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Research Article

The effect of sustainable product design on corporate sustainability: The example of manufacturing enterprises in Türkiye

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ABSTRACT

Companies must meet the requirements and expectations of their customers to ensure their existence. In this sense, the main goal of this study is to show the impact of sustainable product design on corporate sustainability. The universe of the study consists of business managers who work in the metal products and machinery industry. They operate in Şanlıurfa province, which is located in the south-eastern region of Türkiye and is the second-largest city in the region and is an industrial city. We used random sampling method in the study. We collected data from the participants by meeting face to face with the help of the questionnaire we created. We analysed the collected data by applying quantitative research methods and statistical analysis techniques. We found that there is a positive and significant relationship between sustainable product design and the sub-dimensions of corporate sustainability. We also reported that sustainable product design has an impact of approximately 16% on corporate sustainability. In 2022, we encountered some difficulties while collecting data due to the effects of the Covid-19 outbreak. It is prepared for that the findings gained in this investigation will contribute to the literature by shedding light on studies planned for the future. In addition, the study was limited to correlation and simple regression analyses. It is recommended that other methods of analysis be used in future studies.

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INTRODUCTION

To increase sustainability, companies strive to have a structure with a strong strategy and planning method that complies with current and future policies and actions related to environmental regulations. Scientists and entrepreneurs are constantly striving to reduce global warming and resource depletion. In the design stage, which is one of the most significant stages to make sure product sustainability, the environmental impact of the product should be minimized [1]. Companies in the position of industrial consumers reinforce environmental concerns with their sustainability

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goals. Making sustainability environmentally friendly in the design phase can help create a livable world [2]. Management policies for sustainability goals have played an important role in raising awareness through various programs and designs [3]. In recent years, middle-income consumers are known to be more sensitive to environmental issues. This is reflected in various studies. For example, [4] found that consumers are choosing to purchase environmentally friendly products, but among the 17 countries studied, Indian consumers have the highest percentage of respondents who are skeptical about sustainable products. In today's world, where consumer desire to buy eco-friendly products is increasing, industrial companies need to develop their sustainable policies in this direction. The need for sustainable product design has been studied by many researchers, especially to reduce the carbon footprint. Sustainable design and planning play an important role in reducing energy costs, reducing greenhouse gas emissions, and controlling waste and pollution. In the light of all this information, the main objective of this study is to identify companies' thoughts on sustainable product design. For this purpose, the province of Şanlıurfa, which is located in the southeast of Türkiye and is one of the most important industrial cities in the region, constitutes the universe of the study. It is assumed that the results of applied research will contribute to the literature. Moreover, it is assumed that conducting such a study in Şanlıurfa for the first time will provide direction for various studies to be conducted on this topic in the future.

CONCEPTUAL FRAMEWORK

Sustainable Product Design

The concept of sustainable product design refers to the development of the product by taking into account the economic, social, and environmental functions during the design of the product [5]. Product performance: durability, reliability, the purchase should be considered not only in terms of aesthetics but also in terms of criteria such as global warming, reduction of energy consumption and reuse, recycling, and remanufacturing [6, 7]. A sustainable product requires solutions that meet both functional and environmental requirements to achieve operational, economic, and social goals [8, 9].

Explain the concept of sustainable product design in one of the studies [10]. Corresponding to them, substantial aspects should be picked up into detail at the construction stage. In addition, the terms "design for the environment, eco-design, eco-efficient design, environmentally friendly production, green design, and life cycle design" are explained in the corresponding study. In a scientific research, sustainable product design is examined in three sub-dimensions. These; classified as environmental, social and economic dimensions. For companies to have sustainable products, these three dimensions should be considered throughout the life cycle of the products.

