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The Mediating Role of Green Innovation and Environmental Performance in the Effect of Green Transformational Leadership on Sustainable Competitive Advantage

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Abstract: Owing to global warming and changing environmental factors, the world has been experiencing negative and major changes. Society is showing a strong reaction to these environmental problems through marches, protests, and political initiatives, which also demonstrate the need for a new understanding of leadership. In this respect, green transformational leadership emerges as a potential solution. The current study aims to determine the mediating role of green innovation and environmental performance in the effect of green transformational leadership on sustainable competitive advantage. With this aim, a model was formed by utilizing the Natural Resource-Based View (NRBV) theory. To test the model, data were collected through a survey answered by 412 people working in SMEs in Istanbul and analyzed via the Smart-PLS program. The results indicate that green innovation had a moderate mediating role, and environmental performance had a low mediating role in the effect of green transformational leadership on sustainable competitive advantage. In light of these results, the sustainable competitive advantage predicted by the NRBV theory was found to have been achieved.

Keywords: green innovation; environmental performance; green transformational leadership; sustainable competitive advantage; SMEs; NRBV

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1. Introduction

Currently, 3.6 billion people live in areas which are sensitive to the effects of climate change. According to the World Health Organization (WHO), seven million deaths every year are estimated to be related to climate change. For instance, according to the WHO, within the three-month summer period of 2022, four thousand people in Spain, one thousand people in Portugal, and four thousand five hundred people in Germany died because of high temperatures. This situation is worsening day by day due to the impact of extraordinary natural events such as excessive rainfall, floods, and storms caused by climate change [1]. Organizations that pollute water resources with CO_2 and other harmful gases are held responsible for the increasing impacts of climate change [2]. Nevertheless, a serious public reaction against climate change has begun to emerge. As a response to these public movements, many international organizations have been formed worldwide to

take measures [3]. For example, some environmental obligations have been undertaken by countries within the scope of the sustainable development goals set by the United Nations. Countries also practice these obligations within organizations through laws [4]. Countries are observed to be removing incentives, especially for polluting sectors, and are introducing new taxation and rules. In this regard, carbon tax applications are increasing gradually in the world, and as of 2023, there are 38 different carbon tax applications in 30 different countries. Carbon tax promotes sustainable development through economic means by reducing carbon emissions [5]. These vary from country to country; for example, in Japan, it is stated that the average price of a ton of carbon tax in 2023 was USD 29.1 [6]. The Norwegian government increased the carbon tax by 8.6% in 2020, whereas the Portuguese government increased the carbon tax by 84.6% in 2020 [7]. Organizations are trying to find innovative solutions to reduce the use of raw materials, paper, water, and various inputs, and to collect and treat waste to avoid being exposed to high levels of carbon tax [8]. In this respect, a new leadership approach was needed to create solutions to the problems that are arising due to global environmental obligations. Green transformational leadership has emerged as the most popular leadership theory [9].

A green transformational leader strives to ensure that employees take initiative and spread innovative thinking throughout an organization, firstly by creating a vision which will address green concerns [10,11]. If environmental challenges can be converted into opportunities by the green transformational leader, it will be possible for the organization to obtain a sustainable competitive advantage over its competitors. In this respect, the Natural Resource-Based View (NRBV) theory [12] suggests that organizations develop capabilities for the efficient use of natural resources to address environmental challenges. Considering the Natural Resource-Based View (NRBV) theory [12], many previous studies have found a significant relationship between green transformational leadership, environmental performance, and green innovation. In the study carried out by Akram et al. [13] with 205 people in Pakistan in which the NRBV theory was utilized, the interaction between green transformational leadership and environmental performance was explained by developing and sharing a green vision and mission that creates green values and organizational culture within the organization. In the study conducted by Xin and Wang [11] in Spain, it was observed that the distinctive green resources of the organization, using the NRBV theory, enabled it to create and develop its green capabilities. Green capabilities are found to be effective in meeting customers' continuous green demands, creating value, and gaining a green competitive advantage, and green transformational leadership has a regulatory effect on these variables. In the study conducted by Van et al. [14] in Vietnam, using the NRBV theory, it was claimed that employees with a higher level of green awareness can gain a sustainable competitive advantage by increasing the environmental performance of the organization. Meanwhile, the study also showed that transformational leadership had a moderating effect on the relationship between green awareness and green innovation. Begum et al. [9] conducted a study in China, and found that green transformational leadership had an impact on the use of organizational capabilities and resources to promote green innovation through the NRBV. It is possible to increase the number of studies given as examples in accordance with the literature. Although it is seen that the reviewed studies mainly emphasize sustainable competitive advantage, it is realized that sustainable competitive advantage is not measured as a variable and is expected to emerge as a result of NRBV. Bearing this in mind, the present study seeks answers to the following questions.

Can green transformational leadership, effected by NRBV, truly create a sustainable competitive advantage?

If green transformational leadership can create a sustainable competitive advantage, what is the role of environmental performance and green innovation in this process?

In light of the questions stated above, the present study aims to reinforce the theoretical understanding in the literature with practice, which makes it different from others. The study is expected to make contributions to the literature in that it proves the existence of a sustainable competitive advantage in real life, which is one of the expected results of NRBV theory. Moreover, it aims to explain the relationship between green transformational leadership and other variables in organizational life.

The study was carried out with 412 senior and middle-level managers working in SMEs in Istanbul. SMEs were specifically selected due to their small and flexible structure with limited opportunities. Istanbul constitutes one of the settlements with the highest population in the world. Nearly 16 million people live in a total area of 5461 km^2. According to the 2019 data from the Turkish Statistical Institute, Istanbul Province hosts 797,302 of the 3,221,000 SMEs in Turkiye. In the same report, it is suggested that SMEs in Turkiye enable employment for more than 11 million people. SMEs appear to be common in the manufacturing and construction sectors which involve polluting businesses [15]. In the present study, Istanbul was preferred owing to the difficulties of managing the pollution that is expected to emerge as a consequence of the presence of too many SMEs in a limited area. Turkiye's special situation and Istanbul being the largest commercial activity area were considered in the study. The current study is expected to measure the mediating role of environmental performance and green innovation in the effect of green transformational leadership on sustainable competitive advantage and to contribute to the present literature.

