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THE IMPACT OF GREEN BUSINESS FUNCTIONS ON SUSTAINABLE PERFORMANCE: THE MODERATING ROLE OF GREEN MANAGEMENT PERCEPTION

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Abstract

Objective: This study examines the impact of green business functions on the sustainable performance of businesses and analyzes the moderating role of green management perception in this relationship. The study assesses how green business functions—including production, packaging, distribution, purchasing, and marketing—impact sustainable performance (encompassing environmental, social, and economic dimensions) under varying levels of managerial support. Method: Quantitative research methods were employed, and data were collected from 206 participants working in businesses across different sectors. The sample was determined using purposive sampling to include participants capable of evaluating green practices and business performance. Survey instruments were developed using scales with established validity and reliability in the literature, and the data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM). Findings: The analyses revealed that green business functions have a direct, negative, and significant effect on sustainable performance, while green management perception has a positive and significant effect on sustainable performance. Conclusion: The impact of green business functions on sustainable performance is contextual and conditional. For green business functions to contribute positively to sustainable performance, they must be integrated with strong managerial support and a green management orientation.

Keywords: *Green Business Functions, Sustainable Performance, Green Management Perception, PLS-SEM.*

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YEŞİL İŞ FONKSİYONLARININ SÜRDÜRÜLEBİLİR PERFORMANSA ETKİSİ: YEŞİL YÖNETİM ALGISININ DÜZENLEYİCİ ROLÜ

Öz

Amaç: Çalışmada, yeşil işletme fonksiyonlarının işletmelerin sürdürülebilir performansı üzerindeki etkisini incelemek ve bu ilişkide yeşil yönetim algısının düzenleyici rolünü analiz etmek amaçlanmıştır. Bu çerçevede yeşil üretim, yeşil ambalajlama, yeşil dağıtım, yeşil satın alma ve yeşil pazarlama gibi yeşil işletme fonksiyonlarının çevresel, sosyal ve ekonomik performansı içeren sürdürülebilir performans üzerindeki etkileri değerlendirilerek; bu ilişkinin yönetsel algı ve destek düzeyine bağlı olarak nasıl şekillendiği belirlenmiştir. Yöntem: Araştırmada nicel araştırma yöntemleri kullanılmış olup araştırma farklı sektörlere ait işletmelerde çalışan 206 katılımcı ile gerçekleştirilmiştir. Örneklem, yeşil uygulamalar ve işletme performansı hakkında değerlendirme yapabilecek katılımcıların dâhil edildiği amaçlı örnekleme yöntemiyle belirlenmiştir. Literatürde geçerlik ve güvenirliği kanıtlanmış ölçekler kullanılarak anket soruları hazırlanmış ve bu anketler aracılığı ile katılımcıların görüşleri alınmıştır. Elde edilen veriler Kısmi En Küçük Kareler Yapısal Eşitlik Modellemesi (PLS-SEM) yöntemiyle analiz edilmiştir. Bulgular: Analizlerde elde edilen bulgularda, yeşil işletme fonksiyonlarının sürdürülebilir performans üzerinde doğrudan negatif ve anlamlı etkisinin olduğu; yeşil yönetim algısının sürdürülebilir performans üzerinde pozitif ve anlamlı etkisinin olduğu belirlenmiştir. Sonuç: Çalışmada yeşil işletme fonksiyonlarının sürdürülebilir performans üzerinde etkisinin bağlamsal ve koşullu bir yapısının olduğu saptanmıştır. Yeşil işletme fonksiyonlarının sürdürülebilir performansa olumlu katkı sağlayabilmesi için, bu fonksiyonların güçlü bir yönetsel destek ve yeşil yönetim algısı ile bütünleştirilmesi gerekmektedir.

Anahtar Kelimeler: *Yeşil İşletme Fonksiyonları, Sürdürülebilir Performans, Yeşil Yönetim Algısı, PLS-SEM.*

Introduction

In the business world, the importance of the “green” concept has increased substantially across nearly all business functions within the framework of technological and scientific developments, and green practices have become a prominent research topic. Growing environmental awareness has increased the importance and value of green functions across all business units and applications, leading to their integration into mainstream business practices.