Managers need accurate information and product life cycle data to realize the design of a sustainable product. Life cycle assessment tools are costly and time-consuming [11]. It will be difficult to use this method at an early stage of design when detailed information about the final product is not available. Therefore, it is difficult to assess the environmental impact of the design phase of a product, a particular material, or a production process [12]. Assessing the environmental impact of products requires knowledge of material properties, product form, size, and manufacturing processes. However, these data are difficult to obtain in the conceptual design process when there is no reference [6]. The current research suggests that products are limited to considering the general functional characteristics of products rather than the detailed design parameters because it is difficult to access detailed information in the early design stage [13]. Sustainable design is an approach that encourages companies to minimize their environmental impact through product design while increasing their market advantage and innovation [10].

Corporate Sustainability

The concept of sustainability has been defined as “meeting the needs of a business's direct and indirect stakeholders (such as shareholders, employees, customers, pressure groups, communities, etc.) without compromising its ability to meet the needs of future stakeholders”. Businesses carry out environmental, social and economic activities to be sustainable [14]. The fact that wastes become unmanageable and natural resources are consumed or damaged has revealed the concept of sustainability within businesses [15]. The concept of corporate sustainability has become something that needs to be worked on for organizations today and its existence is not even considered. However, the mentioned sustainability phenomenon is more about strategic management than how conflicting logics can coexist [16]. In its most general form, corporate sustainability refers to the capacity of businesses to sustain any situation or process for a certain period of time [17]. Sustainability-oriented strategies in businesses take into account all possible environmental, social and economic factors that affect stakeholders and sustainable development. Strategies focused on corporate sustainability, businesses for the environment; It covers preferences that aim to create long-term value and competitive advantage by considering ecological, social and economic factors [18].

Environmental Sustainability

The concept of environmental sustainability was first used by the World Bank. The term “environmentally responsible development” was used [19]. Next, the notion became current as “environmentally sustainable development” [20]. The notion of environmental sustainability is today used. For example, P. Sutton, Environmental Sustainability Com-

missioner for the Australian state of Victoria, defined environmental sustainability as "the ability to maintain valued qualities of the physical environment" [21]. The OECD Environmental Strategy for the First Decade of the 21st Century has contributed importantly to the concept of environmental sustainability [22]. These are first, reconstruction (renewable resources are used and their use should not exceed long-term natural reclamation rates). Second, substitutability (non-renewable resources are used efficiently and their use is replaced by renewable resources or other types of capital). By taking third, assimilation (the release of hazardous or polluting substances into the environment does not exceed the absorption capacity). Finally, it is possible to explain it as removing the barriers to recycling.

Ecological sustainability is an approach based on the notion of ecosystem services. These are both renewable and non-renewable resources and the ability to absorb wastes that benefit people and thus enhance their well-being. In order to enjoy and use these services for centuries, humanity must learn to live within the limits of the biophysical environment. Unlike the economic or social spheres, environmental sustainability implies open to the development and application of goals that are hard tied to the biophysical properties of the system. The borders of the ecosystem serve as a fixed series of highly special pressures at local and universal scales [23].

Economic Sustainability

Economic sustainability is more adopted by many firms on an international scale. It means that companies should consider the economic, environmental, and social effects of their activities [24]. The dimension of economically sustainable consumption raises another question about whether a product should be purchased. To some extent, consumption benefits the economy and consumer welfare. [25]. However, it has been shown that purely materialistically motivated consumption does not contribute to personal happiness [26]. Moreover, lowering consumption levels can bring benefits to businesses, society, and the environment that are detrimental to consumers' well-being in some situation [27]. Lembet, explained the concept of economic responsibility in his scientific study as "being profitable for shareholders, creating good employment opportunities for employees, producing quality products for customers" [28]. In another empirical study, it was mentioned that economic sustainability is most emphasized to incorporate sustainability and is the focus in achieving these types of sustainability [29].