2. Theoretical Background and Formation of Hypotheses

2.1. Environmental Issues Related to Turkiye

Current global warming and the melting of glaciers mainly result from population growth, industrial production, non-renewable resources, and unconscious social understanding [16]. The fact that some countries will disappear as a result of unexpected natural events such as droughts, floods, and storms occurring due to global warming, melting glaciers, and rising water levels has raised environmental awareness [4]. For example, in 2022, Turkiye spent approximately USD 9 billion, which corresponds to 0.93% of its total gross national product, on environmental problems [17]. In Turkiye, water pollution is a primary environmental problem in 32 provinces, while air pollution is a primary problem in 27 provinces, waste in 19 provinces, noise pollution in 2 provinces, and erosion in 1 province. According to the Report of the Ministry of Environment and Urbanization of Turkiye, Istanbul is one of the main cities experiencing water and air pollution and waste problems [18]. Due to the increasing number of similar examples, it has become necessary to implement reforms that could ensure the establishment of balance between the environment and organizations by the sustainable development goals [19]. A serious environmental problem has emerged as developed countries send their dirty and environmentally damaging production to developing countries. According to the World Bank, developing countries are responsible for 46% of CO_2 emissions in the last 25 years [20]. Turkiye is an important country that needs to be examined because of its developing economy and different approaches toward waste management. Turkiye releases 4.97 tons of CO_2 per capita per year, which is above the world average of 4.47 [21]. While Turkiye produces 40 million tons of waste on an annual basis, it also imports 34.6 million tons. With China restricting waste imports, Turkiye ranks first in the world in this respect [22]. When OECD data are considered, it is realized that Turkiye does not have a good performance in terms of the environment in general. It is observed that there are deficiencies compared to other OECD countries in many criteria such as the use of coal and fossil fuels for energy, development of environmental management technologies (patents), waste management, older vehicles used in transportation, and more carbon emissions [23]. Istanbul seems to be

under greater threat than Turkiye due to increasing urbanization and population. There is a situation in which air pollution is reduced to some extent by using natural gas instead of coal, water needs are solved by establishing systems that transport hundreds of kilometers away, and wastewater management is attempted through new treatment plants. Taking the serious pollution problems in the Marmara Sea into consideration, concerns about the future of Istanbul are increasing. For this reason, Istanbul needs to make more effort to become a sustainable city [18].

In 2015, the United Nations announced the sustainable development goals, which include seventeen targets, and envisaged that these targets would be achieved by 2030. The majority of the targets seem to be related to the protection of the environment [24]. The targets in question including SDG3 (Good Health and Well-Being); SDG6 (Clean Water and Sanitation); SDG7 (Affordable and Clean Energy); SDG9 (Industry, Innovation, and Infrastructure); SDG11 (Sustainable Cities and Communities); SDG12 (Responsible Consumption and Production); SDG13 (Climate Action); SDG14 (Life under Water); and SDG15 (Life on Land) are realized to impose serious restrictions on countries' environmental policies [25]. According to the report prepared by Dublin University on the SDGs, Turkiye ranks 72nd among 167 countries. When the report in question is paid attention to, Turkiye is realized to have serious problems in terms of the SDGs, especially regarding the environment and climate [26].

Turkiye, a developing country, is expected to solve its environmental problems. In terms of the present study, the issues explained above lead us to predict that SMEs have a limited infrastructure system and will face serious environmental problems in the future. It is thought that it will be difficult to obtain certificates such as good production practice, sustainability, and environmental management, which are obligatory for SMEs to sell products in international markets.

2.2. Theoretical Background

According to the Resource-Based View theory, possessing valuable, rare, or irreplaceable resources forms the basis for the organization on its way to achieving a sustainable competitive advantage. The valuable resources of the organization ensure the formation and implementation of efficient and effective strategic plans [27]. It is possible to classify the resources of the organization as human, structural, and relational. Human resources refers to experience, knowledge, and abilities. Structural resources, on the other hand, cover both concrete concepts such as capital, facility, and equipment and abstract concepts such as corporate culture. Lastly, relational capital resources involve the organization's internal and external network and stakeholder relationships [11]. Inspired by the Resource-Based View (RBV) theory [28], the main basis of the present study is the Natural Resource-Based View (NRBV) theory [12], which concentrates on environmental problems. The theory in question attempts to explain the improvement of environmental performance through an analysis of which natural resources organizations use to produce their final products [9]. Organizations provide green innovative solutions to improve their environmental performance. As a consequence of the continuous and sustainable implementation of solutions, organizations are expected to gain a sustainable competitive advantage [29]. Sustainable competitive advantage is a race and key to survival in the global business world. Furthermore, sustainable competitive advantage is an important strategy search to combat the numerous negative effects that the organization creates on the environment [30].

If environmental challenges can be converted into an opportunity by the green transformational leader, it will be possible for the organization to obtain a sustainable competitive advantage over its competitors. In this respect, the Natural Resource-Based View (NRBV) theory [12] suggests that organizations develop capabilities for the efficient use of natural

resources so as to control environmental challenges. The theory in question is applied in three different stages. In the first stage, the aim is to reduce waste and decrease emissions and contamination in business processes. The second stage involves reducing the environmental impact of the product throughout its life cycle such as evaluating the process from raw material supply to final consumption and the disposal of hazardous substances. In this regard, the recycling of products such as old textile products, washing machines, and refrigerators can be paid attention to. The third stage includes the development of sustainable products and technologies with a low impact on the environment [9]. NRBV puts forward that valuable, rare, and inimitable resources and capabilities form the basis for sustainable competitive advantages. The theory proposes an organizational climate that includes technological and product innovation to overcome environmental challenges. Managers and employees are expected to move towards the same goal in creating the organizational climate. By increasing the skills of employees in the light of the organizational vision, performance results such as high efficiency, less waste, higher quality, and profit will be transformed [24]. In the light of NRBV theory, employees are expected to gain cognitive ability in terms of reducing industrial waste and pollution as green-thinking individuals [9]. With the help of NRBV, green transformational leadership is expected to promote green innovation in the sector of the organization and increase the ability to use organizational capabilities and resources through the cognitive reactions of employees. Therefore, NRBV suggests that the company's position in the market, image, brand value, and competitive advantage are difficult to imitate for competitors, and the acquired talent is based on the natural strategic resources of the organization [8]. For example, while the number of electric vehicles in use in the world was only 0.11 million in 2012, this figure increased to 6.8 billion in 2020. Electric vehicles have some advantages such as lower fuel and maintenance costs, being quieter than fossil fuel vehicles, and reducing CO_2 and noise pollution [31]. Despite some problems in battery technology and some shortcomings of electronic systems, electric vehicles are realized to have a great impact on the century-old vehicle production giants and increase their market shares day by day.

