep	Hatay	K.maraş	Kilis	Malatya	Osmaniye	Ş.urfa	Region-wide	Türkiye
Professional, Scientific, and Technical Activities	Veterinary activities	266	41	84	118	75	74	2	54	36	125	875	10,964
	Rental and leasing activities	578	154	254	580	414	137	6	97	36	284	2,540	25,011
	Employment activities	1,407	6	330	194	337	466	68	203	733	3,149	6,893	91,273
	Travel agency, tour operator and other reservation service and related activities	254	136	183	207	339	152	5	93	21	165	1,555	49,597
Administrative and Support Service Activities	Security and investigation activities	5,194	604	5,523	7,004	1,765	1976	420	1,493	508	2,317	26,804	247,299
	Services to buildings and landscape activities	14,338	1,096	7,732	14,027	8,419	2,896	706	3,036	2,103	14,069	68,422	483.775
	Office administrative, office support and other business support activities	9,153	3,301	8,805	5,714	5,543	3,658	1,050	4,078	1,711	9,752	52,765	483.345
Public Administration and Defense	Public administration and defence; compulsory social security	5,902	2,712	10,253	7,831	5,850	5,155	240	5,169	672	9,250	53,034	299,901
Education Services	Education	14,366	3,931	15,224	15,165	12,350	7,151	2,825	5,407	4,827	17,133	98,379	701.985
Human Health and Social Work Activities	Human health activities	23,459	3,395	12,869	23,203	12,589	8,588	1,493	7,160	3,355	12,095	108,206	824,215
	Residential care activities	973	239	515	603	727	590	86	710	347	402	5,192	48,632
	Social work activities without accommodation	1,477	550	2,166	2,137	1,424	801	262	589	243	2,048	11,697	69,729
Culture, Art, Entertainment, Recreation, and Sports	Creative, arts and entertainment activities	164	23	93	11	23	15	2	-	-	35	366	13,236
	Libraries, archives, museums and other cultural activities	74	17	28	32	74	41	19	36	13	25	359	5,140
	Gambling and betting activities	270	27	82	58	40	16	3	40	10	25	571	5,356
	Sports activities and amusement and recreation activities	985	166	395	554	581	482	27	478	215	412	4,295	51,965
Other Service Activities	Activities of membership organisations	994	372	358	3,107	1,829	610	422	644	171	1,562	10,069	66,158
	Repair of computers and personal and household goods	1,278	208	544	829	901	401	54	657	335	474	5,681	54,997
	Other personal service activities	2,378	247	721	1,094	1,058	885	76	627	183	349	7,618	114.411
Total		**338,884**	**66,916**	**183,177**	**362,357**	**193,284**	**171,182**	**19,512**	**119,047**	**62,449**	**170,297**	**1,687,105**	**16,099,880**

Source: SSI, 2021

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KURUMSAL SÜRDÜRÜLEBİLİRLİK PERFORMANSI BORÇ FİNANSMAN MALİYETİNİ ETKİLER Mİ? BORSA İSTANBUL ÖRNEĞİ

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ÖZ

Bu çalışmanın amacı Borsa İstanbul 100 (BIST 100) endeksinde yer alan ve finansal olmayan şirketlerin kurumsal sürdürülebilirlik performanslarının (KSP) borçlanma maliyetleri üzerindeki etkisini incelemektir. Örneklem 2014-2019 yılları arası 54 firmadan oluşmaktadır ve analizler panel veri yöntemi ile yapılmıştır. Kurumsal sürdürülebilirlik performansı olarak şirketlerin Borsa İstanbul Sürdürülebilirlik Endeksinde (BIST SE) yer alması kriter olarak belirlenmiştir. Bulgular, KSP'nin borçlanma maliyetini düşürdüğünü ve fon sağlayıcıların iflas riski algılamalarını azalttığını göstermektedir.

Anahtar Kelimeler: Kurumsal Sürdürülebilirlik Performansı, Borçlanma Maliyeti, Borsa İstanbul.

Makale Türü: Araştırma Makalesi

JEL Sınıflandırması: G3, G32.

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DOES CORPORATE SUSTAINABILITY PERFORMANCE AFFECT DEBT FINANCING COST? BORSA ISTANBUL EXAMPLE

Abstract

The purpose of this study is to examine the impact of corporate sustainability performance (CSP) on the cost of borrowing of non-financial companies listed in the Borsa Istanbul 100 (BIST 100) index. The sample consists of 54 firms from the years 2014-2019 and is analyzed using the panel data method. Being listed in the Borsa Istanbul Sustainability Index (BIST SI) is determined as the criterion for corporate sustainability performance. The findings show that CSP reduces the cost of borrowing and decreases the perceived risk of bankruptcy by fund providers.

Key Words: Corporate Sustainability Performance, Cost Of Borrowing, Borsa İstanbul.

Article Type: Research Article.

JEL Classification: G3,G32.

I. GİRİŞ

Globalleşmeyle birlikte günümüzde işletmelerin yeni rekabet stratejisi kurumsal sürdürülebilirlik uygulamaları olmuştur. Kurumsal sürdürülebilirlik performansına sahip işletmeler kâr elde etmek amacı yanında üretim ve çevre standartlarına uyarak marka değerlerini oluşturmakta ve toplumsal saygınlık kazanmaktadır. Açıkçası, bu işletmeler sermaye maliyetlerini düşürmekte ve firma değerlerini artırarak hem ekonomik hem de sosyal değer yaratabilmektedir.

Kurumsal sürdürülebilirlik uygulamaları, işletmelerin uzun vadede ve gelecekte varlıklarını devam ettirmesi ve değer yaratabilmesi için önemli bir stratejik yöntemdir. Kurumsal sürdürülebilirlik, firmaların tüm paydaşlarına mevcut ve gelecekteki ihtiyaçlarını karşılama yeteneği sağlamasıdır. Firmalar politik anlamda sürdürülebilirliğe aktif olarak katkıda bulunup aynı zamanda ekonomik, sosyal ve çevresel sermayelerinin devamlılığı ve büyümesini planlamalıdır. Klasik anlayışta sürdürülebilirliğin yalnızca işletme karlılığı ile sınırlı olduğu düşünülürken, günümüzde sürdürülebilirlik ekolojik, sosyal ve ekonomik alanlara eşit derecede önem vermeyi gerektirmektedir (Dyllick & Hockerts, 2002: 131).

Geleneksel finans, risk ve getiri üzerinde yoğunlaşırken, sürdürülebilir finans sosyal, finansal ve çevresel getirilerin birleşimini değerlendirmektedir. Açıkçası sürdürülebilir finans dar anlamdaki hissedar modelinden, daha geniş anlamlı ve uzun vadeli paydaşlık modeline geçişi sağlamaktadır (Schoenmaker, 2017:1).

Kurumsal sosyal sorumluluk (KSS) uygulamaları, şirketlerin faaliyetlerini yürütürken topluma ve paydaşlarına karşı sorumlu bir şekilde davranmalarını vurgulayan bir kavramdır. Geleneksel işletme stratejilerinin aksine, paydaşları sadece işletme sahipleri ve hissedarlarla sınırlı tutmak yerine, Freeman (1984) paydaş kavramını genişleterek hükümetler, politik gruplar, hissedarlar, finansal ve ticari birlikler, tüketiciler, çalışanlar, tüketici koruma dernekleri, tedarikçiler ve rakip işletmeleri de bu gruba dahil etmiştir (Ertuğrul, 2008:206).

Devletler küresel iklim kriziyle mücadele etmek amacıyla, yeşil projelere ve düşük karbonlu ekonomiye geçiş planlamalarında sürdürülebilir finansman araçları (yeşil tahviller, yeşil bonolar) ihraç etmeye başlamışlardır. Çevre dostu projelerin hayata geçirilebilmesi için finansal düzenleyiciler, özel fonlama türlerinin artması için bankaları motive etmektedir. Bu kapsamda ortaya çıkan yeşil krediler, enerji verimliliği, karbon emisyonunun azaltılması gibi projelere fon sağlamak için düşünülmüş bir mekanizmadır (Canikli, 2022:23).

Sürdürülebilirliğin üç boyutu da ayrı ayrı olarak bir sermaye kaynağı olduğu için bu kaynakların birbirinden ayrılması mümkün değildir. Açıkçası bu sermaye kaynaklarından birinde meydana gelen azalma veya kaybın, diğerinde yaşanan artışla telafi edilmesi mümkün olmamaktadır (Dalğıç ve ark., 2018:21). Albu ve ark. (2013)'e göre, sürdürülebilirlik raporlamasının faydaları dört bölümde ele alınmıştır. Bunlar; doğrudan maliyetlerin azalması (enerji, malzeme, zaman kaybı, vb.), işçi verimliliğinin artması (artan motivasyon, düşük devamsızlık, azalmış personel değişimi), riskin azalması (krediye daha kolay erişim, yatırımcılar için varlık değerinin artması, paydaşlar tarafından destek, vb.) ve firma rekabetçiliğinin artması olarak ifade edilmiştir.

Kurumsal sosyal sorumluluk ÇSY (Çevresel, Sosyal, Yönetişim) raporlarıyla açıklanmaktadır. ÇSY, şirketlerin çevresel, sosyal ve yönetim unsurlarını iş modellerine nasıl entegre ettiklerini ifade ederken, KSS ise şirketlerin toplumsal sorumluluk bilinciyle daha iyi bir kurumsal vatandaş olma çabalarını kapsar. ÇSY, kurumsal yönetime doğrudan vurgu yaparken, KSS bunu dolaylı olarak ele alır. Bu nedenle, ÇSY'nin kapsam bakımından KSS'ye göre daha geniş olduğu söylenebilir (Gillan ve ark., 2021:2).

Firmaların finansal performansının yüksek olması kısa vadede bir avantaj olarak görülse bile uzun vadede firmanın bekası için bir garanti unsuru olmamaktadır. Uzun vadede firmaların çevresel ve sosyal faktörleri göz önünde bulundurmaları gerekmektedir (Ertan, 2018: 464). Varlık yöneticileri için sürdürülebilirlik uygulamaları yatırım stratejilerini geliştirmede ve uygulamada kritik bir araçtır. ÇSY faaliyetleri, uzun vadeli yatırım fırsatlarını değerlendirmeye ve toplumsal etki yaratmaya çalışan uygulayıcılar arasında giderek daha fazla ilgi görmektedir. İş yöneticileri, ÇSY ve sürdürülebilirlik çabalarının şirketin uzun vadeli sürdürülebilirliği ve itibarı için önemli bir rol oynadığının bilincindedir (Özer ve ark., 2023:338).

Sürdürülebilirlik endeksleri kapsamındaki şirketleri değerlendirmek için genellikle çevresel, sosyal ve kurumsal yönetim kriterleri kullanılmaktadır. Bu kriterler, endekslerin temel aldığı sürdürülebilirlik konularını daha ayrıntılı olarak açıklayan çeşitli alt değerlendirme ölçütlerine ayrılmaktadır. Örneğin, potansiyel değerlendirme ölçütleri arasında katı atık yönetimi, su kaynaklarının yönetimi ve enerji verimliliği gibi konular yer almaktadır. Sera gazı emisyonu verilerinin izlenmesi ve raporlanması, işyerindeki yaralanmalar nedeniyle kaybedilen zaman, cinsiyet eşitsizliği, çalışan devir hızındaki değişimler ve yeşil bina anlayışının desteklenmesi gibi uygulamalar, Dünya Borsalar Federasyonu bünyesinde faaliyet

gösteren Sürdürülebilirlik Çalışma Grubu'nun (WFE SWG) belirttiği ölçütler arasında yer almaktadır (Gündüz,2018:3). Firmalar, faaliyetlerini sürdürebilmek ve yeni yatırımlar yapabilmek için finansmana ihtiyaç duyarlar. Gerekli olan bu finansman ya firmanın özkaynaklarından ya da dış kaynaklardan sağlanmaktadır. Firmaların sahip oldukları iç ve dış fon kaynaklarının toplamı, sermaye yapılarını belirlemektedir. Her iki fon kaynağının da bir maliyeti vardır, firmalar için önemli olan finansman kaynaklarını ihtiyaç duyulan zamanda ve uygun maliyetle temin edebilmektir. Elde edilen finansmanın, firma değerine katkı sağlayacak şekilde kullanılması, optimal finansman kullanımı için tüm seçeneklerin risk ve getiri açısından analiz edilmesini gerektirmektedir (Karabulut & Şeker, 2020:29).

Bu çalışma, Borsa İstanbul (BIST) hisse senedi piyasasında faaliyet gösteren ve finansal olmayan şirketlerin kurumsal sürdürülebilirlik performanslarının borçlanma maliyetleri üzerindeki etkisini araştırmayı amaçlamaktadır. Kurumsal sürdürülebilirlik performansı olarak şirketlerin Borsa İstanbul Sürdürülebilirlik Endeksinde (BIST SE) yer alması kriter olarak belirlenmiştir. Çalışma 2014-2019 yılları arasında BIST 100 endeksi içerisinde yer alan 54 firmayı kapsamaktadır. Bu çalışma üç açıdan katkı sağlamaktadır. Bunlar; (i) KSP'nin borç finansman maliyeti üzerindeki etkisi üzerine farkındalık oluşturarak literatürü zenginleştirmek, (ii) gelişmekte olan ülkeler grubunda yer alan Türkiye'de şirketlere borç maliyet konusunda rehberlik ederek bilgiler sunmak, (iii) KSP'si yüksek olan şirketleri için risk algısı konusunda değerlendirme yaparak finansal kurumlar için kanıtlar sunmaktadır. Bulgular aynı zamanda vekalet ve paydaş teorilerine katkıda bulunmaktadır. Bu makalenin geri kalanı şu şekilde yapılandırılmıştır. İkinci bölümde literatür incelenmiş ve araştırma hipotezleri geliştirilmiştir. Üçüncü bölüm, veri ve araştırma metodolojisini açıklarken, dördüncü bölüm sonuçları raporlamaktadır. Son olarak, makale bulguların tartışılması ile sona ermekte ve gelecek araştırma alanlarına dikkat çekmektedir.

II. LİTERATÜR İNCELEMESİ VE HİPOTEZ GELİŞTİRME

Sürdürülebilirlik uygulamalarındaki artış, sürdürülebilirliğin finansal sonuçlar üzerindeki etkilerini anlamak amacıyla önemli ölçüde araştırmaya yol açmaktadır. Çalışmada önce bu konu ile ilgili Türkiye özelinde yapılan çalışmalara, devamında ise diğer ülkeler için yapılan çalışmalara yer verilmiştir.

Aksoy & Yılmaz (2023) Borsa İstanbul'da işlem gören 211 finansal olmayan şirketten oluşan bir örneklem oluşturarak, kadın başkan ve kadın yöneticilerin yönetim kurulunda bulunmasının borç maliyetini ve fon sağlayıcıların temerrüt riski algısını azalttığı sonucuna

ulaşmışlardır. Buna karşın yönetim kurulunun bağımsızlığı ve büyüklüğünün borç maliyeti üzerinde önemli bir etkisi olmadığını ortaya koymuşlardır. Atasel & Güneysu (2023), BIST Tüm Endeksindeki şirketlerin borç maliyeti ile çevre, sosyal, yönetişim ve toplam ÇSY performansı arasındaki ilişkiyi 66 şirketi örneklem olarak kullanarak 2015-2021 yılları arasında incelemişlerdir. Bulgulara göre çevresel performans, sosyal performans ve toplam ÇSY performansının borç maliyetini azalttığı ve daha yüksek ÇSY performansına sahip şirketlerin daha fazla dış finansman kaynağına erişebildiği sonucuna ulaşmışlardır.

Ateş (2021) Türkiye'de faaliyet gösteren firmalar için, 2009-2018 verilerini kullanarak, kurumsal sosyal performans ile borç maliyet ilişkisini incelemiştir. Araştırma sonuçlarına göre çevresel performans ile borçlanma maliyeti arasında negatif ve anlamlı bir ilişki olduğu ancak toplam ÇSY performansı ile sosyal ve yönetişim performansının borçlanma maliyeti üzerinde anlamlı bir etkisi olmadığı sonucuna varılmıştır. Ayrıca borç verenlerin, firmaların kurumsal sosyal performanslarını tüm boyutları ile detaylı değerlendirmedikleri bulunmuştur. Özer ve ark. (2023), 2007-2019 yılları arasında Borsa İstanbul'da işlem gören 29 firmanın kurumsal yönetim derecelendirme notları ile borçlanma maliyetleri arasındaki ilişkiyi incelemişlerdir. Yazarlar kurumsal yönetim derecelendirme notlarının yükselmesinin borç maliyetlerini azaltıcı bir etkisi olduğunu bulmuşlardır. Ayrıca çalışmada, kurumsal yönetimin güçlendirilmesine yönelik yatırımların, borçlanma maliyetlerini düşürerek firmaların kâr marjlarının artmasına, nakit akışlarının güçlenmesine ve finansal esnekliklerinin artmasına katkıda bulunabileceği belirtilmiştir. Temiz (2022), 2015-2019 yılları arası gelişmekte olan 17 ülkeye ait şirketlerin çevresel performansının hem borç hem de öz sermaye maliyeti üzerinde azaltıcı etkileri olduğunu bulmuştur. Sonuçlara göre tüm çevresel performans boyutları (kaynak azaltımı, emisyon azaltımı ve çevresel ürün inovasyonu) borç maliyeti üzerinde negatif etkiye sahip iken, sadece emisyon performansının öz sermaye maliyeti üzerinde negatif ve anlamlı etkiye sahip olduğunu belirtmiştir. Temiz & Varıcı (2022) BIST Tüm Endeksinde işlem gören 242 firmanın verilerini kullanarak yaptıkları çalışmada firmaların BIST SE'de işlem görmeleri, KSS komitesine sahip olmalarının ve KSS raporu yayımlamalarının finansman erişimini kolaylaştırdığını ifade etmişlerdir.

Birçok araştırma (Crifo ve ark., 2017; Eliwa ve ark., 2021; Fonseka ve ark., 2019; Ge & Liu, 2015), sürdürülebilirlik uygulamaları ile borç maliyeti arasında negatif bir ilişki olduğuna dair ampirik kanıtlar sunarken, bazı araştırmalar (Erragragui, 2018; Hoepner ve

ark., 2016; Ye & Zhang, 2011) pozitif ilişki bulmuştur. Sürdürülebilirlik uygulamalarının borç maliyeti üzerindeki etkilerine dair ampirik bulgular hala kesin olmadığından, birçok akademisyen (Eliwa ve ark., 2021; Fonseka ve ark., 2019; Ye & Zhang, 2011) bu ilişkinin daha fazla incelenmesini önermektedir.

Tan ve ark., (2021) Çin'deki firmalar tarafından ihraç edilen 1067 tahvili kullanarak, hava kirliliği ile borç finansman maliyeti arasında pozitif ve anlamlı bir ilişki olduğunu tespit etmişlerdir. Bulgulara göre hava kirliliği bir firmanın borç maliyeti artırmaktadır. Ng & Rezaee (2012) sürdürülebilirlik performans bilgilerini açıklayan şirketlerin, benzer bilgileri açıklamayan şirketlere göre daha düşük borç maliyetine sahip olduğunu belirtmektedir. Sukmadilaga ve ark. (2023) ASEAN ülkelerindeki halka açık şirketlerin borç maliyeti üzerinde sürdürülebilirlik uygulamalarının önemli bir negatif etkisi olduğunu belirtmişlerdir. Shad ve ark. (2020) sürdürülebilirlik raporlamasının ve raporun bir bileşeni olan ekonomik sürdürülebilirliğin raporlanmasının hem borç maliyetini hem de öz sermaye maliyetini azalttığını ayrıca, sürdürülebilirliğe yatırım yapan şirketlerin itibar sermayesini arttırarak olumlu bir değer oluşturduğunu bulmuşlardır. Yazarlar gönüllü karbon açıklamasının, 2010-2015 dönemi için Güney Afrika firmalarının genel sermaye maliyeti üzerinde bir azalmayla ilişkilendirildiğini belirlemektedir. Çevre kirliliği yoğun projeler borç verenler tarafından riskli olarak görülebilir çünkü bunlar genellikle karbon kirliliğinin dışsallaştırılmasını içerir ve buna örtülü maliyetlerin açıkça firmalara aktarılması riski de eşlik etmektedir (Goss & Roberts, 2011).

Kordsachia (2021) Avrupa'da sosyal sorumluluk sahibi şirketlerin borç maliyetlerinin daha düşük olduğunu ve şirketlerin KSS uygulamaları yoluyla manevi sermaye elde edip beklenmeyen olumsuz olayların olası finansal etkilerini azaltmaya yardımcı olmak için sigortaya benzer bir koruma elde edeceğini belirtmiştir. Latvala (2022) KSP ile borç maliyetleri arasında anlamlı ve negatif bir ilişki olduğunu göstererek ayrıca kadın yönetim kurulu üyelere sahip firmaların KSP ile borç maliyetleri arasında negatif bir etkiye sahip olduklarını bulmuştur. Ratajczak ve Mikołajewicz (2021), çevresel performansın özellikle uzun vadede borç maliyetini düşürdüğünü, sosyal performansın ise hem kısa hem de uzun vadeli borçlar üzerinde olumlu etkiler yarattığını ifade etmişlerdir.

Gao ve ark. (2016) Amsterdam Borsası'nda 2004 ile 2012 yılları arasında listelenen 61 firmanın kurumsal sosyal sorumluluk açıklama düzeyini inceleyerek, kurumsal sosyal sorumluluk açıklaması ile borç maliyeti arasında ters bir ilişki olduğunu tespit etmişlerdir.

Jung ve ark. (2018) tarafından yapılan çalışmada, kredi kurumlarının, bir firmanın karbon riskini kredi kararlarına dahil ettiği ve bu riskin borç maliyetlerini artırdığı gözlemlenmiştir. Ayrıca, firmaların bu risklerin farkında olduğu ve yeşil teknolojilere yatırım yaparak yeni sermaye yatırım planlarıyla riskleri hafiflettiği belirtilmiştir.

ÇSY puanları ve finansal yatırım ilişkisi açısından mevcut çalışmalar incelendiğinde, yüksek ÇSY puanlarına sahip firmaların daha düşük kredi riski taşıdığı görülmektedir (Chava, 2014; Goss & Roberts, 2011; Sharfman & Fernando, 2008). Apergis ve ark. (2022) borçlanan şirketlerin borç maliyetlerinin, ÇSY değerlendirmeleri ile ilişkili olduğunu ortaya koyarak, düşük ÇSY puanlarına sahip şirketlerin daha yüksek risk algısına sahip oldukları için iflas risklerinin arttığı kabul edilmektedir (El Ghoul ve ark., 2018; Gao & Wan, 2023; Kumar & Firoz, 2018; Lemma ve ark., 2019; Pizzutilo ve ark., 2020; Palea & Drogo, 2020; Schneider, 2011; Wang ve ark., 2021; Zhou ve ark., 2018).

El Ghoul ve ark. (2011), daha yüksek KSP seviyelerine sahip şirketlerin daha az risk ve daha büyük bir yatırım tabanına sahip olduğunu varsayarak, öz sermaye maliyetinin KSS gücü ile negatif bir ilişkisi olduğunu ortaya koymuşlardır. Oikonomou ve ark. (2014), yüksek KSS performanslı şirketlerin daha düşük riskli oldukları için, tahvil getirileri daha düşük olup, bunun tersine düşük KSS performanslı şirketlerin yüksek risk taşıdıkları için yatırımcılar tarafından artan riskten dolayı yüksek tahvil getirileri talep edildiğini ifade etmişlerdir. Anis & Utama (2016), bankaların kredi verme kararlarında KSP açıklamalarına önem verdiklerini gözlemlemişlerdir. KSP açıklamalarının, bankalara borçluların riskini değerlendirmede ek bilgi sağladığını ve kredi verme kararında firmanın iyi yönetimini temsil eden bir güvence sunduğunu ifade etmişlerdir.

Firmalar KSP aracılığıyla daha düşük faiz oranlarından (Goss & Roberts, 2011) ve daha yüksek borç sermaye erişiminden faydalanabilmektedir (Cheng ve ark., 2014). Daha iyi KSP'ye sahip firmalar daha iyi kredi derecelendirmelerine sahiptir ve daha düşük maliyetle tahvil ihraç edebilmektedir (Ge & Liu, 2015). Aman & Nguyen (2013), firmaların daha yüksek düzeyde KSS açıklamalarının, bilgi asimetrisini azalttığını, temsil maliyetlerini düşürdüğünü ve borç verenler için risk algısını hafiflettiğini belirtmişlerdir. Ayrıca, kredi notlarının yönetim kurulu büyüklüğü ile birlikte arttığını ve bu sayede daha düşük maliyetlerle daha yüksek miktarda fon erişimi sağlandığını ifade etmişlerdir.