Furthermore, growing environmental awareness, compounded by increasing environmental pollution, has further heightened the importance of green business practices. Businesses are implementing green functions that prioritize environmental responsibility, particularly in areas such as green production, green packaging, green distribution, green marketing, and green purchasing. Through these practices, businesses can establish themselves as

green enterprises within their sectors. It is also observed that green practices significantly influence management units such as green management and green organizational behavior. However, the majority of studies on green management practices are based on foreign literature. Therefore, increasing research on this topic using Türkiye as a case study is of great importance.

Thanks to green business functions, businesses benefit from minimizing ecological damage in their production processes, ensuring balanced resource use, and increasing customer satisfaction within the scope of developing environmental awareness (Garad & Khalifa, 2024). Research on this subject demonstrates that green business and management functions are important factors enabling businesses to achieve sustainability and competitive advantage, particularly due to their positive effects on organizational, social, financial, and ecological performance (Geng et al., 2016; Vargas-Hernandez et al., 2025). Notably, businesses seeking sustainability and competitive advantage adopt green management functions and integrate them into their management units even in the absence of stakeholder pressure or legal obligations. However, despite these advantages, the integration of green business functions aimed at protecting ecological balance into business units remains below the desired level today, largely due to increased costs and stakeholder impact.

It is now widely recognized that green practices developed with environmental awareness yield significant contributions, including increased productivity and market share, reduced costs, improved brand image, competitive advantage, and enhanced sustainability. Accordingly, green strategies aimed at environmental protection should be adopted and implemented across all areas of the business, from operational sub-units to management. In recent years, a notable shift in customer profiles toward environmentally conscious practices and green applications has been observed. Green practices consequently deliver significant gains in brand image by attracting environmentally responsible consumers (Garzella & Fiorentino, 2014). Adopting green environmental practices positively impacts the economic development of businesses while contributing to the preservation of ecological balance (Cosimato & Troisi, 2015). Enterprises operating within a green management framework thereby strengthen both ecological performance and economic and operational outcomes.

In this context, the research aims to examine the impact of green business functions on sustainable performance in enterprises and the moderating role of green management perception.

This study makes several important contributions to the literature. First, it challenges the dominant assumption that green business functions universally improve firm performance by demonstrating a context-dependent and conditional relationship. Second, it introduces green management perception as a moderating mechanism, highlighting the critical role of managerial cognition and strategic alignment in shaping sustainability

outcomes. Third, by integrating green operational practices with managerial perception, the study contributes to a more nuanced understanding of sustainability-performance relationships within emerging market contexts.

1. CONCEPTUAL AND THEORETICAL FRAMEWORK

In order to examine the impact of green business functions on the sustainable performance of enterprises and to analyze the regulatory role of green management perception in this relationship, research hypotheses were developed by evaluating the effects of green business functions such as green production, green packaging, green distribution, green purchasing and green marketing on sustainable performance, including environmental, social and economic performance.

1.1. Green Management Perception and Business Functions

Heightened global environmental challenges—such as climate change, resource scarcity, deterioration of ecological balance, and environmental damage caused by production activities—have necessitated robust mitigation measures. Accordingly, various green practices such as waste disposal, wastewater discharge, emission reduction, and energy efficiency in enterprise production processes are both actively encouraged and governed by legal regulations (Mustapha et al., 2017, p. 158). Green management practices in enterprises particularly support production activities aimed at protecting ecological balance. Green management activities primarily focus on production technologies and the classification of products as green (Yu et al., 2020). In general, green production refers to the economical use of energy and depleting resources in achieving target production performance, alongside the adoption of conservation and energy-saving principles that minimize environmental pollution by reducing industrial waste (Zhou et al., 2019).

Producers can develop environmentally friendly products with lower emissions for consumers with varying levels of environmental sensitivity; however, these products are often associated with higher costs. Implementing government support to encourage these manufacturers to produce environmentally friendly products is an important issue (Yu et al., 2020).

In businesses, design refers to the function that implements innovations in new products, services, processes, packaging, etc. In this context, the concept of Green Design refers to designing products not only to meet economic and performance expectations but also to minimize environmental pollution and waste throughout the product life cycle, from the raw materials used in its production to its packaging (Kasap Coşkun & Peker, 2011, p. 101).