As a result of the innovation offered by NBRV, green products came into existence. The concept of green products was introduced to ensure the balance between the development of organizations and the natural environment [27,32,33]. Green products can be described as products which cause less harm to the environment, are composed of partially recycled components, are produced with a focus on energy saving, or are offered to the market with less packaging [16]. As a consequence of increasing awareness about environmental protection with the SDGs, organizations appear to be turning their attention towards the production of products and services that reduce environmental costs and meet consumer demand by reducing the negative impact on the environment through green innovation [34]. With increasing consumer awareness and government incentives worldwide, it is realized that 27% of consumers are willing to pay more for green products [35]. According to the 2023 China Consumer Trends Report, 73.8% of consumers prefer green, environmentally friendly brands, products, and services in their daily lives [36]. In the study by Luckho et al. [37], 74% of the participants state that they feel under social pressure to adopt green practices. Green practices are known to bring technological innovation and trigger improvements in performance [38]. It seems that there is a need for strategic management for organizations to strengthen their production structures with green innovation so as to meet the increasing demand for environmentally friendly products and services and to achieve a strategically sustainable economic and environmental performance [39]. Solving environmental problems has made a new leadership approach for organizations necessary to survive in an environmentally friendly developing market structure. In this regard, green transformational leadership has become a phenomenon [9].

2.3. Formation of Hypotheses

The leader organizes complex processes for high performance by forming a vision for the organization's present and future activities in society and in the market [40]. Transformational leadership refers to the fact that the leader is a role model with his professional and ethical behaviors toward employees, and employees respect and trust in the leader [41]. The leader is expected to explain the future vision about the strategic goals of the organization with inspiring motivation and guide his employees to act at this vision point [33]. Employee creativity must be stimulated and supported by the leader in order to increase organizational performance [42]. The leader increases employees' commitment and loyalty to the organization by enabling individual support to relieve employees' concerns and increase their well-being [27]. To maintain and monitor the sustainable competitive advantage, creating a system that is suitable for the measurable and continuous improvement of organizational performance is required. Taking the complex nature and characteristics of the concept of sustainability into consideration, it is necessary to form an organizational climate and bring together all employees from the bottom to the top for a common effort [43].

Many previous studies are observed to focus mainly on large organizations. Although SMEs' environmental actions are low, it can be stated that they are at a level comparable with large organizational structures due to their large number [44]. SMEs are expected to be influenced by environmental constraints due to their numerical abundance. This is an inevitable situation, especially for SMEs located in a crowded region like Istanbul. There seem to be serious obstacles for SMEs in terms of reaching an environmentally friendly structure quickly, especially considering the limited capital and the small amount of production equipment [45]. However, green transformational leaders are needed for SMEs to overcome the obstacles. It is not possible to create an environmentally friendly structure unless there is a leader who determines a vision and acts in accordance with that vision. When the leader fosters innovation, they also motivate and encourage employees to ensure high performance [42]. In addition to encouraging innovation, the green transformational leader also motivates and stimulates employees to achieve high performance. Using the vision, the green transformational leader ensures that employees develop green working behaviors through tools such as training, skill development, promotion, incentives, and rewards [46]. By determining performance criteria for employees by the leader, the employees as a whole are expected to contribute to the green transformation. For new employees to be hired, the recruitment of candidates who comply with green business behaviors within the framework of the organization's vision comes to the fore during recruitment interviews. The aim is to transform the processes by acting collaboratively with employees and other stakeholders to ensure that the organization is compatible with the green approach [33]. While managing all these processes, the green transformational leader encounters resistance to change from employees and concerns about decreased profitability from shareholders. Increasing punitive practices like carbon tax and supporting environmentally friendly production with grant support put organizations on an obligatory path and process for green transformation. In recent years, green transformation has enabled employees to continue working and shareholders to ensure profitability. As a result, the solutions obtained by the green transformational leader are observed to make a significant contribution to creating a sustainable competitive advantage for the organization [47]. Green transformational leadership creates a solution not only to the environmental problems of SMEs, but also to the institutionalization problems arising from the structure of SMEs. It will ensure that SMEs are formed with a professional management structure along with a green transformational leadership approach [44].

An attempt is made to explain the behaviors of the green transformational leader through NRBV within the scope of the present study. According to NRBV, green management includes concrete and intangible cognitive resources and creates a strategy that contributes to increasing performance. It is expected to create a sustainable competitive advantage as a result of revealing the hidden or social resources of the organization, determining the basic capabilities, and developing them with the contribution of innovation [48]. When the theory is evaluated in three stages as mentioned before, it is realized that the emphasis is on pollution prevention. Performance increases are observed to be expected with the introduction of innovative products along with the product life cycle, and emphasis is placed on the sustainable competitive advantage by maximizing both performance and innovation values by means of sustainable products [9], which is supported in the literature as well. Chen et al. [49] point out that green transformational leadership has a significant effect on environmental performance, and they highlight the importance of innovation in this effect. Sobaih et al. [50] reveal that the leader's clear vision and abilities come to the fore in the interaction between green transformational leadership and environmental performance. Begum et al. [9] explained the great effect of green transformational leadership on green innovation and the NRBV theory of this effect. It was found by Niazi et al. [51] that green transformational leadership moderates the relationship between green innovation and environmental performance significantly. Previous research indicates that green transformational leadership supports employees' environmental performance and green innovation [40]. Green transformational leaders influence green innovation and environmental performance positively because they can motivate and encourage employees to look at problems from new perspectives, show a goal and result that employees can achieve within the framework of the vision, and guide employees with the effect of their personal qualities [49]. Based on this, H1 and H2 were formed.