Cultural Sustainability

Innovative sustainability solutions that benefit the environment, society, and businesses depend on the willingness of leaders to develop a "culture of sustainability" within their companies. Research has shown that an organization's culture operates at multiple levels, and developing and sustaining a culture of sustainability requires leaders to address each of these levels. The first level consists of visible artifacts and behaviors. These are the tangible and specific parts of the system that can be observed by those who are not part of the system. The second stage of culture includes the values that the system embraces. These are plainly set forth values and methods of treatment that show how the organization chooses to present itself privately and externally. The final stage of managerial culture. It consists of shared basic assumptions that guide the behavior of organizational members. These assumptions are often implicit and operate at an unconscious level, but are thoroughly embedded and easily integrated into the life of the organization [3].

The complex nature of corporate culture presents managers with unique challenges as they seek to create awareness among their employees that sustainability can not only reduce the company's impact on the natural environment but also significantly impact the company's long-term health and success. Research has shown that changing a culture is an extensive undertaking and that managers must use multiple tools to change the decision-making framework in which managers and employees evaluate and ultimately generate solutions to the challenges facing the organization [30]. Despite the complexity and time involved, cultures can be changed through the diligent efforts of the organization's leadership team [3].

Social Sustainability

In now's earth, firms are progressively seeking to gain a competitive advantage by incorporating sustainability into their business strategies. Sustainability discourse usually focuses on triple bottom line standards with targets for economic, social, and environmental purposes [31]. Companies focus on building organizational resources and capabilities in ways that are difficult to imitate and then building the foundations for a lasting, sustainable competitive advantage. In theory, its application is very intuitive as it shares certain terms with other common sustainability studies, such as "resources" and "sustainable" [32]. Social sustainability is directly related to gaining a place in the middle of society.

The means of social sustainability; first, using social sustainability as a source forces industry officers to change from a short-term to a longer-term context. Second, a multidimensional view of social sustainability allows managers to improve corporate social sustainability. It shows that employees, customers, and other corporate stakeholders play a significant role in effectively improving social sustainability. So, it becomes the possible to reduce the perception of the lack of benefits of social sustainability [33].

Managerial Sustainability

Sustainable management is the integration of management and environmental management principles and their development in a seamless relationship between environ-

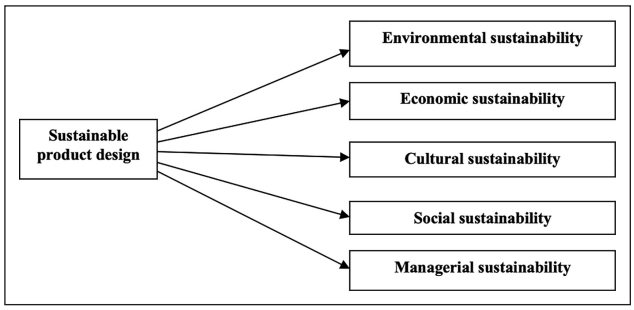

Figure 1. Conceptual model of the study. Source: Authors' Construction.

ment and management. Sustainable management is not a pure structure, because it requires some components intertwined with environmental and management processes [34]. Sustainable management requires the internal development of environmental and social measures and external contribution to sustainability in society and economy [35]. Sustainability management tools enable managers to operationalize sustainability-oriented strategies and coordinate activities within a company. He points out that companies pursuing corporate sustainability need practical decision-making tools to facilitate the design and selection of sustainable products, processes, and programs. In addition, such management tools can be useful for the corporate change and learning process [36]. In this study, we showed our research model, which we developed in accordance with the literature, in Figure 1.

METHODOLOGY

Within the scope of the study, sustainable product design was used as an independent variable. Dependent variables consist of 5 variables. These are respectively; environmental sustainability, cultural sustainability, social sustainability, economic sustainability, and managerial sustainability. The study is based on the quantitative research method. To collect data, a questionnaire consisting of two parts, based on the original scale and covering demographic information, was created. Before collecting data, on 9 December 2021, Adıyaman University Social and Human Sciences Ethics Committee was applied and permission was requested. By its decision dated March 2, 2022, and numbered 222, the relevant unit allowed the collection of information using a questionnaire. First of all, the validity and reliability of the scale were tested for the collected data.