Logistics is the heart of modern transportation (Rodrigue et al., 2013). Green logistics, also referred to as reverse logistics in the literature, is a systematic way of collecting and recovering products. It is defined as the process of managing the flow of recyclable waste and related information

from the point of origin to the point of consumption, and it holds a significant place in the literature (Karaçay, 2005, p. 317). The concept of "green" suggests environmental compatibility, and when combined with logistics, it represents an environmentally friendly and efficient transportation and distribution system (Rodrigue et al., 2013).

When examining studies on green production, design, and logistics in the literature; Campos & Vazquez-Brust (2016) examined green and lean manufacturing strategies in supply chain management; Cosimato & Troisi (2015) investigated how logistics companies cope with ecological challenges and the green technologies they use to be green and competitive; Jaggernath & Khan (2015) explored green supply chains through literature review; and Green et al. (2012) examined the impact of green supply chain activities on performance in their research on manufacturing companies. Zhu et al. (2008) developed a scale for green supply chains, while Rodrigue et al. (2013) and Büyüközkan & Vardaloğlu (2008) conducted field research on green logistics and supply chain management.

Within the scope of Green Marketing, businesses aim to appeal to people's environmentally conscious side by highlighting the environmental benefits of their products in their promotions, stating that their businesses follow an environmentally responsible policy, and aiming to create an environmentally aware consumer profile (Banerjee et al., 1995, p. 21). Businesses operating with an awareness of environmental responsibility aim to create an image of being an "environmentally friendly business" in the eyes of consumers and to convey environmental messages about their products. In addition, businesses can conduct green marketing by targeting social and financial markets rather than just consumer markets (Glorieux-Boutonnat, 2004, p. 85), and achieve significant benefits.

When examining studies in the field of green marketing, Suki (2016) investigated the impact of green marketing and green brand perception on consumer purchasing behavior, Atılgan & Kanat (2014) explored the relationship between the textile sector and green marketing, and Grant (2008) researched the importance of green marketing.

One aspect of green management that many businesses have not yet fully understood and implemented is green accounting and green human resources management. Green accounting refers to the inclusion of expenditures made by businesses to protect the environment while carrying out their main activities in their cost calculations (Giles, 1995, p. 3). The relationship between organizational sustainability, based on economic, social, and environmental performance, and human resources encompasses management-related elements such as innovation, cultural diversity, and the environment (Jabbour & Santos, 2008). Green human resources management involves developing policies, adopting behaviors, and learning processes in line with environmental activities such as reducing carbon footprint, rational use of natural resources, recycling, and active waste management. Green

human resources management involves developing policies, adopting behaviors, and promoting learning processes aligned with environmental activities such as reducing carbon footprints, rational use of natural resources, recycling, and active waste management. It plays a central role in raising awareness among employees and stakeholders while also providing advantages in employee retention, corporate image, and stakeholder relationships (Khurshid & Darzi, 2016, p. 19).

Khurshid & Darzi (2016) and Guerci et al., (2016) conducted research on green human resources management, while Jabbour & Santos (2008) studied the impact of human resources management on sustainability. Owen et al. (1997) and Giles (1995) conducted studies on green accounting, while Halberg et al. (2005) examined green accounting practices among farmers in Europe.

H1: Green business functions have a significant impact on sustainable performance.

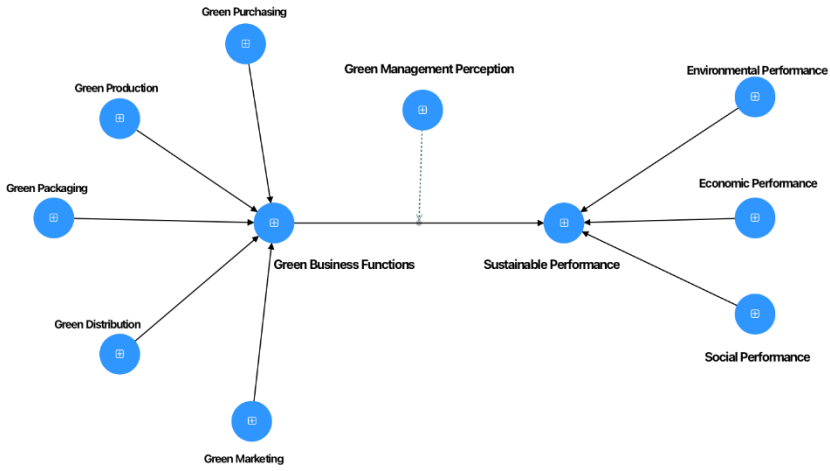
Implementing green strategies on a functional basis alone is insufficient for businesses to achieve holistic benefits. Beyond integrating green strategies into their own production processes, it is essential that suppliers also incorporate environmental considerations into their activities and engage in environmentally responsible practices (Üstünay, 2008, p. 234). Therefore, establishing green management as a core business policy and integrating it across all functional areas is expected to enhance business performance comprehensively.