H1. *Green transformational leadership has a significant effect on green innovation.*

H2. *Green transformational leadership has a significant effect on environmental performance.*

The sustainable development goals (SDGs) set by the United Nations describe 17 different targets based on the understanding that "economic prosperity, environmental protection, and social well-being are interconnected elements that cannot be addressed separately" [52]. As stated before, environmental issues seem to be predominant among the targets. Organizations have turned their attention towards more sustainability-oriented activities with the impact of the SDGs. The main factors that are effective in this orientation include easy access to suitable or free financial resources and a strategic understanding based on long-term competitive advantage [53]. The concept of sustainable development has become an important norm today. For this reason, increasing pressure exists on organizations in terms of following green practices to gain a sustainable competitive advantage [42]. Organizations need strong leaders so as to raise environmental awareness, ensure integration with internal and external resources, develop their competencies, and capture green opportunities [54]. The green transformational leader is exposed to this pressure constantly and stimulates employees to exhibit green behavior. According to NRBV theory, leaders are claimed to inspire and motivate employees to create valuable strategic resources that are difficult to imitate for competitors in the market in order to achieve a sustainable competitive advantage [55]. Based on this, H3 was formed.

H3. *Green transformational leadership has a significant effect on sustainable competitive advantage.*

To be able to survive in the market, organizations practice environmental management activities actively to keep up with environmental trends and turn their green brand image into a competitive advantage [33]. Gaining a competitive advantage is also possible through green innovation because customers are increasingly sensitive to environmental issues and demand green products [9]. It is seen that the concept of green innovation contributes to the sustainability of the organization by taking strength from sustainable development and pollution reduction [56]. Organizations can benefit from green innovation to differentiate themselves from competitors as well as meeting environmental requirements in the market [2]. Green innovation involves the use and development of green production processes along with the production of environmentally friendly products. As a result of this understanding, a reduction in CO_2 emissions, production of the same product with the same quality with fewer materials, the use of recycled raw materials, and the consumption of less energy are observed [55]. Polyester yarn resulting from the recycling of plastic bottles and making clothes from the yarn in question can be given as good examples of this.

Practicing a green innovation system within the organization is becoming a requirement in some sectors. Particularly in the information technologies sector, sustainable design, production, and disposal systems are rewarded with bonuses, incentives, and gifts [57]. For instance, a chip company established in Taiwan consumes 156 thousand tons of water per day, consuming 5 L of water per chip. Owing to the drought in 2021, there was a serious slowdown in chip production, and many sectors in the world were affected by this [58]. Due to the problems it experienced, the sector managed to save approximately 3.2 million tons of water annually through green innovation [59]. Based on this, green innovation can be claimed to be an important figure not only in finding solutions to environmental problems but also in generating wealth by creating new market opportunities, and it is a strategic concept that influences the competitive environment and organizational culture [46]. In the study conducted by Ge et al. [60], it is stated that the short-term advantage losses of green innovation will turn into a long-term advantage, emphasizing the strong relationship between green innovation and sustainable competitive advantage. In addition, the study includes the need for relying on new information with a flexible organizational structure rather than a routine working order. Green innovation provides a sustainable competitive advantage, as explained by NRBV theory, in terms of creating valuable strategic resources that are difficult to imitate for competitors [9]. Based on this, the hypothesis H4 was formed.

H4. *Green innovation has a significant impact on sustainable competitive advantage.*

Environmental performance can be defined as how well organizations can fulfill the responsibilities which their stakeholders expect to be met regarding environmental problems [61]. Environmental performance refers to the organization's ability to meet stakeholders' expectations related to environmental issues [62]. Environmental performance is the quantitative and numerical expression of the environmental outcomes of the organization. Organizations are constantly searching for various solutions to improve their environmental performance. In this regard, factors such as reducing the negative environmental effect, increasing green practices, and obtaining the same quality products with less energy and raw materials come to the fore [29]. Previous research reveals that using environmentally friendly products, reducing pollutant emissions, reducing energy use, and saving resources can ensure a competitive advantage by increasing environmental performance [11]. Briefly, environmentally friendly production practices create enhanced competitiveness for the organization. It is possible to create new opportunities for the organization by increasing its environmental performance and increasing its environmental image and brand awareness [63]. For instance, in the research conducted by Waqas

et al. [64], it was found that sustainable competitive advantage helps to increase environmental performance in manufacturing companies. Chiou et al. [65] found that increasing environmental performance is significant in terms of improving competitiveness as well as promoting efficiency and synergy. Based on this, the hypothesis H5 was formed.

H5. *Environmental performance has a significant effect on sustainable competitive advantage.*

In the past century, organizations may have primarily aimed at making profit. However, currently, the main goals must be environmental problems and sustainability [2]. Organizations must pay attention to environmental issues for some significant reasons. These reasons involve utilizing the financial support of governments for environmental protection, being protected from environmental penalties and taxes, maintaining production and reducing costs, selling green products to customers more profitably, and achieving a sustainable competitive advantage [66]. For this to happen, green innovation must be realized. The green transformational leader is known to achieve green innovation by developing basic skills and competencies through NRBV [67]. In the organizational structure where green transformational leaders exist, employees are open to continuous learning and strive in accordance with the organization's goals and objectives [68]. Chen et al. [69] determined a positive, medium-level relationship between green transformational leadership and green innovation, and they suggested that the relationship was preliminary due to the lack of sufficient previous studies and theoretical background. Pham and Pham [10] tried to explain the regulatory effect of green transformational leadership on green innovation through socio-technical system theory, which is used to understand the mechanism of social and technical systems of organizations and how they can increase performance together. Taking other previous studies into consideration, the hypothesis H6 was formed within the scope of NRBV [9,10,55].