Cho ve ark., (2013) performansın negatif ya da pozitif olmasından bağımsız olarak kurumsal sosyal sorumluluk açıklamalarının firma ile paydaşları arasındaki bilgi asimetrisini

azalttığı sonuca varmışlardır. Dhaliwal ve ark., (2014), 31 ülkenin firmalarından oluşan verileri kullanarak, KSP açıklamalarının sermaye maliyetini azalttığını ve bu sonucun paydaş ilişkilerinin güçlü olduğu ülkelerde daha belirgin olduğunu ortaya koymuşlardır. KSP raporlaması ile sermaye maliyeti arasındaki negatif ilişkinin, bu raporlamanın firma ile paydaşlar arasındaki bilgi asimetrisini azaltıcı rolünden kaynaklandığını gözlemlemişlerdir.

Borç verenlerin, firmaların en önemli paydaşlarından biri olduğu kabul edilmektedir. Paydaş teorisi, paydaşların desteklerini elde etmek için firmaların ilgili uygulamaları benimsemeleri gerektiğini, paydaşlarının çıkarlarını doğrudan ve açık bir şekilde savunmalarını önermektedir (Deegan, 2014; Theodoulidis ve ark., 2017). Bu nedenle, borç verenlerin sürdürülebilirlik endişelerini dikkate alarak, firmalar daha yüksek krediye değer görülmekte ve düşük bir borç maliyeti ile ödüllendirilmektedir (Deegan, 2002).

Sürdürülebilirlik ile borç maliyeti arasındaki ilişkinin temelinde vekâlet teorisi ve bilgi asimetrisi bulunmaktadır. Vekalet teorisi (Jensen & Meckling, 1976), sürdürülebilirlik uygulamalarının, bir firmanın iletişim biçimi olarak, firmalar ile borç verenleri arasında var olan bilgi asimetrisini azaltacağını öne sürmektedir (Bhuiyan & Nguyen, 2020; Martínez-Ferrero ve ark., 2016). Borç verenler, bir firmanın borç verme kararına yönelik belirli türde risklerle karşılaşmaktadırlar (Thompson & Cowton, 2004) ve sürdürülebilirlik uygulamaları bu riskleri hafifletebilir (Ge & Liu, 2015). Bu bağlamda, firmanın sürdürülebilirlik girişimleri kredi değerlendirmede önemli bir pay sağlamaktadır (Bhuiyan & Nguyen, 2020), bu da firma ve borç verenleri arasındaki bilgi asimetrisini hafifletebilmektedir. İlgili firma daha sonra borç verenler tarafından daha yüksek krediye değer görülmekte ve daha düşük bir borç maliyeti ile ödüllendirilmektedir (Derrien ve ark., 2016).

İyi bir sürdürülebilirlik performansı, yatırımcılar ve kredi verenler arasında düşük risk algısı oluşturabilmektedir. Kredi derecelendirme kuruluşları, şirketlerin sürdürülebilirlik performansını değerlendirerek kredi notlarını belirlemektedir. Daha yüksek bir kredi notu, genellikle daha düşük bir borç maliyetine işaret etmektedir. Düşük sermaye maliyeti firmaya yüksek itibar, yüksek karlılık oranı, yüksek firma değeri, karbon emisyonu kaynaklı finansal risk düzeyinde azalma, yüksek çalışan motivasyonu sağlamaktadır (Akbaş & Canikli, 2019; Chouaibi ve ark., 2021; Giese ve ark., 2019; Lins ve ark., 2017; Sherwood & Pollard, 2018; Temiz &Varıcı, 2022; Velte, 2017). Bu doğrultuda literatürde yapılan çalışmalar dikkate alarak, aşağıdaki hipotez oluşturulmuştur.

H_1: Kurumsal sürdürülebilirlik performansı yüksek olan şirketler daha düşük borçlanma maliyetine sahiptirler.

III. METODOLOJİ

III.I. Veri Seti

Bu çalışmanın örneklemi, 2014- 2019 dönemi için BIST 100 endeksinde yer alan finansal olmayan 54 firmadan oluşmaktadır. Veriler Türkiye sermaye piyasaları – Merkezi Kayıt Kuruluşu (MKK) ve şirketlerin yıllık faaliyet raporlarından elde edilmiştir. Tablo I'de BIST SE de yer alan firma sayıları yıllar itibarıyla görülmektedir.

Tablo I: 2014-2019 Yılları Arası BIST SE de Yer Alan ve Almayan Şirket Sayıları

	2014	**2015**	**2016**	**2017**	**2018**	**2019**
BIST SE	10	22	32	35	37	41
DİĞER	58	48	38	39	44	49

III.II. Değişkenler

Kurumsal sürdürülebilirlik performansı ve borçlanma maliyeti arasındaki ilişkiyi analiz etmek için kullanılan bağımlı değişken, bağımsız değişkenler ve kontrol değişkenleri Tablo II'de gösterilmiştir. Firmaların ilgili yıldaki borçlanma maliyeti (BM) olarak Aksoy & Yilmaz (2023) tarafından yapılan çalışmadan yola çıkılarak Worldscope veri tabanında yer alan yıllık faiz oranı verisi (tahmini faiz oranı ortalaması) kullanılmıştır. Bu alternatif ölçütün seçilmesinin nedeni, banka kredilerinin faiz oranı ve ödenmemiş tahvillerin getirisi ile ilgili verilerin mevcut olmamasından kaynaklanmaktadır. Ayrıca firma bazında ilgili yıl için Worldscope veri tabanında yer alan faiz oranı (WC08356) hesaplanış şekli Tablo II'de formüle edilmiştir.

Önceki çalışmalarla uyumlu olarak, bu çalışmada firma büyüklüğü (Aksoy & Yilmaz, 2023; Atasel & Güneysu, 2023; Cooper & Uzun, 2015; Dunne & McBrayer, 2019; Eliwa ve ark., 2021; Özer ve ark., 2023; Ratajczak & Mikołajewicz, 2021; Kordsachia, 2021; Ge & Liu, 2015;) ve firma karlılığı (Aksoy & Yilmaz, 2023; Atasel & Güneysu, 2023; Ateş, 2021; Eliwa ve ark., 2021; Ge & Liu, 2015; Oikonomou ve ark., 2014; Özer ve ark., 2023; Shad ve ark., 2020) kontrol değişkeni olarak kullanılmıştır. Ayrıca finansal kaldıraç da kontrol

değişkeni olarak (Aksoy & Yilmaz, 2023; Atasel & Güneysu, 2023; Al Hadi ve ark., 2017; Eliwa ve ark., 2021; Özer ve ark., 2023) kullanılmıştır. Literatürde duran varlıklar oranı (Dunne & McBrayer, 2019; Magnanelli & İzzo, 2017; Sun ve ark.,2022) ve cari oran (Aksoy &Yilmaz, 2023; Fandella ve ark., 2022; Jeriji, 2022; Pizzutilo ve ark, 2020; La Rosa ve ark., 2018) kontrol değişkeni olarak kullanıldığından dolayı bu çalışmada da kullanılmıştır. Son olarak sektör değişkeni modele eklenmiştir (Aksoy & Yilmaz, 2023; Atasel & Güneysu, 2023; Bayındır & Aksoy,2024). Ayrıca zaman etkilerini kontrol etmek için modele yıl kukla değişken olarak eklenmiştir.

Tablo II: Değişkenler ve Hesaplanış Şekilleri

	Değişken	Sembol	Hesaplanış Şekli
Bağımlı Değişken	Borçlanma Maliyeti	BM	Tahmini Ortalama Faiz Oranı = Borç Faiz Gideri / (Kısa Vadeli Borç ve Uzun Vadeli Borcun Kısa Vadeli Kısmı + Uzun Vadeli Borç) * 100
Bağımsız Değişken	Kurumsal Sürdürülebilirlik Performansı	KSP	Kukla değişken, BIST Sürdürülebilirlik Endeksine dahil olan firmalar için 1, diğer firmalar için 0 değerini almıştır.
Kontrol Değişken	Firma Büyüklüğü	FB	Toplam Varlıkların Doğal Logaritması
	Finansal Kaldıraç	FK	Toplam Borçlar / Toplam Varlıklar
	Aktif Karlılık	AKAR	Net Kar / Toplam Varlıklar
	Cari Oran	CO	Dönen Varlıklar/ Kısa Vadeli Borçlar
	Duran Varlıklar Oranı	DVO	Duran varlıklar / Toplam Varlıklar
	Sektör	SEK	Kukla Değişken, Hizmet sektörü için 1, Sanayi sektörü için 0 değerini almıştır

III.III. Model

Çalışmanın veri seti panel verilere uygun yatay kesit ve zaman serisi gözlemlerini içermektedir. Analizler Stata programı ile yapılmıştır. Literatürde yer alan çalışmalar dikkate alınarak hipotezi test etmek için aşağıdaki model kullanılmıştır.

$$BM_{i,t} = a + X_1 KSP_{i,t} + X_2 FB_{i,t} + X_3 FK_{i,t} + X_4 AKAR_{\,i,t} + X_5 CO_{i,t} + X_6 DVO_{i,t} + X_7 SEK + X_8 \sum_{k=1}^{6} Yıl_{i,t} + e_{i,t} \quad (1)$$

IV. ANALİZLER

Çalışmada yer alan değişkenlere ilişkin tanımlayıcı istatistikler Tablo III'de gösterilmiştir. Değişkenlere ilişkin aritmetik ortalamalar sırasıyla borçlanma maliyeti (BM) için 8,337, Firma büyüklüğü (FB) için 15,425, Finansal Kaldıraç (FK) için 0,570, Aktif karlılık (AKAR) için 0,052, Cari oran (CO) için 1,505, Duran varlıklar oranı (DVO) için 0,445 olarak görülmektedir. Değişkenlere ilişkin standart sapma, minimum ve maksimum değerleri ile ilgili bilgiler Tablo III'de görülmektedir. Ayrıca Tablo III'de KSP, SEK ve Yıl değişkenleri kukla (0,1) değerlerini aldıkları için bu değişkenlere yer verilmemiştir.

Tablo III: Tanımlayıcı İstatistikler

Değişkenler	Ortalama	Standard Sapma	Minimum Değer	Maksimum Değer
BM	8,337	7,242	0.57	60,48
FB	15,425	1,392	11,969	18,806
FK	0,570	0,182	0,899	0,977
AKAR	0,521	0,067	-0,272	0,333
CO	1,505	0,711	0,221	3,774
DVO	0,445	0,200	0,496	0,950

Tablo IV'de değişkenler arasındaki ilişkinin yönünü ve gücünü gösteren korelasyon katsayılarına yer verilmiştir. Bazı değişkenler arasında anlamsız ilişki olmasına rağmen birçok değişkende %5 anlamlılık düzeyinde pozitif veya negatif yönlü bir ilişki bulunmaktadır. Bağımsız değişken (KSP) ile bağımlı değişken (BM) arasında negatif ve anlamlı bir ilişki görülmektedir (-0,115, $p<0.05$). FK ile BM arasında negatif ve anlamsız bir ilişki olduğu görülmektedir. DVO ile bağımlı değişken (BM) arasında ise negatif ve anlamlı bir ilişki gözlemlenmiştir (-0,166, $p<0.05$). AKAR ile BM arasında pozitif ve anlamsız bir ilişki, CO değişkeni ile BM arasında negatif ve anlamsız bir ilişki görülmektedir. SEK ile BM arasında ise pozitif ve anlamsız bir ilişki görülmektedir.

Tablo IV: Değişkenlerin Korelasyonu

	BM	KSP	FB	FK	AKAR	CO	DVO	SEK
BM	1,000							
KSP	-0,115*	1,000						
FB	-0,295*	0,459*	1,000					
FK	-0,035	0,282*	0,144*	1,000				
AKAR	0,033	0,031	-0,116*	-0,426*	1,000			
CO	-0,006	-0,068*	-0,082	-0,657*	0,358	1,000		
DVO	-0,166*	-0,247*	0,174*	-0,167*	-0,277*	-0,160*	1,000	
SEK	0,028	-0,121*	-0,304*	-0,042	0,238*	0,078	-0,125*	1,000

** %5 anlamlılık düzeyini ifade etmektedir.*

Bağımsız değişkenler arasında çoklu bağlantı sorununun olup olmadığı VIF değerleri ile incelenmiştir. Çalışmadaki analizler sonucu VIF değerlerinin 1.17-2.65 arasında olduğu görülmektedir (Ek. A.I). VIF değerinin (Ek A.I) 5'in altında olması değişkenler arasında çoklu doğrusal bağlantı sorunun olmadığı anlamına gelmektedir (Tatoğlu, 2020: 261).

Klasik modelin tahmininde yani birim ve zaman etkilerinin olmadığı durumda havuzlanmış en küçük kareler yöntemi ve en çok olabilirlik yöntemi kullanılabilmektedir. Regresyon modelini tahmin etmek için önce F-testi kullanılmıştır. Tablo V'te görüldüğü gibi modelin H_0 hipotezi reddedilmektedir ($p<0.05$). Ayrıca R^2'nin 0.114'ye eşit olduğu görülmektedir. Bu da modelin %11,4'lük kısmının açıklayıcı değişkenler tarafından açıklandığı anlamına gelmektedir.

Tablo V: F-Testi sonuçları

Değişken	Gözlem Sayısı	Serbestlik Derecesi	R^2	F	P
BM	324	7	0,114	5,81	0,000***

*p<0,10 **p<0,05, ***p<0,01

Klasik modelin geçerliliği; yani birim ve/veya zaman etkilerinin olup olmadığı olabilirlik oranı LR (iki yönlü model) testi ile sınanmıştır. Olabilirlik Oranı (LR) testinde, birim ve zaman etkilerinin standart hatalarının sıfıra eşit olduğu, bir başka ifade ile iki yönlü modelin uygun olmadığı temel hipotezi sınanmaktadır. Bu test birleşik bir testtir. H_0 reddi için birim veya zaman etkilerinde birisinin sıfırdan farklı olması yeterli olmaktadır. Bu nedenle H_0 reddedilirse tek tek birim ve zaman etkilerinin varlığı sınanmıştır. Ancak çalışmada her şart altında zaman etkilerini elimine etmek için (i.TarihID) değişkeni modele

eklenmiştir. Tablo VI sonuçlarına göre (p <0.05) birim ve zaman etkisinin varlığı görünmektedir.

Tablo VI: LR Testi

Değişken	Gözlem Sayısı	LR (Chi2)	P
BM	324	55.92	0,000***

*p<0,10 **p<0,05, ***p<0,01

Sabit etkiler tahmincisi ile tesadüfi etkiler tahmincisi arasında tercih yapmak için Tablo VII'de yer aldığı gibi Hausman testi yapılmıştır. Testin sonuçlarına göre H_0 hipotezi reddedilemeyerek (Prob>chi2 = 0,735> 0.05) BM değişkeni için tesadüfi etkiler modelinin geçerli olduğu sonucuna varılmıştır.

Tablo VII: Hausman Testi Sonuçları

Değişken	Gözlem Sayısı	Hausman Test İstatistiği	Olasılık Değeri
BM	324	7.75	0.735

*p<0,10 **p<0,05, ***p<0,01

Tatoğlu (2021) panel veri analizinde modelde heteroskedasite, otokorelasyon veya birimler arası korelasyondan en az biri varsa, ya parametre tahminlerine dokunmadan standart hatalar düzeltilmeli ya da varlıkları halinde uygun yöntemlerle tahmin yapılmalıdır diye önermektedir.

Tesadüfi etkiler modelinde BM bağımlı değişkeni için, heteroskedastitenin (değişen varyans) varlığı Levene (1960), Brown ve Forsythe (1974) testi ile araştırılmıştır. Testin sonuçlarına göre H_0 hipotezi reddedilerek Tablo VIII'de görüldüğü gibi tesadüfi etkiler modelleri için heteroskedastitenin var olduğu sonucuna ulaşılmaktadır.

Tablo VIII: Tesadüfi Etkiler Heteroskedastisite Sonuçları

Değişken	Gözlem Sayısı	W0	W50	W10	Olasılık Değeri
BM	324	3,989	1,519	3,989	0,000***

*p<0,10 **p<0,05, ***p<0,01

Otokorelasyon testi için tesadüfi etkiler modellerinde Baltagi-Wu LBI ve Durbin-Watson ile sınanmıştır. Bu testlerin değeri <2 ise otokorelasyon varlığına neden olmaktadır. Tablo IX'da test değerleri görünmektedir.

Tablo IX: Otokorelasyon Baltagi-Wu ve Durbin-Watson Testleri Sonuçları

Değişken	Durbin-Watson	Baltagi-Wu LBI
BM	1.7646753	1.9879583

Tatoğlu (2022) Monte Carlo Benzetimi, N>T olduğu zaman standart Breusch-Pagan Lagrange Çarpanı testinin performansının kötü olduğunu, Pesaran'ın CD testinin iyi olduğunu göstermiştir. Bu yüzden birimler arası korelasyonun varlığı LM testine alternatif olarak Pesaran test ile sınanmıştır. Tablo X'da görüldüğü gibi P<0.05, birimler arası korelasyon varlığı sonucuna varılmıştır.

Tablo X: Birimler Arası Korelasyon Testi Sonuçları

CD	Anlamlılık Düzeyi
4.38	0.000***

*p<0,10 **p<0,05, ***p<0,01

Çalışmada değişen varyans, otokorelasyon ve birimler arası korelasyonu hesaba katan Driscoll-Kraay tahmincisi kullanılmıştır. Elde edilen panel veri analizleri Tablo XI'de yer verilmiştir. Tablo XI'de yer alan sonuçlar incelendiğinde, modelin istatistiksel olarak anlamlı olduğu (F=0.000, p<0.01) ve R^2 (0.207) görülmektedir. Tablo XI'de yer alan sonuçlar dikkate alındığında kurumsal sürdürülebilirlik performansı (KSP) ile borçlanma maliyeti (BM) arasında negatif yönlü ve istatiksel olarak anlamlı bir ilişki olduğu (p<0.05) görülmektedir. Bu sonuca göre daha yüksek sürdürülebilir performansa sahip şirketler daha düşük maliyetli finansman kaynağından yararlanabilmektedirler (Apergis ve ark., 2022; Eliwa ve ark., 2021; Gracia & Siregar, 2021). Yapılan analiz sonuçları dikkate alındığında firma büyüklüğü (FB) ile borçlanma maliyeti (BM) arasında negatif ve istatistiksel olarak anlamlı bir ilişki olduğu görülmektedir (p<0.05). Bu durum, daha büyük şirketlerin bilgi asimetrisini azaltarak daha düşük maliyetli dış finansmana kolay erişim avantajından yararlandığı anlamına gelmektedir (Arena & Michelon, 2018 ; Raimo ve ark., 2021). Finansal kaldıraç (FK) ile borçlanma maliyeti (BM) arasındaki negatif ve anlamsız bir ilişki, aktif karlılık (AKAR) ile borçlanma maliyeti (BM) arasında negatif ve anlamsız bir ilişki olduğu görülmektedir. Cari oran (CO)

ile borçlanma maliyeti (BM) arasında pozitif ve istatistiksel olarak anlamsız bir ilişki bulunmuştur. Duran varlıklar oranı (DVO) ile borçlanma maliyeti arasında negatif ve istatistiksel olarak anlamlı bir ilişki olduğu görülmektedir ($p<0.05$). Duran varlık oranının daha yüksek olması, temerrüde düşmek durumunda borçların geri ödenmesi için şirket varlıklarının daha büyük bir kısmının tasfiye edilebileceği anlamına gelmektedir. Bu da borç verenler için algılanan riski azaltarak borç faiz oranlarının düşmesine yol açabilmektedir (Dunne & McBrayer, 2019; Goss & Roberts, 2011; La Rosa ve ark., 2018; Ye & Zhang, 2011). Sektör (SEK) değişken ile borçlanma maliyeti (BM) arasında negatif ve anlamlı bir ilişki görülmektedir ($p<0.10$). Bu durum, hizmet sektöründeki firmaların daha düşük bir borçlanma maliyetine sahip olduğunu göstermektedir.

Tablo XI: Driscoll -Kraay Dirençli Tahmincisi Sonuçları

Modeldeki Değişkenler	**BM**
KSP	-1.630 (0,615) **
FB	-1.766 (0,460) **
FK	-2,222 (3,700)
AKAR	-0.582 (9,864)
CO	0.038 (1,254)
DVO	-5.438 (2,108) **
SEK	-1.590 (0,777) *
Sabit (C)	68,750 (6,094) ***
F istatistiği	0,000***
R^2	0.207
Gözlem Sayısı	324
Firma Sayısı	54

Not: *p<0.10 **p<0.05, ***p<0.01
Parantez içerisinde standart hatalar gösterilmiştir.
Yıl kukla degişkeni olarak modele dahil edilmiştir ancak raporlanmamıştır.

V. SONUÇ

Sürdürülebilirlik performansını uygulayan firmalar, değişen piyasa dinamiklerine ve toplumsal beklentilere uyum sağlayarak yenilik ve uzun vadeli değer yaratmaya odaklıdırlar.

Bu firmalar ÇSY faktörlerine öncelik veren yatırımcılar oldukları için genellikle daha iyi sermaye ve finansman kaynağı erişimine sahiptirler. Ayrıca KSP uygulamalarında hissedarların ve paydaşların menfaatlerinin korunması firmanın meşruluk elde etmesinde önem arz etmektedir. Çalışmada BIST 100 endeksi içerisinde yer alan ve finansal olmayan 54 şirketin kurumsal sürdürülebilirlik performansı (KSP) ile borçlanma maliyetleri arasındaki ilişki 2014-2019 yılları arasında incelenmiştir. Araştırmanın bulgularına göre, kredi kurumlarının, borç alan firmaların sürdürülebilirlik performansını ve risk profilini kredi verme kararlarında dikkate aldıkları görülmektedir. Sonuç olarak, firmalar daha yüksek bir sürdürülebilirlik performansına sahip olduklarında, bankalardan daha düşük faiz oranlarıyla kredi alabilirler ve bu sayede yapmak istedikleri yatırımlarda dış finansmana daha düşük maliyetle erişebilir ve daha çok borçlanabilirler.

Sonuçlar düzenleyicilere ve politika yapıcılara fayda sağlamakta ve onları şirketlerin KSP faaliyetlerini artırmaları için daha fazla adım atmaya teşvik etmektedir. Çalışmanın bulguları aynı zamanda mevcut literatürle de (Apergis ve ark., 2022; Atasel & Güneysü, 2023; Cheng ve ark., 2014; Eliwa ve ark., 2021; Raimo ve ark., 2021; Temiz & Varıcı,2022) büyük ölçüde uyum sağlamaktadır.

Pek çok araştırmada olduğu gibi, bu çalışmanın da bazı kısıtları bulunmaktadır. İlk olarak, çalışmanın örneklemi Türkiye ile sınırlı kalmıştır, diğer gelişmekte olan piyasalar için de bu çalışmanın benzeri yapılabilir. İkinci olarak Covid-19 pandemi etkisinden dolayı çalışmada 2014-2019 yılları arası, (pandemi öncesi dönem) dikkate alınmıştır. Covid-19 ve sonrası dönem içinde ayrı bir çalışma gerçekleştirilebilir. Çalışmada belirtilen kısıtlar dikkate alınarak, gelecekte yapılacak araştırmalarda şu noktalara dikkat edilmesi önerilir. Bundan sonraki yapılacak çalışmalarda farklı ülke grupları ve farklı sektörler için özellikle Covid-19 pandemi dönemini dikkate alarak finansal şirketler içinde bir araştırma yapılabilir. Buna ek olarak kurumsal sürdürülebilirlik performansı ile ağırlıklı ortalama sermaye maliyeti ve öz sermaye maliyeti ilişkisi de incelenebilir.

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Ek A.I. VIF Değerleri

Değişken	**VIF**	**1/VIF**
FK	2.65	0.377768
CO	2.07	0.483795
FB	1.56	0.653106
KSP	1.55	0.643751
AKAR	1.54	0.647944
DVO	1.55	0.646141
SEK	1.17	0.852248
Mean VIF	1.72	

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BIBLIOMETRIC ANALYSIS OF PUBLICATIONS ON SUSTAINABLE SUPPLIER SELECTION IN THE CONTEXT OF SUPPLY CHAIN MANAGEMENT

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Abstract

Supplier selection is the process of identifying the most suitable supplier to meet a company's needs, directly affecting the effectiveness of its supply chain. Sustainable supplier selection evaluates suppliers based on economic, environmental, and social responsibility criteria. This study aims to conduct a bibliometric analysis of publications on sustainable supplier selection in the WoS database from 2010 to 2024.The study involved searching the WoS database using the keyword "sustainable supplier selection," resulting in a review of 302 publications. These publications were analyzed based on criteria such as distribution by year, prominent authors, high-impact journals, leading institutions, and countries.The research identifies key trends, highly cited works, and the development of the sustainable supplier selection field. This study provides an overview of the knowledge accumulated in the literature and offers recommendations for future research. The purpose of this study is to examine bibliometrically the studies published in the WoS database between 2010 and 2024 on sustainable supplier selection

Keywords: Sustainable Supply Chain Management, Sustainable Supplier Selection, Supplier Evaluation, Multi-criteria supplier selection

JEL Classification: M11, D81, Q56

Article Type: Bibliography

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TEDARİK ZİNCİRİ YÖNETİMİ KAPSAMINDA SÜRDÜRÜLEBİLİR TEDARİKÇİ SEÇİMİNE YÖNELİK YAYINLARIN BİBLİYOMETRİK İNCELENMESİ

Öz

Tedarikçi seçimi, bir işletmenin ihtiyaç duyduğu mal veya hizmetleri sağlayacak en uygun tedarikçiyi belirleme sürecidir. Bu süreç, işletmenin tedarik zincirinin etkinliğini ve verimliliğini doğrudan etkiler. Sürdürülebilir tedarikçi seçimi ise,, bir işletmenin tedarikçilerini seçerken ekonomik, çevresel ve sosyal sorumluluk kriterlerini dikkate alarak uzun vadeli ve sürdürülebilir iş ilişkileri kurmayı amaçlayan bir yaklaşımdır. Bu kavram, geleneksel tedarikçi seçim süreçlerine ek olarak, sürdürülebilirlik odaklı kriterlerin de değerlendirilmesini içerir. Sürdürülebilir tedarikçi seçimi, işletmeler için risk yönetimi, maliyet tasarrufu ve verimlilik, rekabet avantajı, müşteri memnuniyeti ve sadakati, uzun vadeli işbirlikleri, çevresel ve sosyal sorumluluk, yenilik ve inovasyon, finansal performans, yasal ve regülasyon uyumu, iş gücü ve çalışan memnuniyeti gibi bir dizi önemli avantaj ve fayda sağlar. Bu çalışmanın amacı, sürdürülebilir tedarikçi seçimi konusunda 2010-2024 yılları arası Web of Science veri tabanında yayınlanan çalışmaların bibliyometrik açıdan incelenmesidir.