H1: Sustainable product design has a positive and significant impact on the environmental sustainability of the company.

H2: Sustainable product design has a positive and significant impact on the cultural sustainability of the company.

Table 1. Distribution of businesses by industry

Business line	Frequency distribution (%)
Metal kitchen	71
Communication machines	2
Electrical machines	6.3
Vehicle machinery	3
Elevator machines	10
Car repair	3
Other machines	4.7

H3: Sustainable product design has a positive and significant impact on the social sustainability of the company.

H4: Sustainable product design has a positive and significant impact on the economic sustainability of the company.

H5: Sustainable product design has a positive and significant impact on the business sustainability of the company.

Population and Sample of the Research

In the organized industrial zone of Şanlıurfa, 95 firms in the metal goods and machinery industry work. With a share of 11% in the amount industry of Şanlıurfa, it ranks third after the metalware and machinery, ceramics, glass, and non-metalware industries. The managers of 90 of the 95 companies in the metalware and machinery industry in Şanlıurfa were examined using a questionnaire.

Scales

The scale we used in this study was taken from a previously validated and reliable study. In this line, the managerial sustainability scale established by [37] was utilized to measure managerial sustainability. The scale consists of 39 items and five sub-dimensions. We used 5-point Likert type in the original scale. We asked the participants to mark the most appropriate option among the options "1=I strongly disagree, 5=I strongly agree". In the study, sustainable product design, i.e., expressions related to the independent variable, was adopted by [38] from their study.

Descriptive Analysis

There are two analyses in this part of the study. These consist of the distribution of companies by business sector and the demographic characteristics of the participants. We have shown the results for descriptive statistics in Table 1 and Table 2.

As seen in Table 1, we found that the highest participation was in the "Metal Kitchen" section with 71%.

We have shown the information on the demographic characteristics of the participants in Table 2. When examining Table 2, the highest number of participants

Table 2. Demographic information

	Frequency distribution (%)
Gender	
Male	73
Female	23
Age	
≤25	12
26–35	28
36–40	19
41–45	20
≥46	21
Education	
Primary education	15
High school	24
Associate degree	23
Graduation	25
Past graduate	13
Duty period	
≤5	13
6–10	20
11–15	24
16–20	23
≥21	20
Status	
Business owner	12
Business partner	20
General director	27
Departmental manager	23
Other	18
Level of Income	
≤10. 000 TL	12
10001–15000 TL	20
1501–20000 TL	19
20001–25000 TL	23
≥25001	26

consists of men, the highest number of participants is in the age group "26-35", the educational level consists of participants at the highest level "undergraduate", when examining the working hours, workers between "11-15" years have the highest weight. When the professional position is measured, we have determined that the highest participation includes the “General Manager” position and eventually, when we look at the income level, the highest participation belongs to the income group of “≥25.001 TL”.

FINDINGS

In this part of the research, we have had the results of the analysis we have made regarding the factor reliability analysis. Then, we performed correlation analysis to determine the relationship between the variables we included in the research model. We included the findings of multiple regression analyzes to test the validity of the hypotheses.

Factor and Reliability Analysis

We applied factor analysis to determine how many dimensions the questionnaire items used in the research were and what their factor loads were. For factor analysis, we used the principal component analysis method and varimax rotation method. From the data obtained as a result of factor analysis, we noticed that the scale has a 6-dimensional structure.

As a result of the analysis we have made, we have revealed that the scale used consists of 6 dimensions as in the original scale. Factor loading values of sustainable product design; Values ranging from 0.602 to 0.865 and factor loads of environmental sustainability; We found that it took values ranging from 0.678 to 0.926. In addition, the factor loads of cultural sustainability; It has values between 0.681 and 0.911, and the factor load values of economic sustainability; We found that it took values between 0.679 and 0.915. Factor loads of social sustainability; Factor loads of corporate sustainability and values between 0.598 and 0.954; We found values varying between 0.596 and 0.965.