H6. *There is a mediating impact of green innovation on the effect of green transformational leadership on sustainable competitive advantage.*

Sustainable competitive advantage enables organizations to be better positioned in comparison to their competitors and to have the opportunity to retain more customers and staff with better sales and profit margins [29]. Moreover, sustainable competitive advantage refers to a process that involves overcoming competitive challenges, forming an organizational culture, and creating knowledge and technological development rather than following it [66]. Research in the literature confirms that transformational leadership is an important element in increasing organizational performance by promoting an innovative environment. Green transformational leaders trigger the necessary organizational climate and motivate their subordinates to participate in environmentally friendly processes. Following that, sustainable competitive advantage is achieved [70]. Based on this, the hypothesis H7 was formed.

H7. *Environmental performance has a mediating impact on the effect of green transformational leadership on sustainable competitive advantage.*

The model created within the framework of the hypotheses is presented in Figure 1.

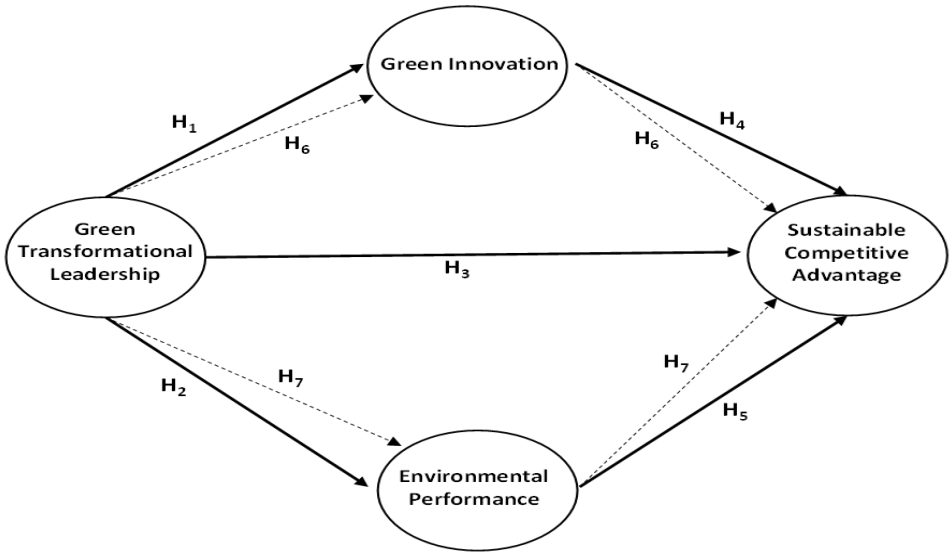

Figure 1. Research model.

3. Materials and Methods

When the green transformational leadership literature is paid attention to, it is realized that it is mainly practiced in hotels [30,42,67,71–76]. Even though hotels are thought to produce a large amount of waste, it is obvious that they do not consume as much energy as organizations producing in industry, as well as not producing hazardous and prohibited substances [2]. Thus, a study was conducted on SMEs that produce industrial-based products in Istanbul. SMEs provide 70.6% of total employment and 36.3% of total production in Turkiye [77]. The selection of SMEs stems from the fact that they are the segment that will be most influenced by environmental practices, as their access to technology and credit is more restricted and their political connections are limited [78]. Bearing this in mind, it is thought that it is important to reveal the SMEs' perspective on green transformational leadership. The study was carried out with employees working in the production sector in Istanbul. A total of 112 SMEs in the Umraniye and Tuzla districts of Istanbul were visited and a survey was conducted in 61 SMEs which permitted the study. The study was carried out with a total of 61 SMEs, 12 in the furniture industry, 13 in the textile industry, 17 in the electrical and electronics industry, and 19 in the machinery manufacturing industry. Surveys were administered to senior and middle-level managers working in SMEs. Data were collected through the convenience sampling method. Convenience sampling is the inclusion of participants who meet the criteria in the study without any special discrimination, continuing until the sample size is full [79]. It seems that there are some criticisms about homogeneity in studies using convenience sampling. As a result of the homogeneity debates, some concerns also arise about generalizability [80]. Nevertheless, considering the difficulties in obtaining answers, as the present study targets especially middle and senior-level managers, the selected method is realized to be used widely in the field of social sciences [81]. Before data collection, permission was obtained from the Giresun University Ethics Committee, dated 4 September 2024, and numbered 2024-08/08. After obtaining the necessary permission, data were collected via a printed survey form between 10 September 2024, and 10 October 2024. Surveys were collected with convenience sampling and a total of 412 people were reached, which is sufficient to statistically represent the sample. In the survey form, questions regarding age, gender, marital status, education level, and experience were used to categorize the participants. In this respect, all information was collected anonymously; that is, no names or characteristics that would describe the participants were ever requested from the participants.

In the study planned as structural equation modeling, four different scales consisting of a total of twenty questions apart from demographic variables were used. The study benefitted from a one-dimensional green transformational leadership scale consisting of six items developed by Chen and Chang [27]. Cronbach's alpha coefficient of the green transformational leadership scale was determined to be 0.903 by Chen and Chang [27], and questions were included such as, "The leader of the green product development project inspires the project members with the environmental plans". A one-dimensional environmental performance scale consisting of three items developed by Asiaei et al. [82] was used. Cronbach's alpha coefficient of the environmental performance scale was found to be 0.709 by Asiaei et al. [82], and questions were included such as, "Our organization complies with environmental regulations (i.e., emissions and waste disposal)". A one-dimensional green innovation scale consisting of 6 items developed by Shahzad et al. [83] was utilized. Cronbach's alpha coefficient of the green innovation scale was determined to be 0.833 by Shahzad et al. [83], and questions were included such as "Our organization chooses the materials of the product that produce the least amount of pollution for conducting the product development or design". A one-dimensional sustainable competitive advantage scale consisting of 5 items developed by Behl et al. [84] was used. Cronbach's alpha coefficient of the green innovation scale was found to be 0.790 by Behl et al. [84], and questions were included such as "Compared with our Competitors, we have a higher profit growth rate". The questions used in the study are presented in Appendix A.

The answers given by the participants to the questions were exposed to structural equation modeling with the Smart-PLS program. With the aim of measuring the mediation model, the number of samples was 5000 using the bootstrapping method, which is frequently preferred in the literature [85–87].