Anahtar Kelimeler: Sürdürülebilir Tedarik Zinciri Yönetimi, Sürdürülebilir Tedarikçi Seçimi, Tedarikçi Değerlendirme

JEL Sınıflandırması: M11, D81, Q56

Makale Türü: Bibliyografi

I. INTRODUCTION

Organizations worldwide are taking critical steps in sustainable supply chain management to reduce negative impacts from their business processes and create a positive impact on the environment. Evaluating and selecting suppliers to establish a sustainable supply chain plays a crucial role in achieving this goal (Suraraksa & Shin, 2019). Sustainable supplier selection integrates economic and social elements with environmental consciousness, adding a different dimension to traditional supply chain management (Sen, Datta, & Mahapatra, 2018). Supplier selection is a complex process that requires balancing multiple, often conflicting criteria-such as environmental, economic, and social factors (Memari et al., 2019). Sustainable supplier selection requires decision-makers to consider and evaluate both qualitative and quantitative factors due to its multi-criteria decision-making nature (Wang, Yang, & Cheng, 2019).

Green and sustainability-focused supplier selection is a critical strategy for businesses in industrial supply chains to support sustainability goals and gain a competitive advantage. This decision helps achieve objectives such as reducing environmental impacts, increasing resource efficiency, and fulfilling social responsibility. Research by Govindan et al. (2013) and Grimm et al. (2014) demonstrates that this strategy enhances business performance and provides a competitive advantage.

Key Elements of Sustainable Supplier Selection (Memari et al., 2019; Sen et al., 2018; Suraraksa & Shin, 2019);

A.Economic Sustainability;

- Financial Stability: The supplier's ability to maintain stable and strong financial health.
- Long-Term Collaboration Potential: Capacity for sustained partnerships.
- Competitive Pricing: Offering fair and competitive pricing structures (Memari et al., 2019).

B.Environmental Sustainability;

- Environmental Management Systems: Implementation of effective policies for environmental impact management.
- Waste & Emission Reduction: Active efforts to minimize waste and emissions.

- Resource Efficiency: Optimized use of energy and natural resources (Sen et al., 2018).
- Eco-Friendly Products: Provision of environmentally responsible products and services (Suraraksa & Shin, 2019).

C.Social Sustainability;

- Employee Rights & Safety: Commitment to employee welfare and a safe work environment.
- Diversity & Equality: Promotion of workplace diversity and equitable practices.
- Social Responsibility: Engagement in societal contributions and ethical projects.
- Ethics & Compliance: Adherence to business ethics and regulatory standards (Memari et al., 2019; Sen et al., 2018).

Sustainable supplier selection contributes to various aspects for businesses. Practices in sustainable supply chain management assist suppliers in reducing their environmental impacts, encompassing measures such as reducing carbon footprint, minimizing waste, and enhancing the efficient use of natural resources. Working with sustainability-focused suppliers can enhance cost efficiency in the long run. For instance, collaborating with suppliers that prioritize energy efficiency can lower energy costs. Another contribution is gaining a competitive advantage. Sustainability is increasingly vital in responding to the rising demands of consumers and stakeholders. Hence, a sustainability-focused supply chain can increase market share and bolster brand reputation. It aids businesses in fulfilling their social responsibilities and positively ontribute to their communities. Practices such as ensuring fair working conditions and supporting local communities enhance businesses' social impacts. These contributions represent just a few of advantages provided sustainable hain management practices. These practices assist businesses in achieving various objectives and ensuring their long-term success.

Despite these contributions, there are challenges to consider. The concept of sustainability encompasses a broad spectrum, requiring consideration of numerous criteria such as environmental, economic, and social factors. Evaluating and balancing each criterion can be challenging. Collecting and analyzing the necessary data to assess suppliers' sustainability performance is time-consuming and difficult. Moreover, concerns regarding the

reliability and accuracy of this data may arise. Contradictions may exist among sustainability criteria. For example, the most environmentally sustainable supplier may not be economically visable. Additionally, differing priorities among businesses can lead to conflicting criteria. The complexity of global supply chains can further complicate sustainable supplier selection. The involvement of the supply chain with various geographic regions and suppliers makes data collection and evaluation processes complex. Sustainable supply chain management necessitates strong collaboration and communication with suppliers. However, establishing collaboration and communication among different stakeholders in the supply chain, especially with suppliers from different cultures and business practices, can be challenging. Despite these challenges, businesses can enhance their environmental, economic, and social sustainability by effectively managing sustainable supplier selection. Utilizing appropriate strategies and tools is crucial in this process. Sustainable supplier selection generally involves the following steps:

Determination of Criteria: The first step involves establishing criteria that evaluate suppliers from environmental, economic, and social sustainability perspectives. For example, criteria such as carbon footprint, energy efficiency, and occupational health and safety practices can be defined (Memari et al., 2019).

Collection of Supplier Data: At this stage, data about suppliers' environmental and social performance, financial status, quality management systems, and other relevant aspects need to be collected. This data can be gathered through supplier surveys, existing databases, certifications, and reports (Suraraksa & Shin, 2019).

Data Analysis and Evaluation: The collected data are then analyzed and evaluated based on the identified criteria. Suppliers are ranked according to their sustainability performance, highlighting their strengths and weaknesses (Wang, Yang, & Cheng, 2019).

Supplier Selection and Decision Making: Based on data analysis results, decisions are made to select the most suitable suppliers. This decision may consider business priorities, supplier performance, and other factors, with communication and negotiation processes also taking place at this stage (Govindan et al., 2013).

Establishment of Contracts and Collaboration: Contracts are signed with selected suppliers, and collaboration is officially initiated. At this stage, it’s crucial to clarify specific goals, commitments, and responsibilities between the parties (Grimm et al., 2014).

Performance Monitoring and Feedback: After collaboration begins, suppliers' performance should be regularly monitored, and feedback provided. This helps suppliers achieve their sustainability goals and enables continuous improvements (Luthra et al., 2017).

These stages provide general guidance and can be tailored to the specific needs and priorities of businesses. Sustainability in supply chain management is becoming increasingly important for businesses to gain competitive advantage and fulfill their social responsibilities.

The first part of the study focuses on defining Sustainable Supplier Selection, emphasizing its importance and the role of strategies. It discusses the stages and challenges involved. The second part identifies the problem. In the third part, a bibliometric analysis of the literature in the field of "Sustainable Supplier Selection" is conducted. By analyzing the authors, institutions, and keywords in this field, the prominent trends and findings of the field are evaluated. Existing knowledge is assessed. Subsequently, regions and products with possible applicability are researched and prioritized. In the fourth part, a summary of the findings and discussion on future research areas are presented.

II. LITERATURE

In the scope of sustainability, supplier selection is of paramount importance and necessity for businesses to fulfill their environmental, economic, and social responsibilities and support sustainability goals. It is critical in terms of reducing environmental impacts, supporting social and ethical standards, managing risks and seizing innovation opportunities, complying with legal and regulatory regulations, meeting customer and investor demands, maintaining customer satisfaction and loyalty, among other factors. Selecting suppliers not only based on environmental but also economic and social sustainability principles enhances businesses' competitive advantage and contributes to a sustainable future. In this context, working with suppliers who adopt and implement sustainability policies is crucial.In this study, a review was conducted on the field of sustainable supplier selection by scanning books, articles, conference papers, etc., through WoS. An assessment of 286 publications was made based on criteria such as the number of publications per year in the relevant literature, leading articles and authors in the field, leading journals, prominent universities, and countries. The aim was to identify trends in the field and to characterize the most influential publications and researchers.

III. METHODOLOGY

III.I. Bibliyometric Analysis

Aria and Cuccurullo's work made a significant contribution by introducing Bibliometric, an open-source R package designed for comprehensive bibliometric analysis. This tool has facilitated the analysis of trends, developments, and knowledge structures within scientific publications and played a crucial role in popularizing bibliometric methods in academic research (Aria & Cuccurullo, 2017).Eugene Garfield's contributions laid the foundation for bibliometric analysis, especially through the development of citation analysis. Garfield's work promoted the widespread use of citation-based bibliometric methods, which have become essential for tracking the influence and interconnections of scholarly publications (Garfield, 1972). In recent years, bibliometric analysis has gained significant importance in social research. Factors behind this popularity include the development of bibliometric software such as Gephi, Leximancer, and VOSviewer, as well as the increased accessibility and usability of scientific databases. Bibliometric analysis involves collecting analyzing and measuring data related to scientific publications. This method is used to understand various aspects of the literature in a specific research field, identify trends in a particular topic or discipline, and identify the most influential publications or researchers. Bibliometric studies are used to reveal the status, trends, and development of studies in a specific scientific field. This analysis is typically conducted by examining various characteristics of publications in a research field, such as the number of publications, citation counts, publication dates, authors, published journals, and geographical distribution. The data obtained from scientific databases are analyzed using bibliometric software, and results are obtained through various visualizations and statistical analyses. To achieve these objectives, this study focused on scientific research types by searching for books, journals, articles, and conference papers with the keyword "sustainable supplier selection" in the titles in the WoS database. The study aimed to determine the trends in sustainable supplier selection by analyzing the geographical and demographic characteristics of publications, the publications with the highest number of citations, authors, and the journals with the highest impact factors. Thus, the aim was to reveal trends in this field and understand developments in the literature.

III.II. Collection of Data And Analysis

WoS, provided by Thomson Reuters (now Clarivate Analytics), is a scientific research platform that serves as a comprehensive multidisciplinary academic database. It is a crucial resource for tracking current developments in scientific literature, conducting academic

research, performing citation analyses, and evaluating academic performance. The platform encompasses a wide range of scientific journals, conference proceedings, books, and patent data. Users can search the extensive databases within WoS, find relevant articles, view citation information, and conduct bibliometric analyses.

On April 24, 2024, a search was conducted with the keyword "Sustainable Supplier Selection" in the "title" field, yielding 302 results. These results span various disciplines/fields, with the oldest publication dating back to 2011 and the most recent to 2024. Among the 302 results, there were 256 articles, 20 conference papers, 11 unpublished works, 8 review articles, 3 correction publications, 2 book chapters, and 2 retraction publications.

This study has two limitations. Firstly, it relies solely on content indexed in the WoS database, excluding sources not indexed in databases such as Scopus or ScienceDirect, as well as offline materials. Secondly, only publications written in English were included in the analysis.

III.II.I. Distribution of Publications by Type

Between 2010 and 2023, a total of 302 publications are listed. The distribution of publications by type is presented in Figure I. Among the total publications, the number of articles published is 256, accounting for 84.77% of the total, indicating a high share.

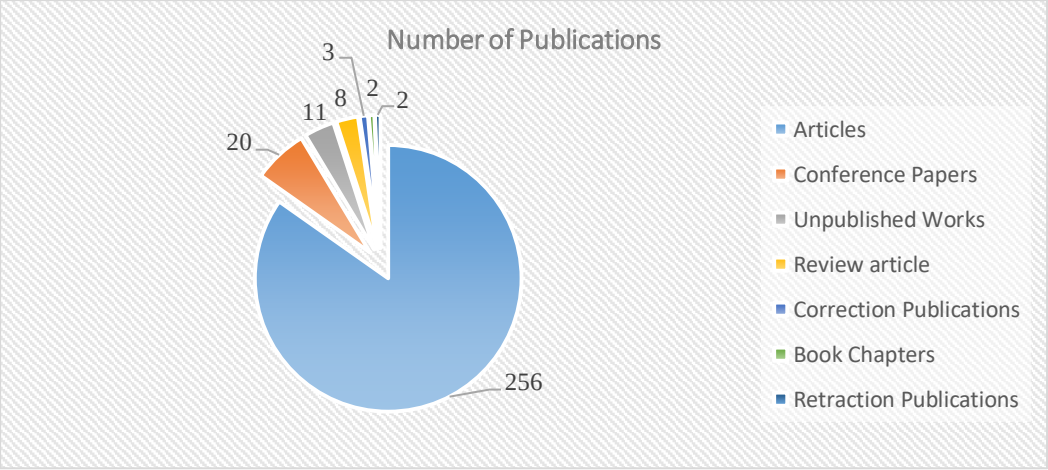

Figure I. Distribution of Publications by Type

III.II.I. Distribution of Publications by Years

Between 2010 and 2024, the graph in Figure II illustrates the distribution of publications on an annual basis. The total number of publications between 2011 and 2018 was 30, with an upward trend beginning in 2018 with 30 publications alone. It is observed that

there is a total of 245 publications after this date. There has been a significant increase since 2018. The primary reasons behind the increase in studies in the field of Sustainable Supplier Selection in 2022 and 2023 can be attributed to increasing awareness and demand, regulations and standards, the desire to provide risk management and competitive advantage, technological advancements, and academic and industry collaborations. At the forefront of these reasons is the 17 Sustainable Development Goals (SDGs) published in the United Nations' "2030 Agenda for Sustainable Development" adopted in 2015. Sustainable supply chain management entails managing businesses' supply chains considering their environmental, economic, and social impacts. Therefore, the adoption of the United Nations Sustainable Development Goals (SDGs) may have encouraged businesses and researchers to focus more on sustainability-related issues.

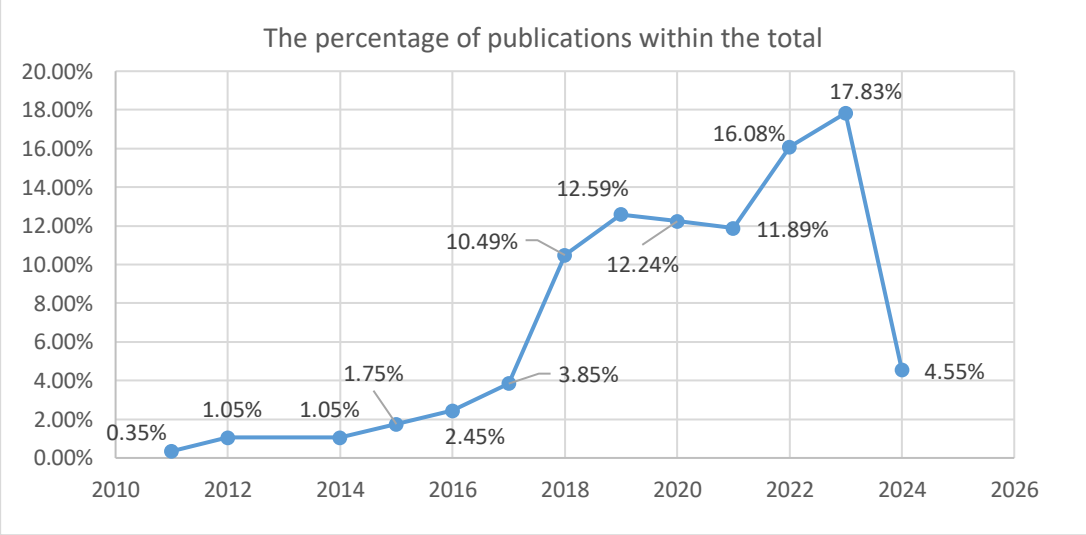

Figure II. Distribution of Publications by Years

III.II.III. Leading Publications in the Field

When identifying significant publications contributing to a field, citation count is an important metric. Table I. lists leading publications in the field along with their total citation counts.

Table I. Leading Publications in the Field

Authors	Publication Year	Citation Count
Stevic, Z; Pamucar, D; Puska, A; Chatterjee, P	2020	545
Luthra, S; Govindan, K; Kannan, D; Mangla, SK; Garg, CP	2017	529
Amindoust, A; Ahmed, S; Saghafinia, A; Bahreininejad, A	2012	379
Büyüközkan, G; Çifçi, G	2011	348
Awasthi, A; Govindan, K; Gold, S	2018	335
Memari, A; Dargi, A; Jokar, MRA; Ahmad, R; Rahim, AA	2019	322
Zimmer, K; Fröhling, M; Schultmann, F	2016	264
Azadnia, AH; Saman, MZM; Wong, KY	2015	241
Kannan, D	2018	219
Yu, CX; Shao, YF; Wang, K; Zhang, LP	2019	218
Ecer, F; Pamucar, D	2020	215
Tirkolaee, EB; Mardani, A; Dashtian, Z; Soltani, M; Weber, GW	2020	213
Abdel-Baset, M; Chang, V; Gamal, A; Smarandache, F	2019	210
Sarkis, J; Dhavale, DG	2015	198
Fallahpour, A; Olugu, EU; Musa, SN; Wong, KY; Noori, S	2017	181
Bai, CG; Kusi-Sarpong, S; Ahmadi, HB; Sarkis, J	2019	174
Vahidi, F; Torabi, SA; Ramezankhani, MJ	2018	165
Arabsheybani, A; Paydar, MM; Safaei, AS	2018	162
Rashidi, K; Cullinane, K	2019	161
Chen, ZH; Ming, XG; Zhou, TT; Chang, Y	2020	156

Asian countries lead the way in research in this field. Collaborations have been established with researchers from various geographies, including Asian countries, the USA, and European countries.

III.II.IV. Leading Authors in the Field

The study included 302 publications authored by a total of 754 authors. Authors with at least 5 or more publications are shown in Table II.

Table II. Leading Authors in the Field

Authors	Publication Number	Citation
Pamucar D	7	863
Wong KY	7	652
Kannan D	6	1046
Tavana M	6	396
Barnes D	5	140
Govindan K	5	1150
Rani P	5	115
Stevic Z	5	857
Wang CN	5	109
Wu C	5	140

When examining Table II, it is evident that the most prolific authors in terms of their contributions to Sustainable Supplier Selection are Kannah and Govindan. Since the publication with the highest citation count is often considered the most impactful in the field, these authors are presumed to have the greatest influence on this area..

III.II.V. Distribution by Categories in Web Of Science (WoS)

WoS is a scientific research platform provided by Clarivate Analytics, offering a vast multidisciplinary academic database. This platform serves as a comprehensive source used for tracking current developments in scientific literature, conducting academic research, performing citation analyses, and evaluating academic performance. When conducting research in WoS, users can filter by these categories and access literature in their respective fields more easily. These categories help researchers gain in-depth knowledge on specific subjects and facilitate the discovery of relevant studies. The categories in Wos are typically determined by publishers and editors, who assign publications to specific categories. Of the 302 publications included in the study, a total of 40 record assignments were reported in the WoS database. Publications with 10 or more records are tabulated. The distribution based on category-specific record numbers is shown in Table III. Upon examining the table, "Green Sustainable Science Technology" and "Environmental Sciences" categories are ranked first and second, respectively. The combined ratio of these two categories, which occupy the top two positions, is 51.40%, representing the highest coefficient and ratio, equivalent to half of the total. Therefore, it can be concluded that the primary focus of research in the field of sustainable supplier selection revolves around green and sustainable environmental topics, primarily pursued by profiles working in this area.

Table III. Distribution by Categories in WoS

Web Of Science Categories	Record Number	Distribution
Green Sustainable Science Technology	76	26.57%
Environmental Sciences	71	24.83%
Engineering Industrial	49	17.13%
Operations Research Management Science	49	17.13%
Computer Science Artificial Intelligence	38	13.29%
Environmental Studies	38	13.29%
Computer Science Interdisciplinary Applications	34	11.89%
Engineering Environmental	28	9.79%
Management	27	9.44%
Engineering Manufacturing	21	7.34%
Computer Science Information Systems	16	5.59%
Engineering Multidisciplinary	14	4.90%
Business	11	3.85%
Engineering Electrical Electronic	11	3.85%

III.II.VI. Leading Journals in the Field

The list of journals with at least 5 or more publications in a total of 302 academic studies, along with the publication counts and their distribution percentages within the total, is shown in Table IV. In terms of total publication count and percentages, the most significant journals are 'Sustainability' and 'Journal of Cleaner Production'

Table IV. Leading Journals in the Field

Journal	Publication No	Distribution
SUSTAINABILITY	32	11.19%
JOURNAL OF CLEANER PRODUCTION	24	8.39%
COMPUTERS INDUSTRIAL ENGINEERING	13	4.55%
EXPERT SYSTEMS WITH APPLICATIONS	9	3.15%
INTERNATIONAL JOURNAL OF PRODUCTION ECONOMICS	7	2.45%
JOURNAL OF INTELLIGENT FUZZY SYSTEMS	7	2.45%
INTERNATIONAL JOURNAL OF PRODUCTION RESEARCH	6	2.10%
PROCESSES	6	2.10%
APPLIED SOFT COMPUTING	5	1.75%
ENVIRONMENTAL SCIENCE AND POLLUTION RESEARCH	5	1.75%
INFORMATION SCIENCES	5	1.75%
INTERNATIONAL JOURNAL OF SUSTAINABLE ENGINEERING	5	1.75%
KYBERNETES	5	1.75%
MATHEMATICS	5	1.75%
SOFT COMPUTING	5	1.75%

III.II.VII. Leading Countries in the Field

Table V. Leading Countries in the Field

Countries	Publication No	Distribution
PEOPLES R CHINA	100	34.97%
IRAN	55	19.23%
INDIA	40	13.99%
USA	25	8.74%
TURKEY	21	7.34%
TAIWAN	20	6.99%
ENGLAND	18	6.29%
GERMANY	15	5.25%
MALAYSIA	14	4.90%
PAKISTAN	12	4.20%
DENMARK	10	3.50%
SERBIA	10	3.50%
VIETNAM	10	3.50%

The countries making the most significant contributions to the field, with publication counts of at least 10 or more, are shown in Table V. Upon examining the table, it can be observed that out of the 302 included publications, China ranks first with a percentage of 34.97%. Following China, Iran, India, the USA, and Turkey are the countries with the highest activity in this area.

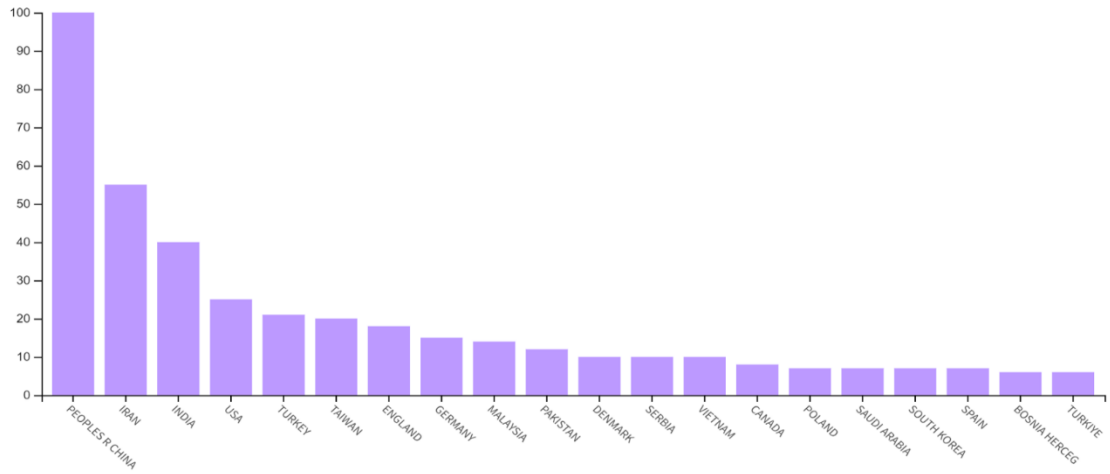

Figure III. Leading Countries in the Field

In Figure III, the distribution of these countries is graphically represented. As seen in the figure, these countries, with China leading, comprise 95.11%, primarily consisting of Asian countries. The increase in research and studies related to sustainability from China and other Asian countries can be attributed primarily to rapid economic growth and

industrialization. Environmental problems have also increased under the influence of rapid economic growth and industrialization in many Asian countries in the last few decades. Problems such as air pollution, water pollution, and waste management have encouraged research in sustainability. Researchers have been directed towards finding solutions to these issues. Several countries in Asia are facing urgent situations requiring immediate action to address environmental problems due to rapid urbanization, population growth, industrialization, depletion of natural resources, and environmental degradation. This situation has increased the importance of sustainability research and focused more attention on these issues. Another reason is government policies and incentives. Asian countries have developed policies and incentives to promote sustainable development. For example, China's "Green Development" strategy, 13th Five-Year Plan, and initiatives such as "Made in China 2025," India's "Smart Cities" initiative, and Japan's incentives for eco-friendly technologies have encouraged researchers to work on sustainability issues. These policies have contributed to the increase in academic and industrial research. China has significantly increased its research and development (R&D) capacity in recent years. Universities and research institutions provide more resources and support in the fields of sustainability and environmental science, encouraging more academics and researchers to work on sustainability issues. Chinese researchers are increasingly participating in international collaborations. These collaborations promote knowledge sharing in sustainability and the development of innovative solutions. International projects and partnerships increase the number and quality of research coming from China. The United Nations' Sustainable Development Goals (SDGs) adopted in 2015 have guided global research on sustainability. China is making intensive efforts to achieve these goals, which is reflected in academic research. In conclusion, the main reasons for the increase in sustainability research in Asian countries, particularly China, include rapid economic growth and industrialization, government policies and incentives, increased R&D capacity, international collaborations, global sustainability goals, and increased environmental awareness. These factors encourage researchers in this region to conduct intensive studies on sustainability.