We noticed that the value we obtained as a result of factor analysis in terms of model factor loads varied between 0.596 and 0.965. Also, the percentages of variance of the factor loadings were determined: Values between 58% and 68%. The fact that the variances of the factor loadings are above 50% indicates that the validity of the analysis is quite high [39].

We used Cronbach's alpha internal reliability coefficients to measure the reliability of the research model. As a result of the analysis of the data we obtained, we noticed that the Cronbach alpha coefficients were greater than 0.7. We found that this result is compatible with the literature [40]. We have shown the factor analysis results of the study in detail in Table 3.

Correlation Analysis

Correlation analysis was performed to test the presence of the relationship between dependent and independent variables in the research model.

When Table 4 on sustainable product design is examined, there is a low and significant relationship between environmental sustainability (r=0.234), a positive, low, and significant relationship between cultural sustainability (r=0.223), and a positive relationship between economic sustainability (r=0.42). We revealed the existence of a significant and

Table 3. Factor and reliability analysis results of variables

Variables	Statement	Factor loading	Varicance %	Cronbach's Alpha
Sustainable	1	0.865	63.652	0.821
product design	2	0.775		
	3	0.844		
	4	0.621		
	5	0.602		
Environmental	1	0.865	62.520	0.860
sustainability	2	0.678		
	3	0.921		
	4	0.796		
	5	0.768		
	6	0.926		
Cultural	1	0.713	58.980	0.768
sustainability	2	0.745		
	3	0.865		
	4	0.681		
	5	0.911		
Economic	1	0.813	63.942	0.742
sustainability	2	0.796		
	3	0.679		
	4	0.915		
Social	1	0.598	58.624	0.786
sustainability	2	0.678		
	3	0.741		
	4	0.753		
	5	0.852		
	6	0.954		
	7	0.856		
	8	0.854		
Managerial	1	0.852	68.920	0.892
sustainability	2	0.874		
	3	0.965		
	4	0.869		
	5	0.961		
	6	0.941		
	7	0.875		
	8	0.652		
	9	0.624		
	10	0.762		
	11	0.742		
	12	0.751		
	13	0.596		
	14	0.623		
	15	0.711		

moderate relationship. We found a low and positive relationship between sustainable product design and social sustainability (r=0.236). Finally, we reported a moderately positive and significant relationship (r=0.381) between sustainable product design and corporate sustainability.

Regression Analysis and Testing Hypotheses

We used multiple regression analysis to determine the relationship levels between sustainable product design and environmental, cultural, economic, social, and corporate sustainability variables. We used SPSS 15.0 analysis program for all statistical analyses. We show the results of multiple regression analysis in Table 5. We have shown the regression equation below to test the hypotheses of the independent variables in the research model.

$$Y=\beta 0 ++ \beta 1+ÇS + \beta 2+KS + \beta 3+ ET + \beta 4SS+ \beta 5+YS$$

We included sustainable product design (ST) in the model as an independent variable in the multiple regression equation. We used the concepts of environmental sustainability (ES), cultural sustainability (CS), economic sustainability (ES), social sustainability (SS), and corporate sustainability (TS) as dependent variables. The β value in the equation is the standardized beta coefficient. The β-coefficients and significance levels (p) of the variables as a result of the regression analysis are shown in Table 5.

As seen in Table 5, we found that sustainable product design has a positive and significant effect on environmental sustainability with a β-coefficient of "0.396" and a significance level of "0,000". In its working model, "H1: Sustainable product design has a positive and meaningful impact on the company's environmental sustainability." hypothesis was supported.

We found that the effect of sustainable product design on cultural sustainability has a positive and significant effect with the significance level of "0.405" and the β coefficient "0,000". In this case, the hypothesis "H2: Sustainable product design has a positive and significant impact on corporate cultural sustainability" was supported.