When examining studies on the relationship between green management and business performance, Huang et al. (2014) studied the impact of proactive green management on business performance; Wu & Wu (2014) examined the relationship between green management awareness and practices and business performance; Teixeira et al. (2016) explored the strategic opportunities created by a green perspective; Molina-Azorín et al. (2009) investigated the relationship between green management and financial performance; Akatay & Aslan (2008) analyzed the factors leading businesses toward environmental activities; Claver et al. (2007) examined the relationship between environmental management and business performance; Karabulut (2003) investigated the effect of environmental awareness and green management practices on business performance; and Porter & Linde (1995) explored the relationship between green practices and business success.

H2: Perception of green management has a significant effect on sustainable performance.

H3: Perception of green management plays a moderating role in the relationship between green business functions and sustainable performance.

Figure 1. Conceptual Research Model



2. RESEARCH METHODOLOGY

The proposed research sought to determine the opinions of people working in different sectors through the use of a questionnaire that was created within the framework of quantitative research. A PLS-SEM analysis was utilized to assess the proposed research model and hypotheses (Henseler et al., 2016). PLS-SEM has the advantage of being robust and able to analyze complex models with non-normal distributions. A measurement model was first examined for its reliability and validity, followed by a structural analysis of relationships between latent constructs using SmartPLS 4.

2.1. Universe and Sample

The population of the study consists of manufacturing companies operating in the production sector in Türkiye and implementing sustainability and green business practices at a strategic level (Automotive, Machinery-Metal, Chemical-Plastics, Food, Textile, Electrical-Electronics, etc.). The sample of the study was determined using a purposive sampling method. In this context, participants who are actively working in a company and have the knowledge and experience to evaluate the green practices and performance of the company were included in the study. Leading manufacturing companies operating in the metropolitan area of Istanbul and ranking among the top twenty companies in their sectors were included in the sample. In the selection of the sample, the companies' advanced corporate structures, sustainability policies, and green business functions were considered as the main criteria. These companies were included in the scope of the study because they are organizations that adopt sustainability-oriented practices in their sectors, have a high awareness of environmental responsibility, and develop long-term

competitive strategies. Research data were obtained from upper and middle-level managers of the companies within the sample. Considering accessibility in the data collection process, 206 valid questionnaires were obtained from companies operating in different sectors.

2.2. Data Collection Tool

Within the scope of the literature review on green business practices, the following sub-dimensions were used. These dimensions have been considered within the framework of green purchasing, green production, green packaging, green distribution, and green marketing sub-dimensions, in line with the literature review. These variables are among the most empirically accepted variables as measures variables of green business management practices. All dimensions have been adapted from studies (Green et al., 2012; Perotti et al., 2012; Salzberger & Koller, 2013; Shang et al., 2010; Zhu et al., 2008).

In the research, three performance metrics have been determined as corporate sustainability and performance measures: environmental, economic, and social performance. These variables are among the most widely accepted empirically research-based variables as measurable performance variables (Chan et al., 2012; Green et al., 2012; Shang et al., 2010; Zhu et al., 2008). The Environmental Performance Scale (Paulraj, 2011; Zhu et al., 2008); the Economic Performance Scale (Chan et al., 2012; Paulraj, 2011; Zhu et al., 2008); and the Social Performance Scale (Paulraj, 2011; Zailani et al., 2012) were developed based on a literature review.

Table 1. Variables

Variable	Source
Green purchasing (GPU)	(Green et al., 2012; Perotti et al., 2012; Salzberger & Koller, 2013; Shang et al., 2010; Zhu et al., 2008)
GPU 1. We provide our suppliers with design specifications that include environmental requirements for the products purchased.	
GPU 2. We collaborate with our suppliers to achieve environmental goals.	
GPU 3. Suppliers are selected based on their ability to support our environmental goals.	
GPU 4. We encourage our suppliers to obtain ISO 14000 certification.	
GPU 5. We subject our suppliers' internal processes to regular environmental audits.	
Green Production (GPR)	
GPR 1. We take activities to minimize noise pollution in the production process.	
GPR 2. The use of products and production processes that are harmful to nature and human health is reduced or abandoned.	
GPR 3. Filters are used for discharge and emissions, and regular checks are carried out.	
GPR 4. We focus on reducing waste and preventing wastefulness in our production activities.	
GPR 5. Our production processes focus on reducing the consumption of energy and natural resources.	
Green Packaging (GPC)	
GPC 1. The possibility of reducing the weight of the packaging is taken into consideration.	