III.II.VIII. Leading Universities in the Field

The universities contributing to the development of the field with at least 5 or more publications are shown in Table VI .

Table VI. Leading Universities in the Field

Universities	Publication No	Distribution
ISLAMIC AZAD UNIVERSITY	16	5.59%
UNIVERSITY OF TEHRAN	16	5.59%
SICHUAN UNIVERSITY	10	3.50%
UNIVERSITI TEKNOLOGI MALAYSIA	10	3.50%
UNIVERSITY OF SOUTHERN DENMARK	10	3.50%
NATIONAL INSTITUTE OF TECHNOLOGY NIT SYSTEM	9	3.15%
IRAN UNIVERSITY SCIENCE TECHNOLOGY	8	2.80%
NATIONAL KAOHSIUNG UNIVERSITY OF SCIENCE TECHNOLOGY	7	2.45%
XIAMEN UNIVERSITY	7	2.45%
INDIAN INSTITUTE OF TECHNOLOGY SYSTEM IIT SYSTEM	6	2.10%
LA SALLE UNIVERSITY	6	2.10%
UNIV DEF BELGRADE	6	2.10%
UNIVERSITY OF PADERBORN	6	2.10%
UNIVERSITY OF EAST SARAJEVO	5	1.75%
UNIVERSITY OF ELECTRONIC SCIENCE TECHNOLOGY OF CHINA	5	1.75%
UNIVERSITY OF WESTMINSTER	5	1.75%

Four of the universities in Table VI are located in China, three in Iran, and two in India. Economic growth and industrialization have increased in China and India over the past decade. This rapid growth, along with dense population and rapid urbanization, has led to environmental degradation and depletion of natural resources. Iran faces environmental pressures such as water scarcity, soil erosion, and air pollution due to industrialization and the energy sector. This situation has increased the number of environmental sustainability research. In conclusion, common reasons for the increase in sustainability research in China, India, and Iran include rapid economic growth and industrialization, the need to address environmental issues, government policies and incentives, increased R&D capacity, international collaborations, global sustainability goals, and high population density and urbanization. These factors encourage researchers in these countries to conduct intensive studies in the field of sustainability.

III.II.IX. Science Mapping

Science mapping is a method aimed at visualizing the structure, dynamics, and development of a specific research area through the analysis of scientific research and literature. This process systematically organizes scientific knowledge using various data

collection and analysis techniques and presents this information in the form of visual maps. These maps are used to understand the structural and conceptual framework of a particular topic, illustrate research relationships, uncover scientific communication networks, and develop research strategies

III.II.X. Citation Density Analysis

Citation density analysis is an important bibliometric method used to evaluate the impact and connections of scientific articles. This analysis helps determine which studies and researchers have the most impact by examining how often and by whom articles in a specific topic or research area are cited. It conducts impact assessments to identify which articles, authors, or journals have the most influence in a given field. It performs trend analysis to examine research trends in a particular field and their changes over time. It elucidates collaborations among researchers and the scientific impact of these collaborations. It helps identify studies that are widely acknowledged and frequently cited as foundational in the field. Citation density analysis is a critical method for understanding the impact and development of scientific research. It enables researchers, institutions, and policymakers to objectively assess the value and significance of scientific studies. Additionally, it can provide guidance for future research by identifying important studies and research gaps in a specific field.

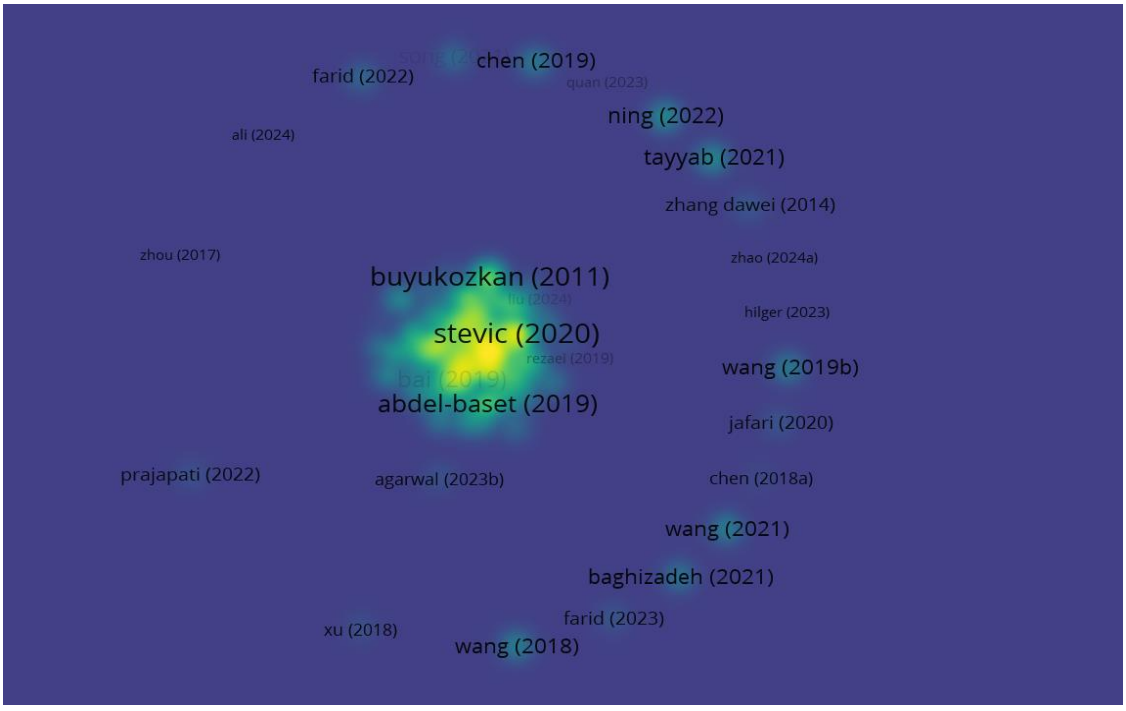

Figure IV. Citation Analysis Density Map

The visualization of the connections between the 302 articles examined in the analysis and the density map of the strongest citation connections identified by the VOSviewer algorithm among the 45 studies meeting the criterion of at least 100 citations are presented in Figure V. The most cited articles are detailed below:

Pamucar et al., 2024, developed a new Measurement and Ranking of Alternatives according to the Compromise Solution (MARCOS) method for sustainable supplier selection at a polyclinic in Bosnia and Herzegovina. The example describes how the MARCOS method can be used to select sustainable suppliers in the private healthcare sector. It involves ranking eight alternatives based on 21 criteria for all aspects of sustainability. The results of the new method and its validation are conducted through comprehensive sensitivity analysis. Twenty-one scenarios were created where the weight values of the criteria were changed, the measurement scale from 1 to 9 was changed to 1-5, comparisons were made with six other methods, and validated under dynamic conditions implying changes in the criteria. All stages of sensitivity analysis have demonstrated the validity of the MARCOS method.

Kannan et al., (2018) propose a framework for evaluating sustainable supplier selection using an integrated Analytic Hierarchy Process (AHP), ViseKriterijumska Optimizacija I Kompromisno Resenje (VIKOR), a multi-criteria optimization, and compromise solution approach. A supplier selection was made based on data from an automotive company in India. According to the findings, 'Environmental costs', 'Product quality', 'Product price', 'Occupational health and safety systems', and 'Environmental competencies' ranked among the top five criteria for sustainable supplier selection. Additionally, among the five sustainable supplier alternatives, the 'third' supplier ranked highest. The study presented in this article can assist managers and business professionals not only in distinguishing important supplier selection criteria but also in evaluating the most efficient supplier in the supply chain for sustainability while remaining competitive in the market.

Amindoust et al., 2012, identified sustainable supplier selection criteria and sub-criteria, and proposed a methodology for evaluating and ranking a specific supplier group based on these criteria and sub-criteria. Fuzzy logic was applied to address the subjectivity of decision-makers' evaluations, and a new ranking method based on fuzzy inference systems (FIS) for supplier selection problems was proposed. Finally, an illustrative example was used to demonstrate the applicability of the proposed method.

Büyüközkan and Çiftçi, 2011, examine the problem of determining an effective model based on sustainability principles for supplier selection operations in supply chains. The approach should also take into account time pressure, lack of expertise in the relevant field, etc., that decision-makers may encounter during the evaluation process. The article develops a new approach based on a fuzzy analytic network process under incomplete preference relations within a multi-person decision-making scheme. The method not only enables adequate evaluations using the provided preference information but also maintains the consistency level of the evaluations. Finally, the article analyzes the sustainability of some suppliers in a real-life problem to demonstrate the validity of the proposed evaluation model.

In conclusion, supplier selection based on sustainability principles is an important strategic tool for businesses to fulfill their environmental, social, and economic responsibilities. This selection not only ensures legal compliance and cost savings but also enhances brand reputation and establishes a solid foundation for long-term business success. Therefore, sustainable supplier selection has become an indispensable practice for modern businesses.

III.II.XI. Co-citation Analysis

Co-citation analysis is a bibliometric analysis method used to examine relationships and connections in scientific literature. This analysis identifies whether two or more studies cite the same third study, thereby revealing the relationship between these studies and common areas of interest. Co-citation analysis is a useful tool not only for discovering related or interconnected publications but also for determining thematic clusters (Donthu et al., 2021). It helps identify common themes, concepts, or theories, uncover connections between researchers or research groups, understand trends and their evolution over time, and identify pioneering and influential studies. Thus, it promotes scientific communication and collaboration.

Figure V shows the density map related to co-citation analysis. Four different clustering patterns are identified based on co-citations.

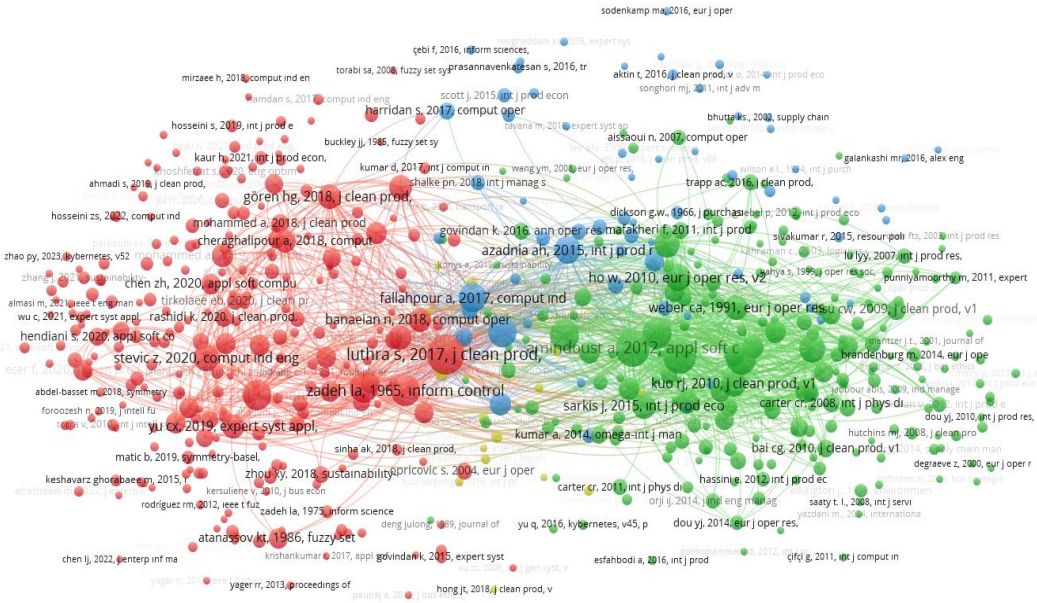

Figure V. Connection Map for Co-Citation Analysis

IV. CONCLUSION AND RECOMMENDATIONS

Sustainable supplier selection is crucial for businesses' long-term success and societal responsibilities, impacting environmental, social, and economic dimensions. This process involves a diverse set of evaluation criteria, from resource preservation and carbon footprint reduction for environmental impact, to cost savings, efficiency, and risk management for economic benefits. Socially, it includes criteria such as ethical practices, employee rights, and safety, all of which collectively support brand reputation and competitive advantage. Moreover, compliance with international standards (e.g., ISO 14001 and ISO 45001) further strengthens a business's position in global markets by enhancing consumer trust and fulfilling regulatory expectations.

While sustainable supplier selection supports businesses in achieving their economic and social goals, it also presents notable challenges. Balancing multiple, often conflicting criteria (environmental, social, and economic) can complicate the decision-making process. For instance, the most environmentally sustainable supplier may not meet economic viability requirements. Additionally, the process can be resource-intensive, requiring robust data collection and analysis, which may not always yield reliable and up-to-date information. Furthermore, as sustainability criteria evolve, businesses may struggle to keep pace with

emerging standards and technologies, creating a need for constant adaptation and reassessment.

This study provides a bibliometric analysis of sustainable supplier selection research, analyzing key publications, authors, journals, and trends in the field. The findings offer insights into the development and focus areas of the literature, with notable contributions identified from prolific authors and leading countries.

Limitations and Future Research Directions:

The study is limited by its reliance on the WoS database, excluding other major databases like Scopus, Google Scholar, and Microsoft Academic. Including these sources in future research could expand the literature scope, enabling a more comprehensive analysis. Additionally, this study focuses only on English publications, potentially overlooking significant contributions in other languages. Future research could address this by incorporating non-English sources for a broader, more diverse perspective.

By recognizing these limitations and exploring additional databases and languages, future studies can build a more detailed understanding of sustainable supplier selection, offering insights that support both academic and practical advancements in the field.In the literature review, selection criteria to be considered while making supplier selection within the scope of sustainability have been determined. Drawing on studies conducted on selection criteria, Coskun, Yıldız, and Bayraktar (2022) ranked the factors they obtained environmentally, economically, and socially, and listed these criteria in Table VII.

Table VII. Selection Criteria for Sustainable Supplier Selection

S	A. ENVIRONMENTAL CRITERIA	STUDIES DONE
1	Waste Management	Govindan vd. (2013); Azadnia vd. (2012); Amindoust vd. (2012)
2	Environmental Protection Policies	Awasthi vd. (2010)
3	Environmental Management System	Çiçek vd. (2020); Bai & Sarkis (2010); Dou & Sarkis (2010)
4	Emissions	Amindoust vd. (2012)
5	Energy consumption	Gold & Awasthi (2015)
6	Recycling Activities	Memari vd. (2019); Su vd. (2016)
7	Resource Consumption	Çiçek vd. (2020); Govindan vd. (2013);Bai & Sarkis, (2010)
8	Pollution Prevention Measures	Govindan vd. (2019); Bai & Sarkis (2010)
9	Pollution Control	Govindan vd. (2019); Dou & Sarkis (2010)
10	Certification	Fallahpour vd. (2017); Su vd. (2016)
11	Participation in Green Activities	Amindoust vd. (2012)
12	Green Transportation and Distribution Strategies	Colicchia vd. (2013)
13	Green Supply Chain	Azadnia vd. (2013); Amindoust vd. (2012)
S	**A. ECONOMIC CRITERIAS**	**STUDIES DONE**
1	Price	Awasthi vd.(2018);Luthra vd. (2017); Amindoust vd. (2012)
2	Company Infrastructure	Yayla vd. (2015)
3	Profitability	Govindan vd. (2019)
4	Environmental Costs	Ahi & Searcy (2015)
5	Market share	Govindan vd. (2019); Ahi & Searcy (2015)
6	Operational Costs	Govindan vd. (2019);Arabsheybani vd. (2018)
7	Service Skill	Chang vd. (2011); Dou & Sarkis (2010)
8	Service Performance	Memari vd. (2019); Luthra vd. (2017)
9	Communication and Information Technology	Govindan vd. (2019); Liu & Wang (2009)
10	Quality	Memari vd. (2019); Amindoust vd. (2012); Bai & Sarkis (2010)
11	Delivery time	Fallahpour vd. (2017); Govindan vd. (2013); Chen vd. (2010)
12	Customer happiness	Ahi & Searcy (2015)
13	Strategic Alignment	Dou & Sarkis (2010)
14	Risk Sharing	Tavana vd. (2016)
15	Product / Service Quality	Govindan vd. (2019)
16	Supply Cost	Govindan vd. (2019); Memari vd. (2019); Ghadimi & Heavey (2014)
18	Technology Expertise/Capacity	Bai & Sarkis (2010); Aktas vd. (2011)
19	Reverse Logistics Investments	Aguezzoul (2014)

The total of 18 economic, 13 environmental, and 12 social criteria have been identified. These criteria are significant in achieving sustainability goals, minimizing environmental impacts, fulfilling social responsibilities, and generating long-term economic

benefits. Each criterion should be selected and evaluated to contribute to the environmental, social, and economic sustainability of your supply chain. This will provide guidance to business professionals and academics aiming to conduct Sustainable Supplier Selection.

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ÇEVRESEL, SOSYAL VE YÖNETİŞİM (ESG) PERFORMANSININ SERMAYE YAPISI ÜZERİNDEKİ ETKİSİ: BRICS-T ÜLKELERİ ÜZERİNE BİR İNCELEME

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Öz

İşletmelerin çevresel, sosyal ve yönetişim (ESG) alanlarında göstermiş olduğu performans başta yatırımcılar olmak üzere diğer tüm paydaşları etkilemekte ve bunun sonucu olarak işletmelerin finansal yapıları bu durumdan etkilenmektedir. Çevresel, sosyal ve yönetişim (ESG) performanslarının ölçümü işletmeler için önem arz etmektedir. Bu noktadan hareketle bu çalışmanın amacı ESG performansının sermaye yapısı üzerindeki etkilerini incelemektir. Bu amaç doğrultusunda, BRICS-T ülkelerinde (Brezilya, Rusya, Hindistan, Çin Halk Cumhuriyeti, Güney Afrika ve Türkiye) finansal sektör dışında faaliyet gösteren firmaların 2014-2021 yılları arası verileri dikkate alınmış ve toplam 6230 firma-yıl gözlemi üzerinden panel veri analizi yapılmıştır. Çalışma sonucunda çevresel performans skoru, sosyal performans skoru ve ESG skorunun uzun vadeli borç oranını negatif yönde ve istatistiksel olarak anlamlı şekilde etkiledikleri sonucuna ulaşılmıştır. Ancak, yönetişim performans skorunun uzun vadeli borç oranı üzerinde istatistiksel olarak anlamlı etkisinin olmadığı görülmüştür.

Anahtar Kelimeler: Kurumsal Sürdürülebilirlik, ESG Performansı, Sermaye Yapısı, Kurumsal Sosyal Sorumluluk

Jel Sınıflandırması: M10, M14, G32

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THE IMPACT OF ENVIRONMENTAL, SOCIAL AND GOVERNANCE (ESG) PERFORMANCE ON CAPITAL STRUCTURE: A STUDY ON BRICS-T COUNTRIES

Abstract

The performance of businesses in environmental, social and governance (ESG) areas affects all other stakeholders, especially investors, and as a result, the financial structures of businesses are affected by this situation. Measurement of environmental, social and governance (ESG) performance is important for businesses. From this point of view, the purpose of this study is to examine the effects of environmental, social and governance performance on capital structure. For this purpose, the data of firms operating outside the financial sector in BRICS-T countries (Brazil, Russia, India, the People's Republic of China, South Africa and Turkey) between 2014 and 2021 are taken into account and a panel data analysis is conducted on a total of 6230 firm-year observations. As a result of the study, it is concluded that environmental performance score, social performance score and ESG score have a negative and statistically significant effect on long-term debtratio. However, the governance performance score has no statistically significant effect on long-term debtratio.

Keywords: Corporate Sustainability, ESG Performance, Capital Structure, Corporate Social Responsibility

Jel Classification: M10, M14, G32

ArticleType: Research Article

I. GİRİŞ

Yaşamakta olduğumuzgezegenin sürdürülebilirliği konusunda ortaya çıkan tehditler ve toplumsal alanlarda yaşanan düzensizlikler, paydaşların şirketlerden olan beklentilerinin kapsamını genişletmiştir. Şirketlerin yürütmüş olduğu faaliyetler sonucunda yalnızca hissedarlarına değil, aynı zamanda ilişki içerisinde bulunduğu tüm paydaşlarına karşı sorumlu olduğu ve yürütülen faaliyetlerinde bu hususun dikkate alarak yürütülmesi gerekliliğini ortaya koyan paydaş yaklaşımı kurumsal sürdürülebilirlik (KS) kavramına temel oluşturmaktadır.

Sürdürülebilirlik kavramının kökleri incelendiğinde, bu kavramın daha geniş sürdürülebilir kalkınma kavramına dayandığı ifade edilebilir (IFAC, 2011). Sürdürülebilir kalkınmaya ilişkin literatürde pek çok tanım yer almasına rağmen en iyi tanımlardan birisine Birleşmiş Milletler Dünya Çevre ve Kalkınma Komisyonu tarafından 1987 yılında yayınlanan Brundtland raporunda yer verildiği ifade edilebilir. Bu raporda sürdürülebilir kalkınma "*gelecek nesillerin kendi ihtiyaçlarını karşılama yeteneğinden ödün vermeden mevcut nesillerin ihtiyaçlarını karşılayan kalkınma"* olarak tanımlanmaktadır (Brundtland, 1987). Kurumsal sürdürülebilirlik ise *"bir şirketin doğrudan ve dolaylı paydaşlarının (hissedarlar, çalışanlar, müşteriler, baskı grupları, topluluklar gibi) ihtiyaçlarını, gelecekteki paydaşlarının da ihtiyaçlarını karşılama kabiliyetinden ödün vermeden karşılaması"* olarak tanımlanmaktadır (Dyllick&Hockerts, 2002).

Kurumsal sürdürülebilirliğin yanı sıra değinilmesi gereken bir diğer kavramda kurumsal sosyal sorumluluk (KSS) kavramıdır. Kurumsal sürdürülebilirlik ve kurumsal sosyal sorumluluk kavramlarının literatürde her ne kadar birbirlerinin yerine sıklıkla kullanıldığı ve birbirine yakın anlama sahip olduğu görülse de bu iki kavram tam olarak aynı anlama gelmez. Kurumsal sosyal sorumluluk genellikle bir şirketin finansal olmayan toplumsal faaliyetleri üzerine odaklanırken, kurumsal sürdürülebilirlik ise hem çevresel faktörlerin şirket üzerindeki etkisine hem de şirketin çevre üzerindeki etkisine odaklanmaktadır (Pirnea ve ark., 2011). Bu yönüyle KSS'nin şirketin toplum, çevre ve paydaşlara karşı sorumluluklarını ortaya koyan kurumsal vatandaşlık davranışını tanımlamada kullanılan bir kavram olduğu ifade edilebilir.

İşletmelerin faaliyetlerini yürütürken çevresel ve sosyal alanlara ilişkin hangi tür uygulamaları benimsediği ve bununla birlikte iyi bir kurumsal yönetim yapısına sahip olma durumu kurumsal sürdürülebilirlik açısından önem arz etmektedir. Bu noktada işletmelerin

faaliyet raporu, entegre rapor veya sürdürülebilirlik raporları gibi finansal bilginin yanı sıra finansal olmayan bilgileri de içeren bu raporlar aracılığıyla yatırımcılar başta olmak üzere tüm paydaşlara işletme faaliyetlerinin sürdürülebilirliği konusunda bilgiler sunmaktadırlar. İşletmelerin çevresel, sosyal ve yönetişim (ESG) kapsamında açıklamış oldukları bilgilerin işletme yönetimi ile yatırımcılar arasındaki bilgi asimetrisini azaltacağı ifade edilebilir. ESG açıklamalarının bilgi asimetrisi üzerindeki etkisini inceleyen çeşitli ampirik çalışmaların sonuçları incelendiğinde, ESG açıklamalarının bilgi asimetrisini azalttığına yönelik sonuçlara ulaşan çalışmaların olduğu görülmektedir (Bilyay-Erdogan, 2022; Nguyen ve ark., 2019; Siew ve ark., 2016). Bilgi asimetrisinin azalması yatırımcı ve kreditörlerin, söz konusu işletme faaliyetlerinin sürdürülebilirliğine ve risk düzeyine ilişkin bir öngörüde bulunmasına katkı sağlamakta ve bu da tarafların talep edecekleri faiz veya getiri oranlarını etkilemek suretiyle sermaye yapısı kararlarının şekillenmesinde önemli rol oynamaktadır. ESG açıklamalarının bilgi asimetrisi ve öz kaynak maliyeti üzerindeki negatif yönlü etkisinden dolayı, ESG performansı yüksek olan firmaların, diğer firmalarla kıyaslandığında, öz kaynak ihracı konusunda daha fazla maliyet avantajına sahip olacağı ve bu sayede de kaldıraç oranlarının daha düşük olacağı ifade edilebilir (Pijourlet, 2013).