4. Findings

For the present study, 412 people were reached, and information about the participants is displayed in Table 1. It was observed that the participants were predominantly male (71.30%). It is realized that the male density is high because the production sector relies more on brute force. The number of married participants (60.90%) is observed to be higher than the number of single participants. The majority of the participants in the study were realized to be between the ages of 31–40 (54.30%), had an undergraduate level of education (39.30%), had experience between 6 and 10 years (29.40%), and had an income below TRY 50,001 (₺) (71.60%).

Table 1. Demographic findings.

Demographic	Variable	*n*	%
Gender	Female	118	28.70
	Male	294	71.30
Marital Status	Married	251	60.90
	Single	161	39.10
Age	Between the ages of 18–30	102	24.80
	Between the ages of 31–40	224	54.30
	Between the ages of 41–50	58	14.10
	51 and above	28	6.80
Level of Education	High school and below	51	12.40
	Undergraduate	162	39.30
	Bachelor	141	34.20
	Postgraduate	58	14.10

Table 1. *Cont.*

Demographic	Variable	*n*	%
Experience	5 years and below	78	18.90
	Between 6 and 10 years	121	29.40
	Between 11 and 15 years	109	26.40
	Between 16 and 20 years	62	15.10
	21 years and above	42	10.20
Income	Between TRY 20.000 and 30.000	83	20.10
	Between TRY 30.001 and 40.000	98	23.80
	Between TRY 40.001 and 50.000	114	27.70
	Between TRY 50.001 and 60.000	64	15.60
	TRY 60.001 and above	53	12.90

Before performing structural equation modeling, the validity and reliability of the scales must be measured. In this respect, the most preferred methods are Cronbach's alpha, Composite Reliability (CR), and Average Variance Extracted (AVE). In convergent validity, the CR value is expected to be greater than the AVE value [87]. The related information is displayed in Table 2.

Table 2. Factor loading values, reliability, and validity.

Items	Factor Loading	Mean	Standard Deviation	Kurtosis	Skewness
Green Transformational Leadership Scale					
Cronbach's Alpha = 0.938, rho_A = 0.939, CR = 0.951, AVE = 0.764					
GTL1	0.845	3.012	1.187	−0.863	−0.085
GTL2	0.882	3.104	1.160	−0.781	−0.186
GTL3	0.865	3.012	1.098	−0.635	−0.179
GTL4	0.887	3.027	1.067	−0.622	−0.101
GTL5	0.881	2.917	1.135	−0.821	−0.037
GTL6	0.883	2.993	1.148	−0.796	−0.063
Green Innovation Scale					
Cronbach's Alpha = 0.935, rho_A = 0.938 CR = 0.949, AVE = 0.756					
GINNOVATION1	0.843	3.425	1.197	−0.711	−0.422
GINNOVATION2	0.865	3.124	1.213	−0.871	−0.190
GINNOVATION3	0.872	3.226	1.197	−0.787	−0.221
GINNOVATION4	0.927	3.153	1.105	−0.501	−0.241
GINNOVATION5	0.891	3.141	1.205	−0.763	−0.231
GINNOVATION6	0.815	3.301	1.209	−0.721	−0.346
Sustainable Competitive Advantage Scale					
Cronbach's Alpha = 0.897, rho_A = 0.905 CR = 0.924, AVE = 0.709					
SCA1	0.850	2.801	1.336	−1.143	0.111
SCA2	0.787	2.833	1.288	−1.126	−0.048
SCA3	0.897	2.881	1.318	−1.099	0.041
SCA4	0.891	2.850	1.253	−1.050	0.012
SCA5	0.777	2.602	1.334	−1.029	0.381
Environmental Performance Scale					
Cronbach's Alpha = 0.872, rho_A = 0.873, CR = 0.922, AVE = 0.797					
EP1	0.865	2.825	1.250	−0.975	0.139
EP2	0.908	2.920	1.249	−0.995	0.115
EP3	0.903	2.772	1.262	−0.874	0.298

The Cronbach's alpha, rho_A, and CR coefficients are expected to be over 0.70, and the AVE value is expected to be over 0.50. Furthermore, factor load values must be above 0.50 for each variable separately [87]. The results show that the scales provide the desired

level of validity and reliability values. It is also required to perform discriminant validity analysis, which allows the scales to be distinguished from each other. In this regard, heterotrait–monotrait ratio analyses were conducted with Fornell and Larcker [88]. The analysis results are indicated in Table 3.

Table 3. Discriminant validity analysis.

	Fornell–Larcker Criterion				**Heterotrait–Monotrait Ratio (HTMT)**			
	1	**2**	**3**	**4**	**1**	**2**	**3**	**4**
Environmental Performance	0.893							
Green Innovation	0.814	0.869			0.899			
Green Transformational Leadership	0.722	0.796	0.874		0.796	0.848		
Sustainable Competitive Advantage	0.792	0.817	0.747	0.842	0.893	0.885	0.807	

The fact that the results obtained through Fornell and Larcker analysis have a value higher than the correlation of the AVE values of the variables reveals that discriminant validity is present. The other method, heterotrait–monotrait ratio, shows that discriminant validity of scales with ratios below 0.90 is achieved [87]. Therefore, the results confirm that the scales provide discriminant validity.

Measuring the goodness of fit values of the model is required within the scope of the literature, as well. The goodness of fit values of the model are presented in Table 4. Considering the sample and number of items, the Standardized Root Mean Square (SRMR) value should be below 0.08 and the Normed Fit Index (NFI) value should be above 0.80 [89].

Table 4. The goodness of fit values.

	Model Fit	
	Saturated Model	**Estimated Model**
SRMR	0.047	0.075
d_ULS	0.467	1.191
d_G	0.330	0.421
Chi-Square	767.475	869.160
NFI	0.901	0.888

The obtained values indicate that the model meets the necessary prerequisites for its application. Even though there are many methods for determining the mediation role in structural equation modeling, the bootstrapping method has become widespread in recent years thanks to its ease of use [90]. To test the model, the bootstrapping method in the literature was performed with a sample size of 5000 [87]. The visual showing the test results for the model is presented in Figure 2.

The results obtained through structural equation modeling are displayed in Table 5. When the *p*- and t-values in the table are considered, it is observed that all hypotheses are supported.