In addition, we found that the effect of sustainable product design on social sustainability has a positive and significant effect with a β-coefficient of "0.398" and a significance level of "0.004". The hypothesis "H3: Sustainable product design has a positive and significant impact on corporate social sustainability" was supported.

We found that sustainable product design has a positive and significant effect on economic sustainability, with a β-coefficient of "0.425" and a significance level of "0.003". In this case, the hypothesis "H4: Sustainable product design positively and significantly impacts economic sustainability" was supported.

We found that "0,426" and β coefficient "0,000" have a positive and significant effect on the impact of sustainable product design on corporate sustainability. In this case, the hypothesis "H5: Sustainable product design has a positive

Table 4. Mean, standard deviation and correlation values of the variables

Variables	1	2	3	4	5	6
Sustainable product design	1.000					
Environmental sustainability	0.234*	1.000				
Cultural sustainability	0.223*	0.211*	1.000			
Economic sustainability	0.420**	0.398**	0.463**	1.000		
Social sustainability	0.236*	0.324**	0.520**	0.542**	1.000	
Managerial sustainability	0.381**	0.376**	0.216*	0.541**	0.452**	1.000
Average	3.210	2.980	3.520	3.230	3.620	3.260
Standard deviation	0.720	0.563	0.765	0.820	0.924	0.886

**: Correlation is significant at the 0.01 level (double tail); *: Correlation is significant at the 0.05 level (single tail).

Table 5. Regression analysis results for sustainable product design in research

	Dependent variables	Std. β	t	p	Tolerance	Variance insertion factor
	Environmental sustainability	0.396	3.966	0.000**	0.702	2.975
Independent	Cultural sustainability	0.405	3.485	0.000**	0.694	1.957
variable	Economic sustainability	0.425	2.986	0.003*	0.698	2.001
	Social sustainability	0.398	2.997	0.004*	0.689	3.260
	Managerial sustainability	0.426	3.432	0.000**	0.735	1.650
	F			3.342**		
	R^2			0.159		

*: Correlation is significant at the 0.05 level (single tail); **: Correlation is significant at the 0.01 level (double tail).

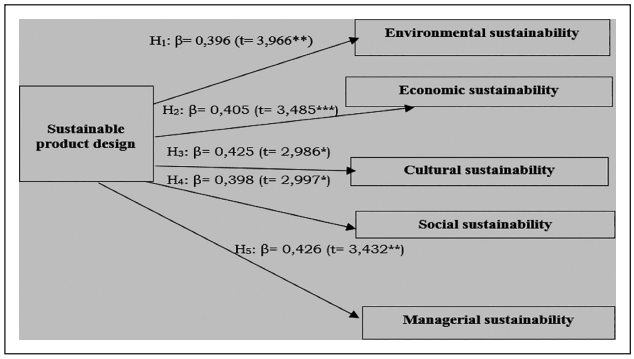

Figure 2. Structural path model results. Source: Authors' Construction.

and significant impact on corporate sustainability" was supported. When the F (3.342) and R2 (0.159) values were analyzed in the regression analysis, it was found that the model was at the "0.000" significance level and explained 15.9% of the variance in sustainable product design. According to this result, 15.9% of corporate sustainability is explained by sustainable product design. We have shown the findings regarding the statistical analysis of the hypotheses we developed within the scope of the study in Figure 2.

DISCUSSION

In this study, we examined the effects of sustainable product design on corporate sustainability. Customer satisfaction is the first priority in today's manufacturing companies. In this direction, the most important goal of the companies is to produce in accordance with the beliefs, attitudes, and expectations of the individuals who make up the society. In an academic study, the concept of sustainability mentioned that the competitive opportunities of companies are not limited to the goods and services they produce. In this context, the performances of companies are evaluated not only according to their economic performance but also according to their performance against the environment and society. In this direction, today's companies have started to adopt a structure that is sensitive to environmental and social problems. There are factors such as organizational culture, innovation, human resources, value creation for customers, supply chain and business ethics, and social responsibility that affect the concept of sustainability in companies [41]. There are many studies in the literature that talk about the impact of social, environmental, societal, social, and environmental criteria in ensuring corporate sustainability [42–44].