Bu çalışmada ESG performansının firmanın sermaye yapısı üzerindeki etkileri incelenecektir. Gelişmekte olan ülkelerin, gelişmiş ülkelerle kıyaslandığında, çevresel ve sosyal konularda daha az paydaş baskısına sahip olması ve bu grupta yer alan ülkelerin gelir seviyesinin göreceli olarak daha düşük olması gibi özelliklerine bağlı olarak, gelişmekte olan ülkelerde faaliyet gösteren firmaların kurumsal sosyal sorumluluk ve sürdürülebilir iş uygulamaları üzerine daha az odaklanacağı düşünülebilir (Doh ve ark., 2015). Bu bakış açısıyla, ESG performansının sermaye yapısı üzerindeki etkisini inceleyen literatürde, gelişmiş ülkeler veya belirli bir ülke örneklemine odaklanan çalışmaların yanı sıra, gelişmekte olan ülkelerdeki durumu ele alan çalışmaların yapılmasının literatüre değerli bir katkı sunacağı belirtilebilir. Literatür incelendiğinde gelişmekte olan birden fazla ülkeyi ele alan çeşitli çalışmaların (Adeneye ve ark., 2023; Ndebele, 2020; Pijourlet, 2013) yürütüldüğü görülmekle birlikte, gelişmekte olan ülke gruplarını ele alan çalışma sayısının nispeten sınırlı kaldığı görülmektedir. Bu durumdan hareketle, bu çalışmada gelişmekte olan ülke piyasalarını temsilen BRICS-Tülkelerinde (Brezilya, Rusya, Hindistan, Çin, Güney Afrika ve Türkiye) finansal sektör dışında faaliyet gösteren firmaların 2014-2021 yılları arası verileri örneklem olarak alınmış ve toplam 6.230 firma-yıl gözlemi üzerinden panel veri analizi gerçekleştirilmiştir. Gerçekleştirilen analizler sonucunda çevresel performans, sosyal

performans ve ESG toplam skorunun sermaye yapısını temsilen kullanılan değişken olan uzun vadeli borç oranını istatistiksel olarak anlamlı ve negatif yönde etkilediği sonucuna ulaşılırken, yönetişim performans skorunun sermaye yapısı üzerindeki etkisi istatistiksel olarak anlamlı bulunmamıştır.

II. KAVRAMSAL ÇERÇEVE

Günümüzde dünyanın karşı karşıya kalmış olduğu küresel ısınma, biyolojik çeşitlilik kaybı, kaynakların hızla tükenmesi, çevre kirliliği, açlık, yoksulluk, ayrımcılık, insan hakları ihlalleri ve yolsuzluk gibi sorunlar, otoriteleri ve iş dünyasını sürdürülebilirlik esasına dayanan yeni bir sistem arayışına doğru yöneltmiştir (Borsa İstanbul, 2014:1). Bu kapsamda yatırımcılar, devlet, toplum gibi firma faaliyetlerinden etkilenen geniş bir paydaş grubunun firmalardan olan beklentileri artmış ve bunun sonucu olarak, firmanın faaliyetleri sonucunda sadece finansal alanda değil, bunun yanı sıra çevresel, sosyal ve kurumsal yönetim alanlarında da nasıl bir strateji izlediği önem kazanmıştır.

Kurumsal sürdürülebilirlik uygulamaları incelendiğinde, bu uygulamaların *çevresel, sosyal* ve *yönetişim* olmak üzere 3 temel boyuttan meydana gelen faaliyetleri kapsadığı görülmektedir (Özer ve ark., 2023).

Çevresel boyut; şirket kaynaklarının verimli bir şekilde kullanılarak kaynak tüketiminin minimuma indirilmesi, karbon salınımının ve atıkların azaltılması, ekosistemdeki biyoçeşitliliğin korunması, hava, çevre ve su kirliliğinin azaltılması, çevre dostu üretim teknolojisi altyapısının kurulması gibi alanlarda yürütülen uygulamaları içermektedir.

Sosyal boyut; bir şirketin toplumla olan ilişkisini inşa etmek ve topluma daha fazla katkıda bulunmak için yürüttüğü tüm operasyon ve faaliyetlerin bir kombinasyonunu ifade ederken (Naeem, 2021:13); aynı zamanda, bir şirketin işgücü uygulamaları, insan hakları ve topluluk katılımı gibi konularda toplum nezdindeki etkisini de temsil etmektedir (Yıldız, 2023).

Yönetişim boyutu; bir şirketin yönetim kurulu çeşitliliği ve bağımsızlığı, azınlık ve paydaş haklarının korunması, şeffaflık ve hesap verebilirlik ilkelerine uygun davranma, etik olmayan yönetim uygulamalarından kaçınma gibi kurumsal yönetim uygulamalarını içermektedir.

ESG, işletmenin faaliyetlerini sürdürürken, tüketilen kaynakların çevreye vermiş olduğu zararlara ilişkin ne ölçüde önlemler alındığı, daha az materyal, enerji ve su tüketimi

yapabilmek amacıyla hangi üretim teknolojilerinin kullanıldığı, işgücünün tatmini ve refahı için hangi uygulamaların benimsendiği, topluma karşı olan sorumlulukların bilincinde olarak hangi faaliyetlerde bulunulduğu ve paydaş menfaatinin korunması için hangi faaliyetlerde bulunulduğu gibi hususları bütüncül bir şekilde ifade etmekte kullanılan bir kavram olarak karşımıza çıkmaktadır.

III. LİTERATÜR TARAMASI VE HİPOTEZ GELİŞTİRME

Kurumsal sosyal sorumluluğun sermaye yapısı üzerindeki etkisini inceleyen çalışmalar incelendiğinde, konunun genellikle firma riski ve bilgi asimetrisi kavramlarıyla ilişkilendirilerek ele alındığı (Yang ve ark., 2018) ve temsil, paydaş ve bilgi asimetrisi teorilerine sıklıkla atıfta bulunulduğu görülmektedir.

Bilgi asimetrisi, şirket yönetimi ile yönetim dışında kalan paydaşlar arasındaki bilgi farkını ifade etmek amacıyla sıklıkla kullanılan bir kavramdır. Şirketin yıllık faaliyet raporu, entegre rapor veya sürdürülebilirlik raporları aracılığıyla yapmış olduğu ESG kapsamındaki açıklamaların yönetim ile paydaşlar arasındaki bilgi dengesizliğini azaltacağından, yatırımcıların şirketi daha az riskli görmelerine yol açacağı düşünülebilir. Bu yönüyle, şirketler, KSS bilgisini, rutin olarak yayınlamış olduğu finansal bilgilerin yanı sıra, paydaşları ile arasındaki bilgi asimetrisini azaltmak ve yatırımcılar ve diğer paydaşlar karşısında olumlu bir imaj yaratabilmek amacıyla kullanabilirler (Benlemlih, 2017b). Dolayısıyla, işletmelerin ESG kapsamında yapmış olduğu açıklamaların bilgi asimetrisiyle birlikte firma riski üzerinde etkisi vardır ve bu durum firmanın sermaye maliyetini değiştirerek, sermaye yapısı kararlarının şekillenmesinde önemli rol oynamaktadır.

Şirket yönetiminin hissedar değerini maksimize etme amacının yanı sıra, şirketin ilişki içerisinde bulunduğu tüm paydaşların (çalışanlar, müşteriler, otoriteler, toplum vs.) çıkarlarını gözetmesi gerektiğini öne süren (Mahmood ve ark., 2023)*paydaş teorisine* göre, şirketin KSS performansının yüksek olması şirketin ün ve itibarının iyileşmesine yönelik katkı sağlayarak uzun vadede firma değerini olumlu yönde etkiler (Sheikh, 2019).

Jensen&Meckling (1976) tarafından geliştirilen *temsil teorisine* göre ise yöneticiler bireysel prestijlerini artırmak amacıyla şirketin sınırlı kaynaklarını bu alana yönelttiklerini ve bu amaçla KSS faaliyetlerine aşırı yatırım yaptıklarını ileri sürmekte ve bu yönüyle KSS yatırımlarını bir temsil problemi olarak görmektedirler (Benlemlih & Cai, 2020; Benlemlih, 2017a; Sheikh, 2019).

Literatür incelendiğinde, KSS ölçümünde ESG skorlarını kullanan çalışmalara rastlanıldığı gibi (Benlemlih, 2017a; Hamrouni ve ark., 2019; Harjoto, 2017; Ho ve ark., 2022; Mansour & Sayed, 2022; Sheikh, 2019); KSS değişkenini firmaların yayınladıkları yıllık rapor veya sürdürülebilirlik raporlarını kullanarak içerik analizi yöntemi ile indeks oluşturmak suretiyle ölçen çalışmaların da bulunduğu görülmektedir (Grabinska ve ark., 2021; Oware & Mallikarjunappa, 2021).

KSS performansının sermaye yapısı üzerindeki etkisini gelişmiş veya gelişmekte olan pek çok ülke piyasasında araştıran ampirik çalışmaların bulguları incelendiğinde, bu çalışmaların çoğunda KSS ile sermaye yapısı arasında negatif yönde bir ilişkinin olduğu sonucuna ulaşıldığı görülmektedir. Örneğin; Pijourlet (2013), dünya genelinde faaliyet gösteren 1.579 firmayı ele alarak yapmış olduğu ve maddi olmayan duran varlık değerlemesi, sosyal puan ve çevresel puanın borçlanma oranı üzerindeki etkilerini incelediği çalışmasında maddi olmayan duran varlık değerlemesinin ve sosyal puanın borçlanma oranı üzerindeki etkilerinin negatif yönde olduğu sonucuna ulaşırken, çevresel puanın borçlanma oranı üzerindeki etkisinin ise istatistiksel olarak anlamlı olmadığını bulmuştur. Lindkvist&Saric (2020); Avrupa Birliği içerisinde faaliyet gösteren firmaların ESG skorlarının sermaye yapıları üzerindeki etkilerini 913 firma-yıl gözlemi üzerinden inceledikleri çalışmalarında, yönetişim skorunun borçlanma oranını pozitif yönde etkilediği sonucuna ulaşılırken, toplam ESG, çevresel ve sosyal skorun ise borçlanma oranı üzerindeki etkilerinin ise istatistiksel olarak anlamlı olmadığını bulmuşlardır.

Ho ve arkadaşları (2022); KSS'nin borçlanma oranı üzerindeki etkisini Çin Halk Cumhuriyeti'nde faaliyet gösteren 5.969 firma-yıl gözlemi üzerinden inceledikleri çalışmalarında, KSS'nin borçlanma oranını negatif yönde etkilediği sonucuna ulaşmışlardır. Mahmood ve arkadaşları (2023); kurumsal yönetimin borçlanma oranı üzerindeki etkisini ve kurumsal sosyal sorumluluğun bu ilişkideki düzenleyici rolünü Çin'de faaliyet gösteren 1.987 firmanın yanı sıra, Amerika Birleşik Devletleri'nde faaliyet gösteren 6.640 firmanın 2001-2019 yılları arasındaki verileri kullanarak karşılaştırmalı olarak incelemişlerdir. Çalışma sonucunda kurumsal sosyal sorumluluk ve kurumsal yönetimin hem Çin hem de ABD firmalarının borçlanma oranlarını negatif bir şekilde etkilediği sonucuna ulaşmışlardır. Çalışmada ayrıca, kurumsal sosyal sorumluluğun kurumsal yönetim ile borçlanma oranı arasındaki ilişkide ılımlaştırıcı rolünün negatif yönde olduğu ortaya konmuştur. KSS'ninılımlaştırıcı rolü yalnızca düşük kaldıraçlı firmalar için anlamlı bulunurken, yüksek kaldıraçlı firmalarda anlamlı olmadığı sonucuna ulaşılmıştır.

Dünya genelindeki ülkeleri ve Çin Halk Cumhuriyeti'ni örneklem olarak ele alan ve yukarıda ifade edilen çalışmaların yanı sıra; ABD'deki firmaları örneklem olarak alan çalışmaların sonucunda da KSS ile sermaye yapısı arasında negatif yönlü bir ilişkinin olduğu sonucuna ulaşan çalışmaların da olduğu ifade edilebilir. Örneğin; KSS'nin sosyal boyutu içerisinde yer alan unsurlardan biri olan çalışan refahının kaldıraç oranı üzerindeki etkisini ABD'de faaliyet gösteren firmalar üzerinden inceleyen çeşitli çalışma sonuçlarına göre çalışan faydasına ilişkin uygulamalar yürüten firmaların daha düşük borç oranlarıyla çalıştıkları ve böylece iflas olasılığını önemli ölçüde azalttıkları sonucuna ulaştıkları görülmektedir (Bae ve ark., 2011; Verwijmeren & Derwall, 2010). Benlemlih&Cai (2020) çalışmasında, çevresel performansın borçlanma oranı üzerindeki etkisini ABD bağlamında incelemişler ve çalışma sonucunda üstün çevresel performansa sahip firmaların daha düşük borç oranlarıyla faaliyet gösterdikleri ve geçici finansal ihtiyaçları için çoğunlukla kısa dönemli borçlanmayı tercih ettikleri sonucuna ulaşmışlardır. Bunun yanı sıra, ESG açıklamalarının borçlanma oranı üzerindeki etkisini ABD bağlamında inceleyen çalışma sonuçlarına bakıldığında da, benzer bir şekilde, ESG'nin kaldıraç oranını negatif yönde etkilediğine dair sonuçlara ulaşıldığı görülmektedir (Benlemlih, 2017a; Harjoto, 2017; Sheikh, 2019).

Çin ve ABD dışında kalan ve özel olarak tek bir ülkenin örneklem olarak alındığı çalışmaların sonuçları incelendiğinde, KSS'nin sermaye yapısı üzerindeki etkisinin negatif yönde olduğunu gösteren çalışmaların bulunduğu görülmektedir. Örneğin; Mansour&Sayed (2022); KSS ile borçlanma oranı arasındaki ilişkiyi ve muhasebe ihtiyatlılığının bu ilişkide ılımlaştırıcı bir etkiye sahip olup olmadığını Mısır'da faaliyet gösteren 120 firmanın 2012-2019 yılları arası verileri üzerinde incelemişler ve çalışma sonucunda KSS ile borçlanma oranı arasında istatistiksel olarak anlamlı ve negatif yönde bir ilişki bulmuşlar ayrıca, KSS'nin borçlanma oranı üzerindeki negatif etkisinin ihtiyatlılığı yüksek olan firmalarda daha belirgin olduğu sonucuna ulaşmışlardır. Minh ve arkadaşları (2022); KSS'nin sermaye yapısı üzerindeki etkisini ve pazar rekabetinin ılımlaştırıcı etkisini Vietnam'da faaliyet gösteren firmaların 2011-2014 yılları arası verileri üzerinde inceledikleri ve kantil regresyon yaklaşımını kullanmış oldukları çalışma sonucunda, kurumsal sosyal sorumluluk faaliyetlerine katılımın firma kaldıracı üzerinde daha yüksek dilimlerde negatif ve anlamlı etkiye sahip olduğu, daha düşük dilimlerde ise hiçbir etkisinin olmadığı sonucuna ulaşmışlardır.

KSS'nin sermaye yapısını negatif yönde etkilediğine dair sonuçlara ulaşan çalışmaların yanı sıra, pozitif yönde etkisi olduğuna dair sonuçlara ulaşan çalışmalar da mevcuttur. Hamrouni ve arkadaşları (2019); ESG açıklamalarının kaldıraç oranları üzerindeki etkisini Fransa'da faaliyet gösteren 80 firmanın verileri üzerinde incelemiş oldukları çalışma sonucunda, sosyal skorun hem toplam borç oranını hem de uzun vadeli borç oranını pozitif yönde etkilediği sonucuna ulaşılırken, yönetişim skorunun ise uzun vadeli borç oranını pozitif yönde etkilediği sonucuna ulaşılmıştır. Grabinska ve arkadaşları (2021) ise; KSS'nin çalışan, sosyal ve çevresel boyutlarının kaldıraç oranı üzerindeki etkisini Polonya'da yüksek teknoloji sektöründe faaliyet gösteren firmaları örneklem alarak incelemişler ve çalışma sonucunda KSS'nin çalışan boyutunun firma kaldıracını pozitif yönde etkilediği sonucuna ulaşılırken, çevresel ve sosyal boyutun firma kaldıracı üzerindeki etkisinin istatistiksel olarak anlamsız olduğu sonucuna ulaşmışlardır.

Literatürdeki çalışmaların sonuçlarından yola çıkarak, bu çalışmanın hipotezleri aşağıdaki şekilde belirlenmiştir.

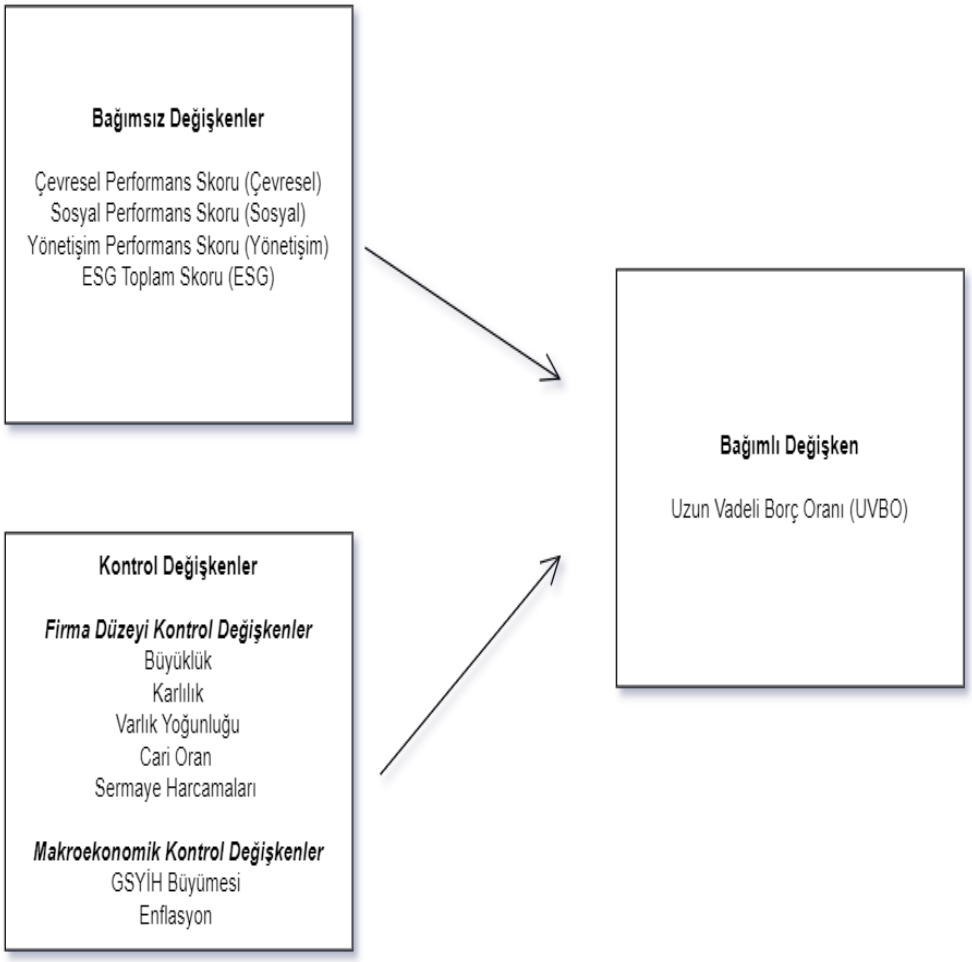
H_1: Çevresel performans skoru ile uzun vadeli borç oranı arasında negatif ilişki vardır.

H_2: Sosyal performans skoru ile uzun vadeli borç oranı arasında negatif ilişki vardır.

H_3: Yönetişim performans skoru ile uzun vadeli borç oranı arasında negatif ilişki vardır.

H_4: ESG skoru ile uzun vadeli borç oranı arasında negatif ilişki vardır.

Çalışmanın teorik modeli Figür I'de yer almaktadır.



Figür I. Teorik Model

IV. ARAŞTIRMANIN METODOLOJİSİ

IV.I. Örneklem

ESG performansının sermaye yapısı üzerindeki etkisinin incelendiği bu çalışmada gelişmekte olan ülke piyasalarını temsilen *BRICS-T ülkelerinde (Brezilya, Rusya, Hindistan, Çin, Güney Afrika veTürkiye)* finansal sektör dışında faaliyet gösteren firmaların 2014-2021 yılları arası verileri örneklem olarak alınmış ve 6.230 firma-yıl gözlem üzerinden analizler gerçekleştirilmiştir. Analizlerde kullanılacak verilerin toplanmış olduğu 2023 yılı içerisinde, örneklemde yer alan bazı ülkelerdeki firmalara ait (Rusya ve Türkiye vb.) ESG skorlarının 2022 ve 2023 yılı verileri yayınlanmadığı için, ülke-yıl gözlemleri arasında denge gözetilmesi açısından çalışmanın gözlem yılı olarak 2014-2021 yılları belirlenmiştir.

IV.II. Değişken Listesi

Bu çalışmada bağımsız değişken olarak kullanılan çevresel, sosyal, yönetişim (ESG) skorları RefinitivEikon veri tabanından elde edilmiştir. ESG skoru hesaplama metodolojisi ele alındığında, ESG skor puanları toplam 10 kategori skorunun hesaplanması ile bulunmaktadır. ESG boyut puanlarının hesaplanabilmesi için gerekli olan kategoriler ve her bir kategoriye ilişkin gösterge sayıları Tablo I'de yer almaktadır.

Tablo I. ESG Boyutları ve Kategori Tanımları

ESG Boyutu	Kategori	Gösterge Sayısı
Çevresel Boyut	Kaynak Kullanımı	20
	Emisyonlar	28
	Yenilik	20
Sosyal Boyut	İşgücü	30
	İnsan Hakları	8
	Toplum	14
	Ürün Sorumluluğu	10
Yönetişim Boyutu	Yönetim	35
	Hissedarlar	12
	Kurumsal Sosyal Sorumluluk Stratejisi	9
Toplam		**186**

Kaynak: (Refinitiv Eikon, 2021)

Bu çalışmadaki bağımsız değişkenler ve firma düzeyindeki finansal değişkeler RefinitivEikon veri tabanından elde edilirken, makroekonomik kontrol değişkenler ise Dünya Bankası veri tabanından elde edilmiştir. Bu çalışmada kullanılan bağımlı, bağımsız ve kontrol değişkenlerinin tanımlarına ilişkin bilgiler Tablo II'de yer almaktadır.

Tablo II. Değişken Tanımları

Değişkenler	Değişken Tanımları	Kaynak
Bağımlı Değişken		
Uzun Vadeli Borç Oranı (UVBO)	Uzun Vadeli Yabancı Kaynak Toplamı / Toplam Varlıklar	RefinitivEikon
Bağımsız Değişkenler		
Çevresel	Çevresel Performans Skoru	RefinitivEikon
Sosyal	Sosyal Performans Skoru	RefinitivEikon
Yönetişim	Yönetişim Performans Skoru	RefinitivEikon
ESG	ESG Toplam Skoru	RefinitivEikon
Kontrol Değişkenler		
Firma Düzeyi Kontrol Değişkenler		
Büyüklük	Toplam Varlıkların Doğal Logaritması	RefinitivEikon
Karlılık	Dönem Net Kârı / Toplam Varlıklar	RefinitivEikon
Varlık Yoğunluğu	Maddi Duran Varlıklar / Toplam Varlıklar	RefinitivEikon
Cari Oran	Dönen Varlıklar / KVYK	RefinitivEikon
Sermaye Harcamaları	Sermaye Harcamaları / Toplam Varlıklar	RefinitivEikon
Makroekonomik Kontrol Değişkenler		
GSYİH Büyümesi	Gayrisafi Yurtiçi Hâsılanın Yıllık Büyüme Oranı	Dünya Bankası
Enflasyon	Tüketici Fiyatları Endeksindeki Yıllık Büyüme Oranı	Dünya Bankası

IV.III. Araştırma Bulguları

Araştırma modelindeki değişkenlere ait tanımlayıcı istatistikler Tablo III'te sunulmaktadır. Veri setinde yer alan aşırı uç değerleri (outliers)diğer değerlerle uyumlu hale getirip veri dağılımı normal dağılıma yaklaştırmak ve uç değerlerin istatistiksel analiz üzerindeki etkisini azaltmak amacıyla bağımlı değişken ile firma düzeyindeki bağımsız ve kontrol değişkenler %5 ve %95 aralığında törpüleme (winsorize) işlemine tâbi tutulmuştur. Söz konusu törpüleme işleminin literatürde yer alan çeşitli çalışmalarda kullanıldığı görülmektedir (Ateş, 2021; Özer ve ark., 2024).