Figure 2. Model path diagram.

Table 5. Hypothesis test results.

Path	ß	Standard Deviation	t-Value	*p*	VAF Value	Hypothesis
Green Transformational Leadership → Green Innovation	0.796	0.029	27.110	0.000		H1 Accept
Green Transformational Leadership → Environmental Performance	0.722	0.032	22.460	0.000		H2 Accept
Green Transformational Leadership → Sustainable Competitive Advantage	0.196	0.047	4.159	0.000		H3 Accept
Green Innovation → Sustainable Competitive Advantage	0.390	0.054	7.232	0.000		H4 Accept
Environmental Performance → Sustainable Competitive Advantage	0.332	0.054	6.206	0.000		H5 Accept
Green Transformational Leadership → Green Innovation → Sustainable Competitive Advantage	0.311	0.042	7.379	0.000	0.613	H6 Accept (Partial)
Green Transformational Leadership → Environmental Performance → Sustainable Competitive Advantage	0.240	0.040	6.022	0.000	0.550	H7 Accept (Partial)

The analysis results showed a significant and positive relationship between green transformational leadership and green innovation (ß = 0.796, $p < 0.05$); therefore, the hypothesis H1 was accepted. Moreover, a significant and positive relationship was observed between green transformational leadership and environmental performance (ß = 0.722, $p < 0.05$), and the hypothesis H2 was accepted. There was a significant and positive relationship between green transformational leadership and sustainable competitive advantage (ß = 0.196, $p < 0.05$); hence, the hypothesis H3 was accepted. A significant and positive relationship between green innovation and sustainable competitive advantage (ß = 0.390, $p < 0.05$) was determined, and the hypothesis H4 was accepted. A significant and positive relationship was observed between environmental performance and sustainable competitive advantage (ß = 0.332, $p < 0.05$), and the hypothesis H5 was accepted. Green innovation was observed to have a mediating role (ß = 0.311, $p < 0.05$) in the effect of green transformational leadership on sustainable competitive advantage; therefore, the hypothesis H6 was accepted. On the

other hand, environmental performance was realized to have a mediating role (ß = 0.240, $p < 0.05$) in the effect of green transformational leadership on sustainable competitive advantage, and the hypothesis H7 was accepted. To fully determine the intermediary role, the Variance Accounted For (VAF) value must be calculated. In this respect, the VAF value being between 20% and 80% shows partial mediation [86]. In light of the obtained values of 0.550 and 0.613, it was found that mediation was achieved.

R^2 values are used as a measure for the predictive power of structural equation modeling. Additionally, Q^2 values provide information about the power and quality of the model. The Q^2 value is expected to be above zero [86,87]. Information regarding the analyses conducted is presented in Table 6.

Table 6. R^2 and Q^2 values.

Items	R^2	R^2 Adj.	Q^2
Environmental Performance	0.521	0.520	0.410
Green Innovation	0.633	0.632	0.474
Sustainable Competitive Advantage	0.728	0.726	0.510

5. Discussion and Conclusions

It is realized that countries agree on the regulation of production activities that lead to environmental degradation such as climate change, the depletion of resources, increasing water and air pollution, and the use of hazardous substances [30]. Hence, the way organizations conduct business is observed to be changing rapidly within the framework of global trends. Organizations need to concentrate on the environment to ensure better financial returns [13]. Green transformational leadership refers to a leadership that moves the goals to be achieved for green transformation beyond short-term interests and motivates and triggers employees to achieve the goals [57]. With high encouragement from the leader, it supports voluntary employee participation in terms of reducing pollution by designing environmentally friendly products with fewer resources [3]. In the study, 412 people working in SMEs in Istanbul were reached, and the mediating role of green innovation and environmental performance in the effect of green transformational leadership on sustainable competitive advantage, as explained by NRBV theory, was determined. In this regard, the result can be claimed to be compatible with NRBV theory and the literature.

According to the literature, green innovation is expected to have a positive influence as a result of the green transformational leader encouraging and motivating employees in accordance with organizational and environmental goals [29]. The analysis results showed that the positive significant relationship between green transformational leadership and green innovation confirmed the results of previous studies in the literature [16,29,55]; therefore, the hypothesis H1 was accepted. In countries with a high power distance, such as Turkiye, leaders have to monitor the interaction of employees to achieve goals. Timidity and withdrawal will cause green innovation and green performance to decrease, whereas motivation and incentive will increase them. The mentioned issue is a process which can be shaped not merely by rewarding and appreciation but also by the leader's behavior and vision. Briefly, the main driving force for developing certain behaviors in employees seems to be the leader [91]. The analysis results showed a positive significant relationship between green transformational leadership and environmental performance, which repeats the results of previous studies in the literature [11,16,33,49]. Bearing this in mind, the hypothesis H2 was accepted.

The present study proves that organizations gain a sustainable competitive advantage thanks to green innovation, which provides a sustainable competitive advantage due to the production of new products with less cost and by reducing environmental pollution [29],

and the hypotheses H3, H4, and H5 have been accepted. It is generally claimed that the theoretical basis underlying all hypotheses is related to NRBV. The theory in question regards a strategy aiming to provide a sustainable competitive advantage with innovative thinking by eliminating the negative environmental consequences of all processes including product design, raw material supply, production, sale, and disposal [19]. A partial mediation effect is observed in the study. The model reveals that green transformational leadership has a strong direct effect on green innovation and environmental performance and a weak effect on determining sustainable competitive advantage. The strong total (ß = 0.747, $p < 0.05$) effect between green transformational leadership and sustainable competitive advantage was found to decrease due to partial mediation. In this case, it is seen that the ß = 0.311 ($p < 0.05$) part of the effect between green transformational leadership and sustainable competitive advantage is explained through green innovation, and the ß = 0.240 ($p < 0.05$) part is explained through green innovation. In short, the effect of green transformational leadership on sustainable competitive advantage can be explained partially using green innovation and environmental performance variables. From this point of view, it is realized that the mediation of environmental performance and green innovation in the effect of green transformational leadership on sustainable competitive advantage is directly shaped based on NRBV theory, and the theory is confirmed. In this respect, the hypotheses H6 and H7 were accepted.