Mentioned sustainable product design in their studies. In the related study, it was emphasized that functionality, cost, and environmental impact should be considered in the design of the product [3]. It is mentioned that this situation constitutes approximately 70% of the production and cost. Three criteria were addressed in product design. These; It was listed as "cost-benefit analysis, maximizing the number of reusable parts and minimizing the amount of waste". In this study, we examined whether the sustainable design has an impact on corporate sustainability. We noticed that there was a research gap in the literature. We have not come across a study directly investigating the relationship between sustainable product design and corporate sustainability.

In the model created in this study, we revealed the effect of the independent variable of sustainable product design on the dependent variables of environmental, cultural, social, economic, and corporate sustainability. We applied factor analysis to determine the variables that make up the research model. As a result of the analysis, we found that the sub-dimensions supported the model, that is, we reached results that are compatible with the original scale. The variables we used within the scope of the study; We looked at the mean, standard deviation, and correlation values and used regression analysis to test the hypotheses established in the model. The results of the analysis we have done within the scope of the study show parallelism with the research findings [45, 46]. On the other hand, the finding that sustainable product design positively and significantly affects social sustainability is consistent with the study [47]. Another result obtained in the study was the conclusion that sustainable product design affects economic sustainability. When the studies in the literature are examined, our study is consistent with similar results to the study of [48]. Again, having similar findings to our study, [49] mentioned that sustainable sourcing and product designs can improve the overall performance of companies and reduce social and financial risks.

To sum up, all hypotheses developed in this study, which examined the effects of sustainable product design on corporate sustainability (environmental, cultural, economic, social, and managerial), where supported. It has been supported that sustainable product design carried out by businesses has a positive and meaningful effect on corporate sustainability. Results consistent with similar studies in the literature were obtained. Considering that sustainable product design has environmental, economic, and social aspects, the relationship between corporate sustainability sub-dimensions was supported in this study. Today's modern businesses should carry out their production by considering social and environmental factors. Profit maximization logic alone does not seem sufficient for business continuity today. Considering the social and environmental stakeholders of the enterprises, in other words, mutual interests come to the fore according to the social change theory. Enterprises that lack environmentally friendly production; face negative reactions from society, that is, consumers and customers. Today's customer profile is more healthy and in the production phase; climate change, zero waste, businesses that use recyclable energy prefer their products and services more. Business owners and managers must consider environmental criteria at every stage of production. Today's customer profile is more healthy and in the production phase; climate change, zero waste, businesses that use recyclable energy prefer their products and services more. Business owners and managers must consider environmental criteria at every stage of production. Today's customer profile is more healthy and in the production phase; climate change, zero waste, businesses that use recyclable energy prefer their products and services more. Business owners and managers must consider environmental criteria at every stage of production.

Contribution

Evidence gathered during the study revealed that sustainable product design affects the sustainability of businesses in general. For companies to survive, they need to develop products with sustainable product design in mind. In other words: If companies want to ensure their existence, they must consider factors such as cost, quality, and efficient use of time, as well as customer, social and natural environmental factors. On the other hand, the study found that sustainable product design has an impact on environmental, cultural, social, economic, and corporate sustainability. In addition, it has been determined that there is a positive and significant relationship between sustainable product design and the sub-dimensions of corporate sustainability.