Tablo III. Tanımlayıcı İstatistikler

Değişken	Gözlem	Ortalama	St. Sapma	Minimum	Maksimum
UVBO	6230	0.17	0.15	-0.00	0.50
Çevresel	6230	35.41	24.59	0.00	80.19
Sosyal	6230	38.06	23.92	5.54	82.54
Yönetişim	6230	50.01	20.24	15.49	82.62
ESG	6230	41.09	18.68	12.81	75.80
Büyüklük	6230	17.70	1.44	15.27	20.39
Karlılık	6230	7.09	5.88	-2.16	21.00
VarlıkYoğunluğu	6230	0.32	0.22	0.03	0.76
Cari Oran	6230	1.60	0.92	0.47	4.25
SermayeHarcamaları	6230	0.04	0.03	0.00	0.13
GSYİH Büyümesi	6230	4.37	3.91	-6.34	11.35
Enflasyon	6230	3.64	3.04	0.98	19.59

Örneklem olarak alınan BRICS-T ülkelerine ilişkin yıllar itibariyle gözlem sayıları Tablo IV'te yer almaktadır. Tablodan görüleceği üzere çalışmanın başlangıç yılı olan 2014'de toplam gözlem sayısı 427 iken, bu sayının yıllar itibariyle istikrarlı bir şekilde artarak 2021 yılına gelindiğinde 1612'ye ulaştığı ve 2014-2021 yılları arası 6 ülkeyi kapsayan toplam gözlem sayısının ise 6230 olduğu görülmektedir. Yine Tablo IV'ten de görüleceği üzere kümülatif gözlem sayısı en fazla olan ülkelerin sırasıyla Çin (3528), Güney Afrika (1112), Hindistan (668), Brezilya (536), Türkiye (258) ve Rusya'dan (128) oluştuğu görülmektedir.

Tablo IV. Yıllar İtibariyle Ülke Gözlem Yılı Sayıları

GözlemYılı	**Ülke / GözlemSayısı**						
	Brezilya	Rusya	Hindistan	Çin	Güney Afrika	Türkiye	**Toplam**
2014	57	14	62	141	134	19	427
2015	58	13	67	148	134	20	440
2016	62	14	73	153	137	20	459
2017	62	15	74	152	139	20	462
2018	65	15	78	407	139	25	729
2019	66	19	85	468	139	43	820
2020	81	19	110	878	145	48	1281
2021	85	19	119	1181	145	63	1612
Toplam Gözlem	**536**	**128**	**668**	**3528**	**1112**	**258**	**6230**

Değişkenler arasındaki ilişkiyi gösteren korelasyon matrisi Tablo V'te yer almaktadır. Tablo V'te görüldüğü gibi, modeldeki bağımsız değişkenler arasındaki ilişkiler incelendiğinde, çoklu doğrusal bağlantı problemine yol açacak kadar güçlü bir ilişki olmadığı anlaşılmaktadır. Modellerdeki bağımsız değişken olan *Çevresel*, *Sosyal*, *Yönetişim* ve *ESG* değişkenleri ile bağımlı değişken olan *Uzun Vadeli Borç Oranı*arasında istatistiksel olarak anlamlı ve pozitif yönlü ilişkilerin olduğu görülmektedir. Ayrıca, çalışmanın kontrol değişkenleri olan büyüklük, varlık yoğunluğu, sermaye harcamaları ve enflasyon değişkenlerinin uzun vadeli borç oranı ile pozitif yönde ilişkilerin olduğu görülürken, karlılık, cari oran ve gayrisafi yurtiçi hâsıla büyümesinin uzun vadeli borç oranı ile aralarındaki ilişkinin negatif ve istatistiksel olarak anlamlı olduğu görülmektedir.

Tablo V. Korelasyon Matrisi

Değişkenler	1	2	3	4	5	6	7	8	9	10	11	12
1. UVBO	1											
2. Çevresel	0.330***	1										
3. Sosyal	0.355***	0.731***	1									
4. Yönetişim	0.127***	0.304***	0.334***	1								
5. ESG	0.343***	0.858***	0.910***	0.585***	1							
6. Büyüklük	0.293***	0.286***	0.183***	0.094***	0.223***	1						
7. Karlılık	-0.253***	-0.064***	0.033***	-0.061***	-0.023*	-0.201***	1					
8. VarlıkYoğunluğu	0.456***	0.198***	0.117***	0.016	0.128***	0.266***	-0.157***	1				
9. Cari Oran	-0.298***	-0.166***	-0.065***	-0.038***	-0.098***	-0.376***	0.374***	-0.354***	1			
10. SermayeHarcamaları	0.145***	0.085***	0.060***	-0.009	0.056***	0.067***	0.095***	0.523***	-0.139***	1		
11. GSYİH Büyümesi	-0.235***	-0.202***	-0.326***	-0.114***	-0.284***	0.134***	0.021*	-0.036***	-0.031**	0.015	1	
12. Enflasyon	0.2477***	0.3036***	0.4359***	0.124***	0.383***	-0.079***	0.145***	0.025**	-0.015	0.002	-0.299***	1

*****, **, * sırasıyla %1, %5 ve %10 düzeyindeanlamlılığıgöstermektedir.**

Regresyon modelini tahmin etmeden önce, uygun tahmin modelinin seçilebilmesi için model belirleme testlerinin yapılması gerekmektedir. Bu noktada,ilk aşamada veri seti için havuzlanmış en küçük kareler ile sabit etkiler tahmincisinden hangisinin etkin sonuçlar vereceğini belirlemek amacıyla F testi yapılmıştır. F testi sonuçlarına göre tüm modeller için sabit etkiler tahmincisi ile modelleri tahmin etmenin etkin sonuçlar vereceği ortaya konulmuştur. İkinci aşamada, veri seti için en küçük kareler ile tesadüfi etkiler tahmincisinden hangisinin etkin sonuçlar vereceğini ortaya koymak amacıyla Breusch Pagan LM testi yapılmıştır. Söz konusu test sonucuna göre tüm modeller için tesadüfi etkiler tahmincisinin

etkin sonuçlar vereceği sonucuna ulaşılmıştır. Model belirleme testlerinin üçüncü aşamasında ise, veri seti için tesadüfi etkiler tahmincisi ile sabit etkiler tahmincisinden hangisinin etkin sonuçlar vereceğinin tespiti için Hausman testi yapılmış olup, bu test sonuçlarına göre tüm modeller için sabit etkiler tahmincinin etkin sonuçlar vereceği sonucuna ulaşılmıştır. Tablo VI'da model belirleme testlerinin sonuçları yer almaktadır.

Tablo VI. Model Belirleme Test Sonuçları

Model	F (Chow) Testi (F-değeri sonucu)	Breusch Pagan LM Testi (Ki-kare sonucu)	Hausman Testi (Ki-kare sonucu)	Geçerli Olan Model
Model 1	15.57***	10329.50***	1083.46***	**Sabit Etkiler**
Model 2	15.49***	10376.76***	1778.49***	**Sabit Etkiler**
Model 3	15.61***	10306.40***	1019.61***	**Sabit Etkiler**
Model 4	15.51***	10383.36***	1293.49***	**Sabit Etkiler**

*****, %1 düzeyinde anlamlılığı göstermektedir.**

Tablo VI'da yer alan sonuçlara göre sabit etkiler tahmincisi ile tahmin edilen modellerde değişen varyans ve otokorelasyon problemlerinin söz konusu olup olmadığının tespiti için sırasıyla değiştirilmiş Wald testi, BaltagiWu ve Durbin Watson testi yapılmıştır. Söz konusu analiz sonuçları Tablo VII'da yer almaktadır. Tablo VII'daki değiştirilmiş Wald testi sonuçlarının yer aldığı sütundaki ki-kare değerleri incelendiğinde, hata terimlerinin varyansının sabit olduğunu öne süren sıfır hipotezinin reddedildiği ve kurulan modellerin tamamında değişen varyans durumunun söz konusu olduğu görülmektedir. Tablo VII'da yer alan ve otokorelasyonun tespiti için yapılmış olan Durbin Watson ve BaltagiWu test sonuçlarına bakıldığında, kurulan modellerin tamamında söz konusu değerlerin "2" değerinin altında olduğu görülmektedir. Literatürde bir modelde otokorelasyonun varlığını test etmek için kritik bir değer verilmemesine rağmen, söz konusu değerler "2" den küçük ise, otokorelasyonun önemli olduğu yorumu yapılmaktadır (Tatoğlu, 2013: 214).Bu sonuçlardan hareketle, bu çalışmanın test edilen modellerinde otokorelasyon durumunun söz konusu olduğu ifade edilebilir.

Tablo VII. Varsayımdan Sapma Test Sonuçları

Model	Değiştirilmiş Wald Testi ((Ki-kare sonucu)	Durbin Watson Testi	BaltagiWu Testi
Model 1	1.5e+07***	1.1459018	1.5561545
Model 2	6.6e+06***	1.1571372	1.5663641
Model 3	1.5e+07***	1.1480236	1.5590972
Model 4	1.8e+07***	1.150087	1.5595728

*****, %1 düzeyinde anlamlılığı göstermektedir.**

Tablo VII'da elde edilen sonuçlara bağlı olarak, Robust Standart Hatalar tahmincisi ile modellerin tahmin edilmesine karar verilmiştir. Çevresel, sosyal ve yönetişim performans skorları ve ESG toplam skorunun sermaye yapısı üzerindeki etkilerinin incelenmesi için 4 model oluşturulmuş ve bu modellerde robust standart hatalar tahmincisi ile tahmin yapılmıştır. İlgili analiz sonuçları Tablo VIII'da yer almaktadır.

Bu çalışma kapsamında yapılacak analizlerin modelleri aşağıda yer almaktadır. Aşağıda yer alan modelde, α sabit terimi, β değişken katsayısını, i ve t alt simgeleri sırasıyla örnekteki her bir firmayı ve yılı göstermektedir. Modelde kullanılan değişkenlerin zaman birimi incelendiğinde, bağımlı ve kontrol değişkenlerin zaman birimi için t yılı dikkate alınırken, modelin bağımsız değişkenleri olan çevresel performans skoru (Çevresel), sosyal performans skoru (Sosyal), yönetişim performans skoru (Yönetişim) ve ESG toplam skorunun (ESG) zaman birimi bir yıl gecikmeli (t-1) olacak şekilde modelde yer verilmiştir. Bağımsız değişkenlerin bir yıl gecikmeli değerinin alınmasının sebebi, firmaların büyük çoğunluğunun ESG skorlarının ilgili mali yılda açıklanmayıp, bir sonraki mali yıla sarkması ve bunun yanı sıra ESG skorlarının sermaye yapısı kararları üzerindeki etkisinin ancak bir sonraki mali yılda izlenebileceğinden kaynaklanmaktadır. Nitekim İlgili literatüre bakıldığında da açıklayıcı değişkenlerin bir yıl gecikmeli değerlerinin model içerisinde yer aldığı çalışmaların yürütüldüğü görülmektedir (Ndebele, 2020; Sheikh, 2019).

$$UVBO_{it} = \alpha + \beta_1 \text{Çevresel}_{it-1} + \beta_2 \text{Büyüklük}_{it} + \beta_3 Karlılık_{it} + \beta_4 Varlık\ Yoğunluğu_{it} + \beta_5 Cari\ Oran_{it} + \beta_6 Sermaye\ Harcamaları_{it} + \beta_7 GSYİH\ Büyümesi + \beta_8 Enflasyon_{it} + \beta_9 Yıl + \beta_{10} Endüstri + \varepsilon_{it}$$

(Model 1)

$$UVBO_{it} = \alpha + \beta_1 Sosyal_{it-1} + \beta_2 \text{Büyüklük}_{it} + \beta_3 Karlılık_{it} + \beta_4 Varlık\ Yoğunluğu_{it} + \beta_5 Cari\ Oran_{it} + \beta_6 Sermaye\ Harcamaları_{it} + \beta_7 GSYİH\ Büyümesi + \beta_8 Enflasyon_{it} + \beta_9 Yıl + \beta_{10} Endüstri + \varepsilon_{it}$$

(Model 2)

$$UVBO_{it} = \alpha + \beta_1 \text{Yönetişim}_{it-1} + \beta_2 \text{Büyüklük}_{it} + \beta_3 Karlılık_{it} + \beta_4 Varlık\ Yoğunluğu_{it} + \beta_5 Cari\ Oran_{it} + \beta_6 Sermaye\ Harcamaları_{it} + \beta_7 GSYİH\ Büyümesi + \beta_8 Enflasyon_{it} + \beta_9 Yıl + \beta_{10} Endüstri + \varepsilon_{it}$$

(Model 3)

$$UVBO_{it} = \alpha + \beta_1 ESG_{it-1} + \beta_2 \text{Büyüklük}_{it} + \beta_3 Karlılık_{it} + \beta_4 Varlık\ Yoğunluğu_{it} + \beta_5 Cari\ Oran_{it} + \beta_6 Sermaye\ Harcamaları_{it} + \beta_7 GSYİH\ Büyümesi + \beta_8 Enflasyon_{it} + \beta_9 Yıl + \beta_{10} Endüstri + \varepsilon_{it}$$

(Model 4)

Tablo VIII. Regresyon Analizi Sonuçları

Bağımlı Değişken UVBO	Model 1	Model 2	Model 3	Model 4
Çevresel	-0.00026**			
	(-2.12)			
Sosyal		-0.00053***		
		(-3.43)		
Yönetişim			-0.00010	
			(-1.01)	
ESG				-0.00047***
				(-2.63)
Büyüklük	0.04922***	0.04993***	0.04637***	0.04961***
	(5.83)	(5.88)	(5.58)	(5.82)
Karlılık	-0.00247***	-0.00247***	-0.00245***	-0.00248***
	(-6.44)	(-6.45)	(-6.45)	(-6.49)
Varlık	0.36546***	0.36610***	0.36579***	0.36405***
Yoğunluğu	(10.27)	(10.32)	(10.29)	(10.23)
Cari Oran	0.02439***	0.02475***	0.02465	0.02455***
	(5.38)	(5.49)	(5.40)	(5.41)
Sermaye	-0.24268***	-0.23663***	-0.25277***	-0.23950***
Harcamaları	(-3.22)	(-3.15)	(-3.40)	(-3.17)
GSYİH Büyümesi	-0.00047	-0.00050	-0.00036	-0.00046
	(-0.68)	(-0.73)	(-0.52)	(-0.66)
Enflasyon	-0.00120	-0.00116	-0.00124	-0.00117
	(-1.44)	(-1.40)	(-1.49)	(-1.41)
Sabit (C)	-0.80608***	-0.81156***	-0.75869***	-0.80419***
	(-5.53)	(-5.55)	(-5,29)	(-5.49)
Yıl Etkisi	Evet	Evet	Evet	Evet
Endüstri Etkisi	Evet	Evet	Evet	Evet
F Değeri	16.33***	16.47***	16.53***	16.55***
R^2 (Overall)	0.2096	0.1885	0.2210	0.2005
Gözlem Sayısı	6.230	6.230	6.230	6.230

*****,**, sırasıyla %1 ve %5 düzeyinde anlamlılığı göstermektedir. T değerleri parantez içerisinde gösterilmiştir.**

Tablo VIII'da yer alan sütunlarda sırasıyla modeldeki bağımsız değişkenler olan çevresel, sosyal, yönetişim performans skoru ile ESG toplam skorunun ve kontrol değişkenlerininuzun vadeli borç oranı üzerindeki etkileri incelenmektedir. Çevresel performans skoru ve kontrol değişkenlerininuzun vadeli borç oranı üzerindeki etkisinin incelendiği model 1'in istatistiksel olarak anlamlı olduğu ($F=16.33$; $p<0.01$) ve açıklayıcılık gücünün %20.96 düzeyinde olduğu görülmektedir. Model 1 parametreleri incelendiğinde, çevresel performans skorunun uzun vadeli borç oranını negatif yönde etkilediği ve bu etkinin istatistiksel olarak anlamlı olduğu görülmektedir ($p<0.05$). İlgili analiz sonuçları, çevreye daha duyarlı olan yani çevresel performansı yüksek olan firmaların uzun vadeli borç oranlarının daha düşük olduğunu ve borç oranlarını düşük tutmak suretiyle firma risklerini azalttıkları sonucunu ortaya koymaktadır. Bu sonuçlardan hareketle, çevresel performans

skorunun uzun vadeli borç oranını negatif yönde etkilediğini öne süren H_1 hipotezi desteklenmiştir. Bu bulgu literatürdeki bazı çalışma sonuçlarıyla tutarlılık göstermektedir (Benlemlih & Cai, 2020).

Sosyal performans skorunun ve kontrol değişkenlerininuzun vadeli borç oranı üzerindeki etkisinin incelendiği model 2'nin istatistiksel olarak anlamlı olduğu ($F=16.47$; $p<0.01$) ve modelin açıklayıcılık gücünün %18.85 düzeyinde olduğu görülmektedir. Model 2 parametreleri incelendiğinde, sosyal performans skorunun uzun vadeli borç oranını negatif yönde etkilediği ve bu etkinin istatistiksel olarak anlamlı olduğu görülmektedir ($p<0.01$). Yani sosyal performans skoru arttıkça firmaların uzun vadeli borç oranları azalmaktadır. Bu bulguya göre H_2 hipotezi desteklenmektedir. Söz konusu bulgu, çalışan refahı gibi çeşitli sosyal performans göstergeleriyle borç oranı arasındaki ilişkiyi inceleyen bazı çalışma sonuçlarıyla tutarlılık göstermektedir (Bae ve ark., 2011; Pijourlet, 2013; Verwijmeren & Derwall, 2010).

Yönetişim performans skorunun ve kontrol değişkenlerininuzun vadeli borç oranı üzerindeki etkisinin araştırıldığı model 3'ün istatistiksel olarak anlamlı olduğu ($F=16.53$; $p<0.01$) ve modelin açıklayıcılık gücünün %22.10 olduğu görülmektedir. Model 3 sonuçları incelendiğinde, yönetişim performans skorunun uzun vadeli borç oranı üzerindeki etkisi istatistiksel olarak anlamlı değildir ($p>0.05$). Bu bulguya göre, H_3 hipotezi desteklenmemiştir.

ESG toplam skorunun ve kontrol değişkenlerin uzun vadeli borç oranı üzerindeki etkisinin araştırıldığı model 4'ün istatistiksel olarak anlamlı olduğu ($F=16.55$; $p<0.01$) ve modelin açıklayıcılık gücünün %20.05 olduğu görülmektedir. Model 4 sonuçlarına göre, ESG toplam skorunun uzun vadeli borç oranı üzerindeki etkisinin negatif ve istatistiksel olarak anlamlı olduğu görülmektedir ($p<0.01$). Yani firmaların ESG toplam skoru arttıkçauzun vadeli borç oranı azalmaktadır. Bu bulgu literatürde yer alan diğer benzer çalışmaların sonuçlarıyla tutarlılık göstermektedir (Benlemlih, 2017a; Harjoto, 2017; Hsu ve ark., 2023; Mahmood ve ark., 2023; Mansour & Sayed, 2022; Sheikh, 2019). Model 4'de yer alan analiz sonucuna göre H_4 hipotezi desteklenmektedir.

Modeldeki kontrol değişkenlerin bağımlı değişken üzerindeki etkileri incelendiğinde, büyüklük, maddi duran varlık yoğunluğu değişkenlerinin uzun vadeli borç oranını tüm modellerde istatistiksel olarak anlamlı ve pozitif yönde, cari oranın ise model 3 hariç tüm modellerde benzer şekilde istatistiksel olarak anlamlı ve pozitif yönde etkilediği görülmektedir. Toplam varlık büyüklüğü ve maddi duran varlık yoğunluğu arttıkça söz

konusu firmanın gerek borçlarına karşılık teminat olarak gösterebileceği miktarın artması gerekse kreditörler tarafından daha az riskli görülmesinin bir sonucu olarak, bu değişkenlerin uzun vadeli borç oranı ile pozitif bir ilişki içerisinde bulunması beklentiler ile tutarlı olduğu ifade edilebilir.

Modelin diğer kontrol değişkenleri olan kârlılık ve sermaye harcamaları değişkenlerinin uzun vadeli borç oranını negatif ve istatistiksel olarak anlamlı olarak etkilediği görülmektedir. Kârlılık oranı yüksek olan firmalar yüksek düzeyde özkaynağa sahip olacağından, karlı firmaların daha yüksek özkaynağa sahip olduğu dolayısıyla da finansman tercihi konusunda borçlanma yerine, öncelikle özkaynağa başvuracağı ifade edilebilir. Dolayısıyla bu çalışmanın sonucunda elde edilen kârlılık ile uzun vadeli borç oranı arasındaki negatif yönlü ilişki beklentiler ile tutarlıdır. Çalışmanın diğer kontrol değişkenleri olan gayrisafi yurtiçi hâsıla ve enflasyonun uzun vadeli borç oranı üzerindeki etkisi istatistiksel olarak anlamsız bulunmuştur.

V. SONUÇ VE DEĞERLENDİRME

ESG performansının sermaye yapısı üzerindeki etkilerini gelişmekte olan ülkeler bağlamında inceleyen ve bu amaçla BRICS-T ülkelerinin 2014-2021 yılları arası verilerini örneklem olarak ele alan bu çalışmada, firmaların çevresel performans skoru, sosyal performans skoru, ve ESG toplam skoru değişkenlerinin uzun vadeli borç oranını negatif yönde etkileyerek sermaye yapısı kompozisyonu üzerinde önemli etki yaptığı sonucuna ulaşılırken, yönetişim performans skoru değişkeninin uzun vadeli borç oranı üzerindeki etkisi istatistiksel olarak anlamsız bulunmuştur. Bu noktada ESG performansı yüksek olan firmaların finansman tercihi noktasında borçlanma yerine öz kaynak yoluyla finansman ihtiyacını karşıladıkları görülmektedir. Elde edilen bu bulgular, ESG skorlarının şirket ile yatırımcılar arasındaki bilgi asimetrisini azalttığını öne süren paydaş teorisi ile de tutarlıdır.

Bu çalışma kapsamında ulaşılan sonuçlar ile çeşitli ölçüm metodolojilerini kullanarak elde edilen kurumsal sürdürülebilirlik performansı ile sermaye yapısı ilişkisini inceleyen çalışmaların sonuçları arasında benzerlikler mevcuttur. Bu kapsamda, kurumsal sürdürülebilirlik ile sermaye yapısı arasında negatif yönlü bir ilişkinin olduğu sonucuna ulaşan çeşitli çalışmaların yürütüldüğü görülmektedir (Harjoto, 2017; Oware&Mallikarjunappa, 2021; Sheikh, 2019). Kurumsal sürdürülebilirliğin alt boyutlarının sermaye yapısı ile ilişkisine dair yürütülen çalışmalar dikkate alındığında ise, bu çalışmanın sonuçlarıyla tutarlı bir şekilde, çevresel performans ile sermaye yapısı arasında negatif yönlü

bir ilişkinin olduğu sonucuna ulaşan çalışmaların literatürde yer aldığı görülmektedir (Benlemlih&Cai, 2020). Benzer bir şekilde, sosyal performans göstergeleri ile sermaye yapısı arasında negatif yönlü bir ilişkinin olduğu sonucuna ulaşan çeşitli çalışmaların yürütüldüğü (Bae ve ark.,2011;Verwijmeren&Derwall,2010; Pijourlet, 2013)görülmekle birlikte, sosyal performans ile sermaye yapısı arasında pozitif yönlü bir ilişkinin olduğu sonucuna ulaşan çalışmaların (Hamrouni ve ark.,2019) da yürütüldüğü görülmektedir. Öte yandan, yönetişim performansının sermaye yapısı üzerinde istatistiksel olarak anlamlı bir etkisi olmadığını ortaya koyan bu çalışmanın sonuçlarından farklı olarak, yönetişim performansı ile sermaye yapısı arasında negatif yönlü bir ilişkinin olduğu sonucuna ulaşan çalışmaların (Ndebele, 2020) yanı sıra, pozitif yönlü bir ilişkinin olduğu sonucuna ulaşan çalışmalarda (Lindkvist&Saric, 2020; Hamrouni ve ark., 2019) mevcuttur.