The identified issues are generally observed to be compatible with the literature. However, it should be admitted that there may be some problems with resistance to change. As SMEs have fewer employees, the leader can contact many employees and minimize problems. However, in larger organizations especially, all managers need to be assigned and trained as green transformational leaders. It is expected that the leader will attach importance to training and motivation activities so as to break down resistance to change. The leader is expected to take the lead in rewarding those who are successful in education and turning the green transformation approach into a culture for the organization [9]. When the dynamics of Istanbul are evaluated specifically in the present study, a new understanding is realized to be necessary for wastewater and water management. It seems that there are serious problems, especially in the collection of rainwater. As there is no special infrastructure system to collect rainwater in the city, rainwater mixes with sewers before it can be used and therefore loses its value. For this reason, unit water costs can be claimed to be high in Istanbul. At the same time, the lack of a special system for rainwater causes floods and spate [92]. It will be possible to establish special systems for rain harvesting in Istanbul and thus consume water at affordable and accessible costs for the whole of society. Considering that transportation opportunities in Istanbul are mainly provided via road, it is thought that the expansion of sea buses will make positive contributions to the traffic. Moreover, it seems likely that increasing the ferry lines in the Marmara Sea and the Black Sea will provide a solution to the traffic. In this respect, it is important to finalize the metro constructions that have been ongoing for years [93]. The steps taken by policymakers in Istanbul will possibly contribute to the development of SMEs. However, it is considered that it would be beneficial to implement special policies for SMEs and initiate various grant programs from the Istanbul Development Agency in this respect. Running grant programs in parallel with the SDGs are thought to facilitate access to European Union and United Nations funds. Thus, it is thought that it would be valuable to highlight projects that support green innovation and organize project writing courses for SMEs.

The results obtained from the study are generally related to SMEs, and support must be enabled by government and local policymaking mechanisms for a successful green transformation, since the decisions taken by the government or local governments affect

SMEs greatly. The carbon tax implemented in many countries is an important example in this regard. The carbon tax practiced in many countries is an important example in this regard. For instance, the USD 8 fee for a ton of CO_2 emissions in the USA has increased to approximately USD 51 per ton. It is estimated that countries will impose higher carbon taxes in accordance with the 2050 Zero Carbon Emission concept as required by the Paris Climate Agreement [94]. When the obstacles and the limited financial resources of SMEs are considered, it will not be possible to achieve green transformation without government support. For this reason, it seems that there is a lot of support. For instance, in Turkiye, the Small and Medium Enterprises Development and Support Administration (KOSGEB) is known to provide great incentives for rooftop solar panels and electricity conversion, especially for SMEs. A grant is given for 60% to 70% of the project cost, and the upper limit of the project is TRY 14 million [95]. To conclude, the decisions taken by the organization must be in accordance with the policies of policymaking and influential mechanisms such as the government and local governments.

According to the results of the present study, the theoretically accepted view suggesting that the effect of green transformational leadership on green innovation and environmental performance will provide a sustainable competitive advantage [11,13,14,16,47,55,66] has been proven in practice. In this respect, the current study reveals the importance of NRBV theory in both theoretical and practical terms.

It is thought that meaningful responses were obtained from senior and middle-level managers such as human resources managers, environmental experts, finance managers, and company partners thanks to the support and information provided by Turkiye in line with the 2053 Zero Carbon target in accordance with the Paris Climate Agreement. However, the study in question is limited by the people's current mood and level of understanding. At the same time, it is accepted that there are some limitations as a result of asking questions from four different scales. It is observed that the generalizability of the study is limited due to its cross-sectional nature and because of being conducted with a limited sample. It is known that developing countries, including Turkiye, give up heavy industry and environmentally damaging production and switch to a more environmentally friendly production approach, which poses great challenges due to the high costs involved. For this reason, the green transformational leadership approach is expected to bring some practical problems for SMEs. It is thought that it would be useful to focus on identifying these difficulties in further studies. It is also considered that measuring the resistance against change that is expected to occur during the green transformation will be helpful in terms of expanding the literature.

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Appendix A

The questions used in the study are presented in Table A1.

Table A1. The questions used in the study.

Green Transformational Leadership Scale	
1. "The leader of the green product development project inspires the project members with the environmental plans". 2. "The leader of the green product development project provides a clear environmental vision for the project members to follow". 3. "The leader of the green product development project gets the project members to work together for the same environmental goals". 4. "The leader of the green product development project encourages the project members to achieve the environmental goals". 5. "The leader of the green product development project acts with considering environmental beliefs of the project members". 6. "The leader of the green product development project stimulates the project members to think about green ideas".	Green transformational leadership scale consisting of 6 items developed by Chen and Chang [27].
Environmental Performance Scale	
1. "Our organization complies with environmental regulations (i.e., emissions and waste disposal)". 2. "Our organization limits environmental impact beyond compliance". 3. "Our organization prevents and mitigates environmental crises (i.e., significant spills)".	Environmental performance scale consisting of 3 items developed by Asiaei et al. [82].
Green Innovation Scale	
1. "Our organization chooses the materials of the product that produce the least amount of pollution for conducting the product development or design". 2. "Our organization uses the fewest amounts of materials to comprise the product for conducting the product development or design". 3. "Our organization would circumspectly deliberate whether the product is easy to recycle, reuse, and decompose for conducting the product development or design" 4. "The manufacturing process of our organization reduces the consumption of water, electricity, coal, or oil". 5. "The manufacturing process of our organization effectively reduces the emission of hazardous substances or waste". 6. "The manufacturing process of our organization reduces the use of raw materials".	Green innovation scale consisting of 6 items developed by Shahzad et al. [83].
Sustainable Competitive Advantage Scale	
1. "Compared with our competitors, we have a higher profit growth rate". 2. "Compared with our competitors, we have a higher sales revenue growth rate". 3. "Compared with our competitors, we have lower operating costs". 4. "Compared with our competitors, we have better product and service quality". 5. "Compared with our competitors, we have an increasingly higher market share".	Sustainable competitive advantage scale consisting of 5 items developed by Behl et al. [84].

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