Practical Implications

Within the scope of the study, it is possible to make some suggestions for market actors, namely practitioners.Firm partners and supervisors should carry out by getting into charge the attitudes of the public and consumers before moving into manufacture. Especially in today's world, global warming, the Covid-19 epidemic and the resulting loss of life and the problems in the supply of raw materials have caused the purchasing power of customers to decrease. At the same time, the Covid 19 pandemic has negatively affected the character of the men who make up the society. Global warming, earthquakes, hot conflicts on a raund scale affect the activities of manufacturing companies. To reduce these effects, it is suggested to focus on customer expectations and requirements in product design. Sustainable product design; Considering that they should carry out their environmental, production

activities by taking into account the social and individual effects, this should be considered important for the acceptance of companies and for them to carry out their activities in a healthy way. In short, customer satisfaction, environmental factors (waste management, waste disposal, use of recyclable energy), taking an active role in social projects (for example, building schools and places of worship, participating in cultural events, supporting employment projects), planned employment activities, supporting sports activities. It is assumed to support a number of socially oriented projects such as making donations.

CONCLUSIONS

We have obtained some results in this study, in which we investigated the effect of sustainable product design on corporate sustainability. First, we examined whether there is a relationship between sustainable product design and corporate sustainability and whether this relationship is meaningful. As a result of the statistical analysis, we determined that there is a positive and significant relationship between sustainable product design and the sub-dimensions of corporate sustainability (environmental, cultural, social, economic and management). When we examined the relationship levels between sustainable product design and the sub-dimensions of corporate sustainability, we noticed that the highest correlation was between sustainable product design and economic sustainability sub-dimension (r=0.42). We found the lowest correlation between sustainable product design and cultural sustainability (r=0.223). We developed 5 hypotheses within the scope of the research and all of these hypotheses were supported by statistical analysis. On the other hand, sustainable product design explained about 16% of the change in corporate sustainability. We realized that sustainable product design has an impact on all sub-dimensions of corporate sustainability. It is recommended that companies show the necessary sensitivity about sustainable product design in order to maintain their existence. Within the scope of the research, 5 hypotheses were developed and all of these hypotheses were supported. In other words, sustainable product design was found to explain about 16% of the change in corporate sustainability. In addition, it has been determined that sustainable product design has an effect on all sub-dimensions of corporate sustainability. In order for companies to survive, they need to show the necessary sensitivity about sustainable product design.

Limitations

In this study, we examined the thoughts of the managers of companies operating in the metal products and machinery industry in the organized industrial zone of Şanlıurfa, one of the most important industrial cities of the region, in the southeastern region of Türkiye, on sustainability and sustainability product design. The main limitation is that the study was carried out at a single point in Türkiye and in a sector operating in a certain sector. Another limitation is that the data collected in the study is based on statistical correlations and simple regression analysis. Coinciding with the year 2022, when the severity of the Covid 19 pandemic is felt most, emerges as the biggest limitation that prevents data collection in different business sectors. On the other hand, we consider it an important limitation that the study is based on a cross-sectional questionnaire. We limited the statements in the questionnaire to the variables of sustainable product design and corporate sustainability.

Future Research

In this study, we investigated the thoughts of manufacturing company managers on sustainable product design and corporate sustainability. We mentioned in the previous section that there are some limitations of the study. In this direction, it would be appropriate to make some suggestions for future studies. Since the research is only about managers, it is suggested that future studies should also be done on employees, business owners and customers. Since the study is a longitudinal study, the cross-sectional design of future studies will contribute to the literature. In addition, we consider it an important shortcoming that the present study was carried out in only one region. We recommend that prospective planned studies be carried out in different regions and in different countries. In addition, the survey method was used in the study. It would be appropriate to use other research methods such as interview methods and observation management in future studies. In this study, we examined the effects of corporate sustainability on sustainable product design. In future studies, it is recommended to examine various mediation effects such as corporate social responsibility, organizational support, employee motivation, stakeholder relations and customer loyalty.

DATA AVAILABILITY STATEMENT

The authors confirm that the data that supports the findings of this study are available within the article. Raw data that support the finding of this study are available from the corresponding author, upon reasonable request.

CONFLICT OF INTEREST

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

ETHICS

There are no ethical issues with the publication of this manuscript.

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