Bu çalışma kapsamında elde edilen sonuçlar sektörde görev alan profesyonellere de bazı tavsiyeler vermektedir. ESG performansının firma performansı, firma değeri veya marka prestiji üzerinde pozitif yönde etkisinin bulunduğuna dair sonuçlara ulaşan pek çok çalışmanın yanı sıra, ESG performansının sermaye yapısı kompozisyonu üzerindeki etkisinin incelendiği bu çalışmada, yönetişim performans skoru hariç diğer ESG bileşenlerininuzun vadeli borç oranı üzerinde etkisinin olduğu görülmüştür. Bu noktadan hareketle, sektörde faaliyet gösteren firma yöneticilerinin ESG göstergelerinin iyileştirilmesine yönelik politikalar izlemesinin ve bu göstergelerin iyileştirilmesine ilişkin yatırım yapmasının firma riskini etkileyerek, öz kaynak maliyetini düşüreceğini ve bu durumun sermaye yapısı kararları gibi finansal kararların verilmesinde önemli rol oynayacağı ifade edilebilir.

Diğer tüm çalışmalarda olduğu gibi, bu çalışmanın da bazı kısıtlara sahip olduğu ifade edilebilir. Bu kısıtlardan birincisi, bu çalışmada kurumsal sürdürülebilirlik performansını temsil eden değişken olarak RefinitivEikon veri tabanında yer alan ESG skorları kullanılmıştır. Bu yönüyle bakıldığında, firmaların kurumsal sürdürülebilirlik performanslarını farklı metodolojileri dikkate alarak inceleyen çalışmaların yürütülmesi ve ulaşılan sonuçların benzerlik ve farklılıklarının ortaya konması ilgili literatüre katkı sağlayacaktır. Ayrıca, ESG skorları ile sermaye yapısı arasındaki ilişkiyi etkileyebileceği düşünülen değişkenlerin ülke bağlamlarının da dikkate alınarak modele ılımlaştırıcı değişken olarak eklendiği çalışmaların yürütülmesi ilgili alan yazına katkı sağlayacaktır.

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EVALUATING THE MULTIFACETED ADVANTAGES OF LEAN PROJECT MANAGEMENT IN SMES: A QUALITATIVE ANALYSIS[1]

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Abstract

This study explores and evaluate multifaceted benefits of lean project management (LPM) in small and medium enterprises from various industry. The 11 corresponding participants were interviewed utilizing semi-structure forms; their responses were interpreted at the mezzo level with MAXQDA 2020 software. The findings revealed that cost reductions are achieved in the use of LPM due to the elimination of features that adhere to the processes and time-to developments. By reducing costs significantly, on account of detailed budget and forecasting, morale is stimulated and surged in the team, which operates on optimal operational efficiency. Lean principles help SMEs deal with unexpectedly challenging times by designing efficient processes, streamlining communication, and aligning their strategic visions to ensure sustainable growth and innovation. Furthermore, effective communication and stakeholder relationship-building contribute to the project's success. It also reveals that gender has some major differences of opinion, wherein females were more cost-saving and resource allocation-oriented while males were cost-benefit ratio-oriented. The study's limitations are a small sample size and the qualitative nature of the data, but key findings still emphasize cost efficiency and financial optimization drivers in SMEs' successful performance through tailored project management.

Keywords: Lean project management, lean practices, lean principles, SMEs

Jel Classification: H21, D23, D24

Article Type: Research Article

[1] This paper is derived from the master thesis titled “Lean Project Management in SMEs.”

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KOBİ'LERDE YALIN PROJE YÖNETİMİNİN ÇOK YÖNLÜ AVANTAJLARININ DEĞERLENDİRİLMESİ: NİTEL BİR ANALİZ

Öz

Bu çalışma, çeşitli sektörlerde faaliyet gösteren küçük ve orta ölçekli işletmelerde (KOBİ), yalın proje yönetiminin sağladığı faydaları değerlendirmek amacıyla hazırlanmıştır. Yarı yapılandırılmış mülakat tekniği kullanılarak 11 katılımcı ile görüşülmüş ve alınan yanıtlar MAXQDA 2020 yazılımı ile analiz edilmiştir. Bulgular, yalın proje yönetiminin, süreçlerdeki karmaşıklıkların ve proje geliştirme sürelerine bağlı belirsizliklerin ortadan kaldırılmasıyla maliyetlerde önemli düşüşler sağladığını göstermiştir. Ayrıntılı bütçeleme ve geleceğe yönelik projeksiyon uygulamalarının maliyetleri kayda değer ölçüde azalttığı, operasyonel verimliliği artırdığı ve bu doğrultuda çalışanların moral ve motivasyonunu olumlu yönde etkilediği görülmüştür. Ayrıca, yalın yönetim ilkelerinin benimsenmesinin, KOBİ'lerin verimli süreçler tasarlamalarını, iletişim kanallarını iyileştirmelerini ve sürdürülebilir büyüme ile inovasyon süreçlerini stratejik bir vizyonla uyumlu hale getirerek beklenmedik zorluklarla başa çıkmalarına yardımcı olduğu anlaşılmaktadır. Ayrıca, etkili iletişim ve paydaş ilişkilerinin güçlendirilmesi, projelerin başarısında kritik bir rol oynamaktadır. Bunun yanı sıra, çalışmada cinsiyetler arasında belirgin görüş farklılıkları tespit edilmiştir; kadınların daha çok tasarruf ve kaynak tahsisi üzerinde durduğu, erkeklerin ise maliyet-fayda oranına odaklandığı ortaya çıkmıştır. Çalışmanın sınırlılıkları, örneklem büyüklüğünün görece küçük olması ve verilerin nitel nitelikte olmasına rağmen, temel bulgular KOBİ'lerin proje yönetimi süreçlerinde maliyet etkinliği ve finansal optimizasyonun başarılı performansın anahtar faktörleri olduğunu vurgulamaktadır.

Anahtar Kelimeler: Yalın proje yönetimi, yalın yönetim uygulamaları, yalın yönetim ilkeleri, KOBİ'ler.

Jel Sınıflandırması: H21, D23, D24

Makale Türü: Araştırma Makalesi

I. INTRODUCTION

The competitive environment of the modern business world constantly puts pressure on small and medium-sized enterprises (SMEs) to become more efficient, reduce costs, and maintain a competitive edge. Lean project management (LPM), with its roots in the Japanese concept of "Kaizen," is a tool for efficiency, flexibility, and dedication to continuous improvement directed at the reduction of waste and maximization of value for end-users (Ekström, 2024; Hosono, 2020), which is critical in the quest to increase efficiency and align operations with strategic organizational goals. It is, therefore, crucial for SMEs to set themselves apart from competitors and foster innovation (Lima et al., 2023). By adopting the concepts of lean, SMEs will have reduced operational costs and increased productivity that will benefit shareholders (Vrečko et al., 2023). LPM suits all corporations, not exclusively large ones; hence, it also suits SMEs because of the dynamic evolution in technology, global linkages, and ever-evolving customer expectations (Vargo & Seville, 2011).

Given the importance of SMEs for economies, it would also be crucial to investigate ways on how they adapt LPM to their specific contexts. This paper, therefore, seeks to assess the multifaceted benefits of LPM within SMEs. The data was acquired by conducting semi-structured interviews on 11 participants from different industries. The interviews gave the real sense of the applications and results of LPM in businesses that span various sectors. The qualitative approach enabled an analysis of immediate operational advantages, including cost reduction and productivity improvement, and also explored the long-term strategic impacts, including sustainability and growth.

The first section of the study is the in-depth review of the existing literature concerned with LPM, its basic concepts, SMEs, and the significance of this approach. The second part of the paper introduces the methodology, while the third part presents the findings derived from the conducted interviews. The next section discusses the findings from the current research and highlights their practical implications for SMEs. To sum up, the paper concludes with recommendations for SMEs interested in adopting LPM and suggestions for future studies.

II. LITERATURE REVIEW

II.I. Lean Project Management

LPM is a procedure oriented toward maximum value and waste reduction in project processes (Saier, 2017). At the core of this methodology lies the principles of lean

management, which border on the questioning of the necessity of each activity or process in the addition of value to a project (Wu et al., 2019). In essence, LPM is oriented toward efficiency as a way of removing non-value-adding activities and constantly improving processes. It focuses on delivering value to the clients by reducing waste of projects and ensuring high performance at the maximum level possible (Saier, 2017).

LPM has evolved as a concept, and numerous studies show its application in various industries that begin from construction and extend to software development and even manufacturing (Xia et al., 2017; Sutherland et al., 2020; Kashikar et al., 2016). For example, in relation to reducing costs, enhancing productivity, and improving quality, LPM results in huge increases of project performance (Meng, 2019; Uusitalo et al., 2019). This means that the application of lean principles in the organization's practices of project management would lead to better outcomes and, therefore, increase the competitive advantage of the organization (Giridhar et al., 2018). LPM, in turn, can possibly be characterized by continuous improvement and an elimination of waste during the entire cycle of the project. Such a nature of approach certainly sets itself apart from traditional project management practices, with clear goals of project delivery, maximizing of customer value, and control over the life cycle of the project (Ramani & Ksd, 2019).

LPM can be used in every industry to enhance productivity and reduce waste (Etges et al., 2018). Wide range of organizations achieve the optimization of production processes, management of resources, and accomplishment of sustainability through the implementation of lean (Maraqa et al., 2020).

II.II. Lean Project Management in SMEs

Studies have shown how SMEs use lean principles for optimizing processes and driving continuous improvement initiatives. Implementing lean practices in SMEs was associated with many benefits, from improved operational performance and reductions in costs to improvements in productivity (Ali et al., 2020). By focusing on critical success factors for the implementation of lean, SMEs are capable of cutting through the fat by streamlining operations, cutting inefficiency, and thereby achieving sustainable growth (Achanga et al., 2006). The implementation of lean principles in project management enables SMEs to emphasize value-adding activities while eliminating those that are not value-adding and optimizing the use of resources. By doing so, SMEs can perform the delivery of projects more effectively, meet the expectations of customers, and ensure business success (Battistella

et al., 2023). Over and above, implementing lean practices in SMEs is critical for overcoming barriers to lean adoption and realizing the maximum benefits from LPM. Even though SMEs face various resource constraints that might raise challenges during the initial stage of any lean initiatives, starting with small funding and progressively mobilizing other resources will help smaller businesses realize many benefits of lean implementation (Yadav et al., 2019).

Lean and green practices potentially increase the economic, environmental, and social sustainability performance of SMEs (Sajan & Shalij, 2020). Implementing lean practices improves operational efficiency, saves the environment, and guarantees social responsibility, which is increasingly becoming important in business practice (Oliveira et al., 2022). Furthermore, optimizing operational processes and reducing waste in aspects such as inventory, space, and lead time are some of the main goals that the SMEs want to achieve through the introduction of lean. Empowerment of employees at all levels of participation empowers SMEs to drive successful project management in lean and hence achieve sustainable improvement in their operations (Knapić et al., 2022).

SMEs should adopt lean practices that are easy and affordable to implement, i.e., with an emphasis on practical and feasible lean strategies (Sahoo & Yadav, 2018; Yadav et al., 2019). Researchers have explored the acceptability and implementation of lean manufacturing in SMEs with a focus on process, flow, and waste (Tanasić et al., 2019). In SMEs, which, by their nature, have limitations of every kind, the applicability of lean principles becomes more relevant, with which SMEs improve their competitive ability, their speed of innovation, and their reduction in production lead time, flexibility, and cost (Seneviratne et al., 2021). In spite of the challenges pertaining to the reluctance of management to adopt lean methods, the implementation of lean systems in SMEs results in productivity improvements (Singla & Sharma, 2023). Furthermore, successful implementation of lean management was associated with increased productivity, competence, and overall business performance (Pavlovic et al., 2019). The benefits derived from lean implementation are not limited to the shop floor; in fact, the advantages of lean extend into many dimensions of business. Manufacturing SMEs primarily aim at achieving lean practices to improve quality, meet customer needs for shorter lead times, and obtain a competitive advantage in price and service quality (Valente et al., 2019). Research has also linked the comprehensive implementation of lean practices, such as customer involvement, statistical process control, flow, and total productive maintenance, with enhanced measures of the market, financial, and operational performance of SMEs (Berlec et al., 2017).

Several critical factors can be discussed that may facilitate the successful implementation of lean in SMEs. Leadership and commitment of management, financial aspects, skills and expertise, and fostering culture that is receptive to inculcating lean practices by the organization are some of the factors that influence the implementation of lean practices in an organization (Shrimali et al., 2018). Top management involvement, attitudes of employees, resource commitment, and organizational culture are other factors that have also significant impact on the implementation of lean management in SMEs (Vlachos, 2015). Some industries in which the concept of lean management is highly relevant for SMEs. For example, in the food supply chain sector, where many of the firms are SMEs, a lean action plan has been developed to deal with the peculiar requirements of SMEs and the challenges they face, particularly in this sector (Sukwadi et al., 2013).

III. METHODOLOGY

III.I. Research Objective

Lean management is crucial for companies, regardless of their size. Nowadays, organizations from all over the world, including SMEs, are applying the principles of lean management for the achievement of operational excellence and overall performance improvement (Alguirat, 2023), rendering the topic all the more critical because of its importance to economies. In turn, the implementation of lean practices within SMEs has been related to a number of benefits, including significant advances in their operational performance, cost-cutting, and productivity (Ali et al., 2020; Fullerton et al., 2014). From this perspective, the present research was designed to focus on the specifics of using LPM by SMEs and aimed to answer the following questions: [1] What are the benefits of LPM for SMEs in terms of cost reduction, improved productivity, and project success? [2] How does the concept of LPM affect the long-term sustainability and growth of SMEs regarding their overall business strategy?

III.II. Semi-structured Interview Form

Toward the aim of the study and based on the research questions, semi-structured interview form was created. Qualitative research methods, such as semi-structured interviews, use an in-depth understanding of individuals rather than a statistical representation (Patton, 1990). The main goal of this basis is to generate conclusions from individuals holding similar characteristics or behaviors (Schofield, 1990). The formulation process of semi-structured interview questions involves various stages (Büyüköztürk et al., 2016): (1) Problem

definition, (2) Draft form creation, (3) Obtaining an expert opinion and creating an application form.

Based on this approach, a question pool was created after conducting a thorough literature review. Then, the questions were shared with the three experts for review to ensure the accuracy of the produced questions and be able to collect the desired data. The experts' review led to the removal of four questions from the draft form, resulting in the final version of the semi-structured interview questions, consisting of six questions.

III.III. Sample and Interview Process

In qualitative research, there is no guideline for sample size selection; rather, the process of selection is highly adaptive to the individuals. Techniques for sample selection include the extreme or contradictory sampling, maximum diversity sampling, affinity sampling, typical case sampling, critical case sampling, snowball sampling, criterion sampling, confirmatory or falsifier sampling, and easily accessible case sampling (Yıldırım & Şimşek, 2016). In this research, however, the snowball sampling is used due to the difficulty in finding those individuals who apply LPM in SMEs.

Interviews were carried out with a total of 11 individuals who hold the manager position or above in Jordanian companies that regularly implements lean management, or when they had a project. For example, hairdresser chain company was aligning services and inventory with customer demand by keeping popular hair products in stock while avoiding overstocking slow-moving items. Prior to the interview, the interviewers provided an overview of the questions, including details on the structure, purpose, and content. Then, the participants were scheduled for appointments via phone calls, followed by the conduction of online interviews. The duration of the interviews ranged between 1 and 1.5 hours. The interviews were video-recorded, and later the records were decrypted and transmitted to a computer. Table 1 presents the demographic characteristics of the participants in the interviews.

Following the evaluation of the application submitted to the Beykoz University Scientific Research and Publication Ethics Board on May 8, 2024, a positive opinion was formed, as evidenced by decision number 6 during meeting number 9 on June 6, 2024.

Table I. Demographics of the participants

Participants	Genders	Industries
Participant 1	Female	Hairdresser Chain
Participant 2	Male	Hospitality
Participant 3	Female	Digital & Media
Participant 4	Female	Event Organization
Participant 5	Male	Engineering
Participant 6	Female	Fashion & Apparel
Participant 7	Male	Software Development
Participant 8	Male	Agriculture & Food
Participant 9	Female	Education
Participant 10	Female	Travel & Tourism
Participant 11	Female	Recycling

III.IV. Analysis

The participants' responses were analyzed using a content analysis approach. A content analysis approach refers to the methodology of analyzing written material so as to make accurate and precise inferences. The main purpose of the content analysis approach is to uncover the latent meaning of written, audio, visual or any other kind of material that conveys symbolic, meaningful content (Krippendorff, 2004). The main purpose of using this technique is to represent the data and to reveal the hidden realities within it. The content analysis approach attempts to offer a significant outcome that answers the research question through data categorization in relation to some themes and notions (Yıldırım & Şimşek, 2016). Inductive content analysis, on the other hand, involves the derivation of themes and categories from data sets and the codes are based on the expressions of the participants and can be combined together to form meaningful statements. In this study, the method of explicit coding process of analysis was used where the categories are developed after assigning the codes and then combined to form the main themes. The analysis procedure, described in the following section, was used in this research:

- First, the identified codes were amalgamated and inspected and then associated with broad themes which may describe the data at a general level and group the codes in definite groups based on similar characteristics.
- Secondly, the data collected by the researcher has been organized. Their information is presented, explained, and illustrated in a manner that is understandable to the reader.

- In the last stage, the relationships between the findings were explained by the researcher in order to make sense of the collected data, cause-effect relationships were established, some conclusions were drawn from the findings and explanations were made about the importance of the results obtained.

Once the interviews and document analysis were completed, further findings were interpreted by linking them to the tables created from the dataset. Analysis were conducted by using MAXQDA 2020 package program, which is well-known for its effectiveness in qualitative and mixed-methods analysis.

IV. FINDINGS

IV.I. Themes and Coding Analysis

Table II. Codes for the theme of lean project management and cost productivity

Codes	N	%
Cost saving	11	26,83
Reduction in development time	8	19,51
Allocating more resources	7	17,07
Eliminating unnecessary features	6	14,63
Improved team morale	5	12,20
Value-adding activities	4	9,76
TOTAL	41	100,00

In the first interview question, the participants were asked to share a specific example of how LPM contributed to cost reduction or increased productivity in a project they managed. Based on the answers to the first question, regarding the theme of “Lean Project Management and Cost Productivity Increase,” the coding analysis resulted in: cost saving, reduction in development time, allocating more resources, eliminating unnecessary features, improved team morale, and value-adding activities, which are shown in Table 2 and Figure 1.

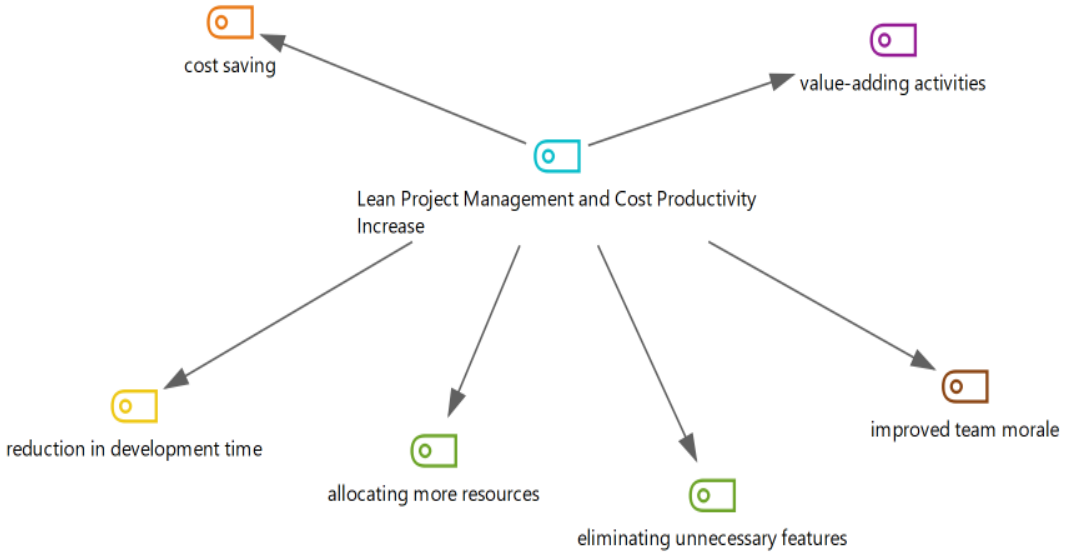

Figure I. Hierarchical code-subcode model for regarding the theme of lean project management and cost productivity increase

Participant 3 provided the most typical response in this context, which is as follows:

Participant 3: "In a digital media project aimed at enhancing our content delivery platform, we employed lean project management by streamlining our development process, eliminating unnecessary features that did not add value to the user experience. This focus on value-added features led to a reduction in development time by 20% and a cost saving of 15% without compromising the quality of the final product. This approach not only increased productivity but also significantly improved team morale as they could see the direct impact of their efforts on the project's success."

The findings revealed that LPM has advantages to SMEs in terms of cost savings, reduced project development time, and elimination of unnecessary features. This encourages SMEs to move their development process towards only value-adding activities, which will lead to a 20% reduction in development time and 15% savings in cost without affecting the quality of the product, as indicated in the third participant respond.

Table III. Codes for the theme of integrating cost considerations into project plan, execution

Codes	N	%
Cost-benefit ratio	7	21,88
Adopting a value-driven approach	6	18,75
Upfront planning	6	18,75
Allocating resources efficiently	5	15,63
Informed decisions	5	15,63
Operational efficiency	3	9,38
TOTAL	32	100,00

In the second interview question, the participants were asked to recall their experience on how they integrated cost considerations into their project planning and execution. Based on the answers to the second question, related to the theme of "Integrating Cost Considerations into Project Plan, Execution," the coding analysis resulted in: cost-benefit ratio, adopting a value-driven approach, upfront planning, allocating resources efficiently, informed decisions, operational efficiency, which are shown in Table 3 and Figure 2.

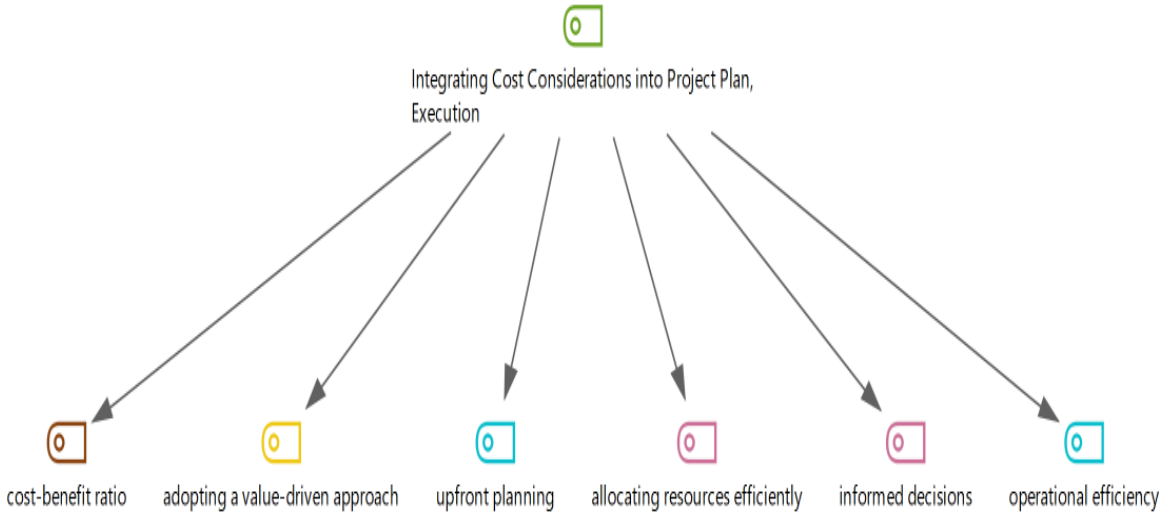

Figure II. Hierarchical code-subcode model for the theme of integrating cost considerations into project plan, execution

Participant 10 provided the most representative response in this context, which is as follows:

Participant 10: "Cost considerations are integrated from the start through detailed budgeting, forecasting, and the application of lean principles to identify cost-saving opportunities without compromising the quality of our travel

experiences. This includes negotiating with suppliers and optimizing internal processes."

Table IV. Codes for the theme of overcoming unexpected challenges with lean principles

Codes	N	%
More efficient process	8	22,22
Reducing time to market	7	19,44
Simplifying	6	16,67
Quickly reassess	5	13,89
Streamlining communication channels	4	11,11
Data integration	4	11,11
Minimizing disruptions	2	5,56
TOTAL	36	100,00

In the third interview question, participants were asked to describe a situation where they faced unexpected challenges during a project. If so, how did lean principles guide their approach to overcome these challenges and contribute to overall project success? Based on the answers to the third question, regarding the theme of "Overcoming Unexpected Challenges with Lean Principles", the coding analysis resulted in: more efficient process, reducing time to market, simplifying, quickly reassess, streamlining communication channels, data integration, minimizing disruptions, which can be seen in Table 4 and Figure 3.

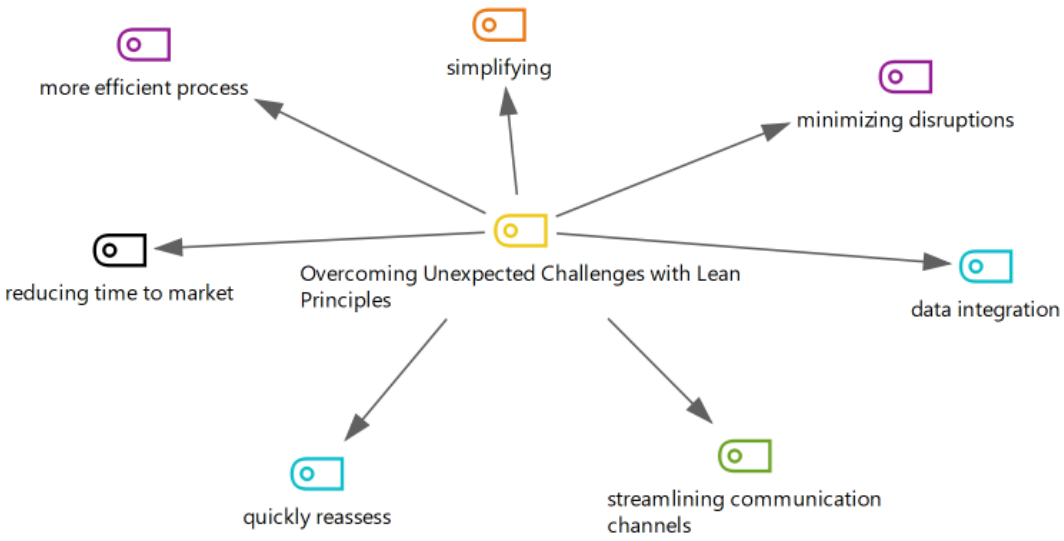

Figure III. Hierarchical code-subcode model for the theme of overcoming unexpected challenges with lean principles

Participant 4 provided the most typical response in this context, which is as follows:

Participant 4: "When a product delivery was delayed, lean principles helped us reassess and optimize our existing inventory, ensuring uninterrupted service. We implemented a just-in-time inventory system as a result, which improved our response to future supply chain challenges."

Table V. Codes for the theme of aligning project plans with strategic vision

Codes	N	%
Long-term objectives	7	19,44
Regular communication	7	19,44
Sustainability	6	16,67
Incorporating flexibility	5	13,89
Market leadership	4	11,11
Innovation	4	11,11
Improving accessibility	3	8,33
TOTAL	36	100,00

The fourth interview question asked participants how they ensured alignment with the company's long-term goals and strategic vision when developing project plans and schedules. Based on their answers, regarding the theme of "Aligning Project Plans with Strategic Vision", the coding analysis resulted in: long-term objectives, regular communication, sustainability, incorporating flexibility, market leadership, innovation, improving accessibility, which are shown in Table 5 and Figure 4.

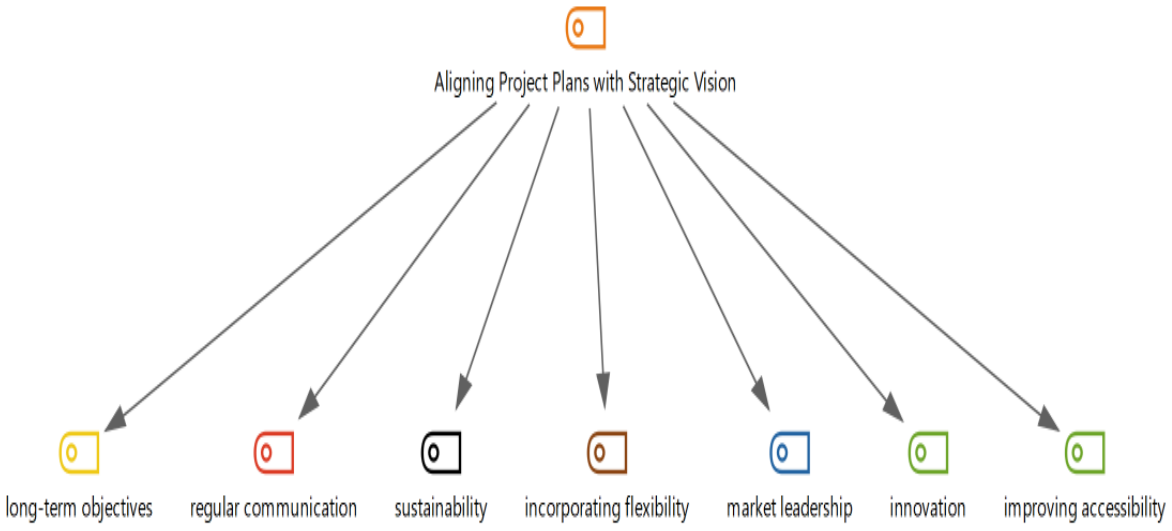

Figure IV. Hierarchical code-subcode model for the theme of aligning project plans with strategic vision

In this respect, participant 3 provided the best example response, which is as follows:

Participant 3: "We align project plans with our company's strategic vision by ensuring each event supports our overarching goals of quality, innovation, and customer satisfaction. Regular reviews with key stakeholders ensure that every event contributes to these long-term objectives."

Table VI. Codes for the theme of effective communication and relationship building

Codes	N	%
Transparency	7	20,00
Clear expectations	5	14,29
Regular update meetings/strong communication	5	14,29
Garnering support	5	14,29
Managing stakeholder expectations	5	14,29
Minimizing resistance	4	11,43
Mutual feedback	4	11,43
TOTAL	35	100,00

The fifth interview question asked participants to share their experience and example, if any, on how has effective communication and relationship building played a role in establishing trust and credibility with team members, stakeholders, and customers. Based on their answers, regarding the theme of "Effective Communication and Relationship Building", the coding analysis resulted in: transparency, clear expectations, regular update meetings/strong communication, garnering support, managing stakeholder expectations, minimizing resistance, mutual feedback, which are shown in Table 6 and Figure 5.

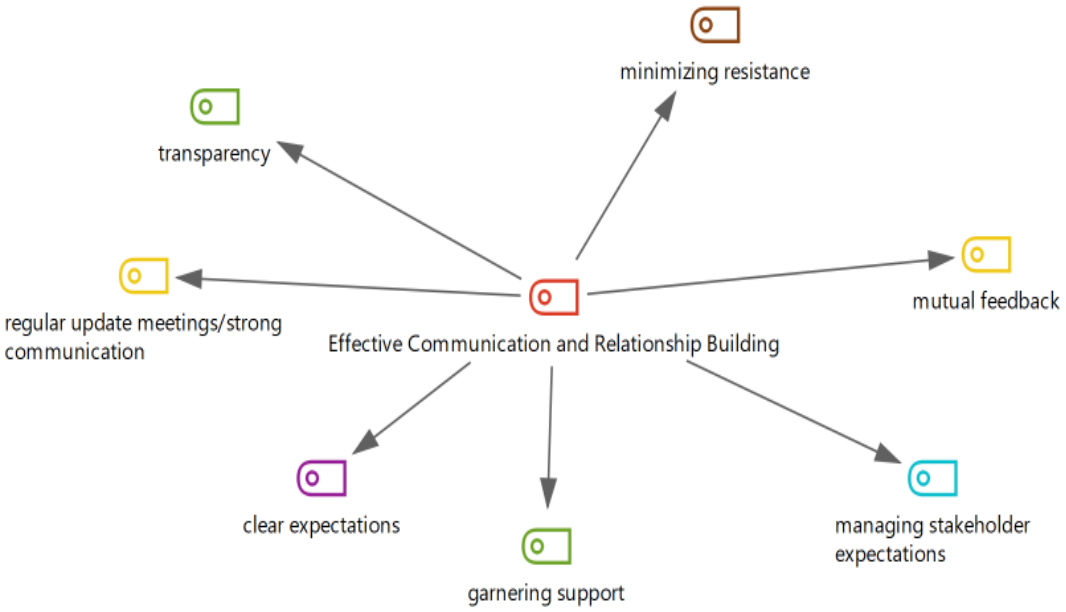

Figure V. Hierarchical code-subcode model for the theme of effective communication and relationship building

In this context, participant 9 provided the most excellent response, which is as follows:

> *Participant 9: "A key example of effective communication was during our initiative to integrate technology in classrooms. By engaging teachers, parents, and students through workshops, surveys, and meetings, we built a strong consensus on the approach, establishing trust and ensuring the initiative's success."*

Table VII. Codes for the theme of lean principles in SMEs' future viability and expansion

Codes	N	%
Sustainable growth	9	20,00
Customer satisfaction	6	13,33
Efficiency	6	13,33
Improving processes	5	11,11
Eliminating waste	5	11,11
Adaptability	4	8,89
Higher productivity	4	8,89
Establishing alternative suppliers	3	6,67
Reducing costs	3	6,67
TOTAL	45	100,00

In the sixth interview question, participants were asked how they foresee the integration of lean principles contributing to the future viability and expansion of SMEs. Based on their answers, regarding the theme of "Lean Principles in SMEs' Future Viability and Expansion", the coding analysis resulted in: sustainable growth, customer satisfaction, efficiency, improving processes, eliminating waste, adaptability, higher productivity, establishing alternative suppliers, reducing costs, which are shown in Table 7 and Figure 6.

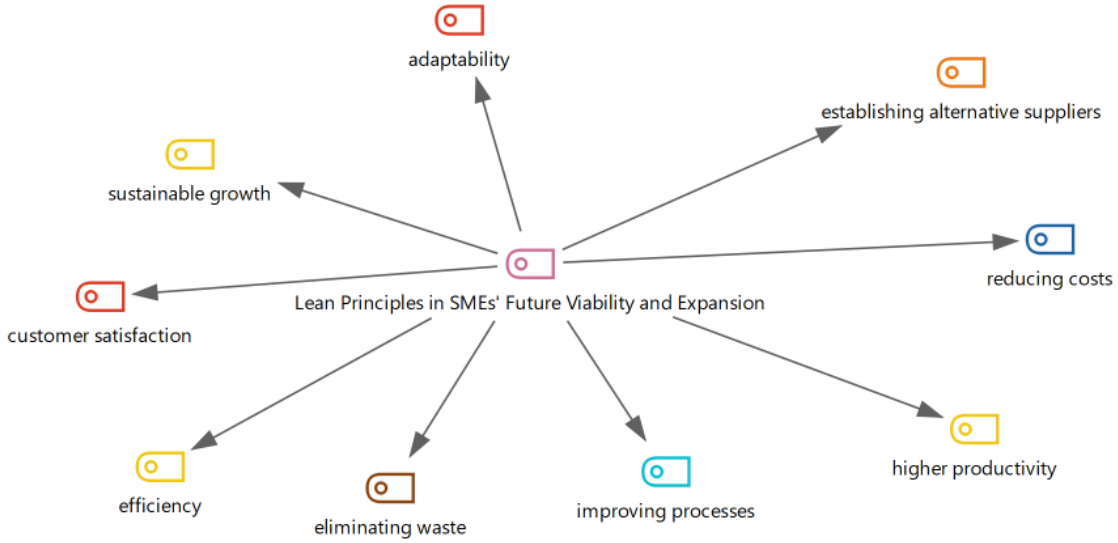

Figure VI. Hierarchical code-subcode model for the theme of lean principles in SMEs' future viability and expansion

In this context, participant 6 provided the exemplary response, which is as follows:

Participant 6: "The integration of lean principles is essential for SMEs to enhance efficiency, reduce costs, and improve customer satisfaction. These practices will be crucial for adapting to market changes, fostering innovation, and ensuring sustainable growth in the competitive fashion industry."

IV.II. Cross-table Analysis

Table 8 lists the most frequently given codes according to the (age, gender) variables taken as demographic variables of the participants within the scope of the study.

Table VIII. Results regarding cross-table

	Female	Male
Lean Project Management and Cost Productivity Increase		
Allocating more resources	5	2
Cost saving	7	4
Reduction in development time	5	3
Integrating Cost Considerations into Project Plan, Execution		
Cost-benefit ratio	3	4
Overcoming Unexpected Challenges with Lean Principles		
Reducing time to market	4	3
More efficient process	4	4
Aligning Project Plans with Strategic Vision		
Long-term objectives	5	2
Regular communication	4	3
Effective Communication and Relationship Building		
Transparency	4	3
Lean Principles in SMEs' Future Viability and Expansion		
Sustainable growth	7	2

The analysis indicates that female participants focus more on resource allocation, cost saving, and reduction in development time during LPM practices than male participants. Male respondents focus more on the cost-benefit ratio and reduction in time to market, indicating they are more focused on process optimization and meeting unexpected challenges. Female respondents also reflect on long-term goals and regular communication, indicating strategic long-term fit and regular communication are important parts of project planning. Transparency is more important for female respondents since it creates trust and builds credibility in the project environment. Sustainable growth is also vital for female respondents and indicates that sustainable growth is one of the most important factors for the future viability and expansion of SMEs.

IV.III. The Code Matrix Browser Analysis

Code matrix browser analysis helps identify key participants whose contributions were particularly significant in the data set. Figure 7 shows the code matrix browser results.

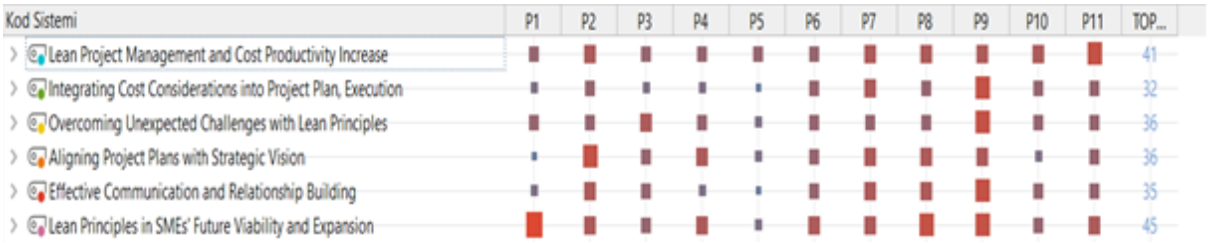

Figure VII. Code matrix scanner related code matrix scanner

The analysis of the Code Matrix Browser shows that participants 8 and 10 made the most substantial contributions to the study. The interviews with these participants had more relevant segments or excerpts that had a code, which means their responses were deeper and richer than those of the other participants. This means that their thoughts and views will most probably provide a better and more accurate reflection of the themes and topics considered in the paper. In all likelihood, these participants gave rich, detailed information that contributed to the richness of the general study.

IV.IV. Code Cloud Analysis

The cloud analysis of the code shows that "cost saving" is the most occurring term from the participants, which can be seen in Figure 8.

Figure VIII. The codes' cloud

V. DISCUSSION

In the first analysis, the finding showed that lean practices can lead a high level of cost efficiency, which is, no doubt, required for the financial health and competitive performance of SMEs. LPM also realign the resources towards value-adding activities, thereby resulting in enhanced productivity and efficient utilization of the resources. Besides, this improves team morale since the impact of their efforts justifies the success of the whole project. Again, based on the value-adding, SMEs are in a well situation to attain a better performance level and more financial health. Those results are consistent with prior studies. For instance, lean implementation within SMEs helps to re-allocate resources to those activities that actually enhance value, subsequently resulting in higher productivity and more effective resource use (Torri et al., 2021). SMEs could use lean management to enhance the performance of the organization and its competitive advantages in the market (Sahoo & Yadav, 2018). In addition, a research has also shown the beneficial effects of lean adoption on the cost-effectiveness, product quality, and delivery time of SMEs (Anuar, 2023).

Based on the second interview question, the participants pointed out the importance of benefit-to-cost evaluation and the necessity for ensuring a value-based SME approach. It could be said that this would ascertain that each investment is projected towards at least one dimension of the project so that investment decisions are prudent and that there is maximum efficiency in the allocation of resources. Also, detailed budgeting and/or forecasting at the upfront planning may enable anticipation of costs and identification of opportunities for costs savings. This approach may facilitate the smooth running of the project and makes it easy for the concerned to make informed decisions throughout the life of the project. Moreover, LPM principles instill the wise use of resources, thus helping to keep costs low and operational efficiency high. The integration of both approaches combines considerations of the cost component in planning and finishing projects to be completed within the project, therefore ensuring that SMEs are cost-efficient. Literature includes valuable results that align with those findings. LPM principles have been found to encourage the judicious use of resources, thus managing costs and improving operational efficiency among SMEs (Nor et al., 2022). Resource allocation is important in SMEs, particularly in the context of challenges in the supply chain, for which modern planning and control methods are needed in order to navigate the complexities and increase the chances for survival (Pérez-Cabañero et al., 2012). Furthermore, the utilization of agile project management practices could provide the SMEs with a more flexible and value-driven approach toward the challenges imposed by new

product development, characteristic of software development practices (Žužek et al., 2021). Implementation of cloud ERP among SMEs can bring some advantages, such as deployment cost reduction, increased scalability, and superior accessibility; therefore, technology adoption can boost operational efficiency and cost-effectiveness (Haddara & Elragal, 2022; Tongsuksai et al., 2023).

In the third interview question, participants stressed the need to design and adapt appropriate processes for SMEs to counteract unforeseen challenges. Waste reduction and customized workflow, through lean principles, might enable SMEs to minimize the time to market and respond to unforeseen challenges. There is also the fact that the situation implies the need to simplify and re-assess the problem immediately. Lean principles imply the division of a larger process into smaller segments that are manageable; thereby, unforeseen problems are identified and solved quickly. Resilient response to unforeseen challenges is based on improved communication. The open channel of communication between employees eliminates noise and increases the speed of solving a problem. The above-strategies will empower the SME to respond correctly to challenges, henceforth the success of a project and efficiency in operation. Literature addresses areas for improvement, which resonates with the need for SMEs to continuously refine their processes to overcome unexpected difficulties (Psomas et al., 2018). A study underlines the advantages of simplifying internal procedure and enhancing performance management through Enterprise Resource Planning. SMEs must have in place simplified internal procedures to achieve better efficacy and agility to adapt to the unforeseen challenge (Federici, 2009). Effective communication within the supply chain is vital for SMEs to overcome obstacles and ensure smooth operations, especially when faced with unexpected challenges that require quick responses (Setyaningsih & Kelle, 2021).

The fourth analysis revealed that project plans should secure or align long-term organizational objectives. Organizing continuous corporate communication between stakeholders may ensure that such alignment is effectively achieved. The project plans should be sustainable to secure the mentioned long-term objectives and overall resilience. This flexibility of the project plans will ensure that the goals are attainable and that there is continuous alignment of the plans with strategic goals. Market leadership can be derived from innovative projects that align with the strategic view. Accessible project plans can also make management of the project more adaptive to and responsive to stakeholders' needs and allow easier modifications and strategies to be flexed with new information or market conditions. Such strategies ensure that project plans are well aligned with the long-term success and

sustainability of the company. These findings are in line with prior studies. For example, the dimension of open innovation and sourcing for ideas—working and collaborating with others outside an entity— corresponds well to the idea of designing effective processes to find solutions. This allows SMEs to tap into expertise from outside in the process of making ways of working streamlined and optimal (Bianchi et al., 2010). On the other hand, a study proposed the role that leadership and strategic management can play in the implementation of LPM projects within SMEs (Belhadi et al., 2019). Moreover, the implementation of lean in SMEs has been indicated as the cause of enhancing lean and green performance, and the two ideas tie in quite well, underlining that one cannot run an effective operation without being responsible for the environment (Thanki & Thakkar, 2019). Another study shows that lean practices positively influence cost-effectiveness, product quality, and delivery time, which stands out as a benefit due to the efficient process (Mangngenre, 2023).

The fifth analysis highlighted the importance of transparency in communication. Clearly stated expectations may also lead to effective interactions and few misunderstandings. Communication and participation need to be maintained through regular updates and good communication systems. The right stakeholders, well-chosen, may offer their support and commit to the project/organization. Harmony needs to be created among the stakeholders' perception, their viewpoints, and the project's objectives by communicating realistic expectations. A well-managed change through communication is able to mitigate apprehensions and concerns about change. Sharing mutual feedback mechanisms can be achieved in long-term partnerships that are created through continuous improvement. All these strategies build trust and credibility, which are important aspects of project implementation and organizational success. A study illustrates that insufficient communication across organizational levels and lack of distribution of lean benefits hinder application of lean principles (Yadav et al., 2019). Establishing clear and efficient communication among all employees involved in the production process allows for timely problem-solving of unexpected difficulties for SMEs (Ajibade et al., 2019). Top management involvement and effective communication are the most important factors for the successful implementation of quality improvement programs in SMEs (Dora et al., 2013). Lean thinking, such as workplace improvements with the use of safety and training, postulates the seriousness of forthright and honest communication to promote a culture of sustainability and innovation within SMEs (De et al., 2020).

The last coding analysis demonstrated that participants, basically, emphasized the need for sustainability of growth in business for long-term survival. Efficiency, waste elimination, and customer satisfaction can also be achieved using lean principles. Moreover, efficiency, cost reductions, and productivity are linked to the processes of improvement emphasized by lean principles. Furthermore, adaptability can ensure SMEs to remain relevant and they can catch up with new opportunities. In addition, efficiency and continuous improvement will result in higher productivity, ensuring more output from less resources. An alternative supplier may also be acquired so as to sustain the productivity and mitigate risk. Hence, cost reduction is expected, as they are able to optimize the processes and eliminate waste, thereby reinvesting in growth initiatives. In brief, these strategies allow SMEs to remain viable, competitive, and capable of expanding in the future by leveraging lean management principles. These findings are in consistent with a research evidence that brings about clear and tangible improvements in operational performance in SMEs while implementing lean practices; this includes a decrease in accidents, machine downtime, and inventory levels. The evidence, therefore, points to the fact that LPM has a favorable effect on SMEs (Ali et al., 2020). Another research proves the successful lean manufacturing progress model and the implementation of SMEs, wherein 10 improvement projects achieved huge milestones within six months. Among them are the reduction of lead time, efficiency metrics like welding per hour and packaging per hour, and the improvement of working process efficiency and raw material storage (Huang et al., 2022).

Furthermore, cross-table analysis revealed nuanced gender-based differences in perspectives and priorities during Lean Project Management (LPM) practices. Such differences provide valuable insights into how diverse approaches can enhance the effectiveness of LPM. Lastly, code cloud analysis gave a clear view that cost-saving measures are of critical importance and relevance with respect to LPM within SMEs. Participants continuously agreed that one of the most important benefits or objectives of implementing lean principles in project management is the reduction of costs. This goes to indicate that cost efficiency and financial optimization are key drivers of success and sustainability with respect to SMEs leveraging LPM practices.

VI. CONCLUSION

The aim of this study is to assess the multifaceted benefits of LPM in SMEs through responding the two main research questions: what are the benefits of LPM for SMEs in terms of cost reduction, improved productivity, and project success? How does the concept of LPM affect the long-term sustainability and growth of SMEs regarding their overall business strategy? The research was conducted using a qualitative approach through semi-structured interviews with 11 participants representing SMEs operating in different industries. The data were analyzed and interpreted using MAXQDA 2020.

Analysis has yielded valuable insights, providing some key benefits of LPM for SMEs. First of all, cost-effectiveness by avoiding irrelevant features that lead to tremendous cost savings and low project development time, increased productivity, and better team morale are direct results of a focus on value-added activities. Secondly, upfront project planning and execution take place by incorporating cost perspectives, detailed budgeting, forecasting, and value-driven approaches for efficient resource allocation and operational efficiency. Lean thinking also helps SMEs make informed decisions and maintain cost control. Third, the lean principles give efficient process design to SMEs; the principles cut across the time to market of products and quicken the communication channels. Quick reassessment and problem-solving strategies manage unexpected difficulties appropriately, ensuring the success of the project. Fourth, regular communication, and flexibility are necessary for ensuring that the plans for a project are in line with the long-term objectives of the company. LPM guarantees sustainable growth, market leadership, and innovation, all fitting into the strategic view of an SME. Fifth, the major principles involving the stakeholder are transparency, regular updating, and mutual feedback to gain trust and credibility with the team, stakeholders, and customers. Project results will be successful if there is effective communication and relationship-building with the stakeholders and their support in managing their expectations. Lastly, the principles of lean make growth and customer satisfaction sustainable by making the value delivery process efficient, eliminating waste, and being adaptive. All these factors support SME viability and expansion over the long term.

Limitations

The study has several limitations that should be noted. The study was conducted by interviewing only 11 participants, and this might not offer a comprehensive view that is characteristic of the diverse range of industries and contexts found in the SME sector. A

larger and more diversified sample will be needed in future research. By deriving qualitative data from semi-structured interviews, it could limit the generalization of the results. Quantitative studies could help in the validation of the found statistics. Triangulating results among participants with other data sources can increase the robustness of the results.

Practical Insights

The findings suggest several practical lessons for SMEs considering the adoption of LPM. They are recommended to focus on eliminating non-value-added activities and to concentrate on features and processes that only contribute directly to the success of the project and customer satisfaction. Cost considerations should be integrated through detailed planning and forecasting, which will allow SMEs to prudently manage resources and maintain control over project costs. The development of flexible project plans responsive to the changing contexts and at the same time addressing the potential unpredicted and challenging conditions is of utmost importance in the achievement of strategic goals and assuring success of the projects. Creation of transparent and regular communication channels between all stakeholders will build trust, manage expectations, and foster a collaborative project environment. It is necessary for an SME to inculcate a culture of continual improvement, ensuring that all procedures are reviewed and fine-tuned, if necessary, to improve efficiency, productivity, and competitiveness.

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