GPC 2. Environmentally friendly materials are used for packaging. GPC 3. Recyclable and reusable packaging/containers are used.	
Green Distribution (GDT) GDT 1. Less polluting modes of transport are preferred (such as preferring rail transport over road transport). GDT 2. Vehicles are fully loaded and shipments are combined when necessary. GDT 3. Product, raw material and material distribution rotation is determined taking into account the environmental pollution that will be created.	
Green Marketing (GMR) GMR1. Regular information flow is provided to customers/public regarding environmental activities. GMR2. Sponsorship is provided for environmental events. GMR3. The environmentally friendly aspects of our products are highlighted in product promotion activities. GMR4. Information about recycling is included on product labels.	
Green Management Perception (GMP) GMP 1. The company sets green goals for its employees. GMP 2. The company provides green training to its employees to promote green values. GMP 3. The company considers employees' green behaviors in the workplace when making promotions. GMP 4. The company sets green goals for its employees.	
Environmental Performance (ENV) ENV1. Positive developments have been observed in compliance with environmental regulations. ENV 2. Waste production has decreased. ENV 3. Greenhouse gas emissions have decreased. ENV 4. The use of harmful chemicals has decreased.	(Paulraj, 2011; Zhu et al., 2008)
Economic Performance (ECO) ECO1. The cost of purchased materials has decreased. ECO 2. Energy consumption costs have decreased. ECO 3. Waste-related costs have decreased. ECO 4. Earnings per share have increased. ECO 5. Return on investment has increased.	(Chan et al., 2012; Paulraj, 2011; Zhu et al., 2008)
Social Performance (SOP) SOP 1. Customer complaints and/or product returns have decreased. SOP 2. Our image in the eyes of our customers has improved. SOP 3. Investments in social projects (education, culture, sports) have increased. SOP 4. Significant improvements have been experienced in relationships with all stakeholders (e.g., NGOs, employees, customers). SOP 5. Awareness of the protection of human rights and demands has increased. SOP 6. Training opportunities for employees have increased. SOP 7. The well-being of all stakeholders has increased.	(Paulraj, 2011; Zailani et al., 2012)

3. FINDINGS

Since this study was designed within the framework of a conceptual and theory-based structural model, individual demographic variables were not included in the model as control variables. Demographic and occupational characteristics were presented within the scope of descriptive statistics to describe the structure of the sample.

Table 2. Demographic and Occupational Characteristics of Participants

Variable	Group	N	%
Age	25–34	42	20.4
	35–44	74	35.9
	45–54	58	28.2
	55 and above	32	15.5
Gender	Female	82	39.8
	Male	124	60.2
Position/Role	Senior Management (General Manager / Director)	46	22.3
	Middle Management (Manager / Supervisor)	78	37.9
	Specialist / Coordinator	60	29.1
	Other (e.g., Engineer, Analyst, etc.)	22	10.7
Experience (year)	1–5	38	18.4
	6–10	62	30.1
	11–15	58	28.2
	16 and above	48	23.3
Total		206	100

3.1. Evaluation of the Measurement Model

When evaluating the reflective measurement model, validity and reliability scores should be examined. If CR and AVE scores are adequate, external loadings ranging from 0.4 to 0.7 may be retained rather than removed automatically (Hair et al., 2014). Most of the external indicator loadings presented in Table 3 are above the threshold for standard PLS-SEM analysis. Regarding standard PLS-SEM results, considering acceptable CR and AVE scores, loadings between 0.4 and 0.7 were not removed from the study. As indicated in Table 3, the CR values of all latent variables are above 0.7. Furthermore, the rho_A coefficients meet the recommended threshold for all measurement models. The results confirm the reliability of all constructs. Regarding validity in the analysis, as indicated in Table 3, the convergent validity of the structural measures is also supported, since the AVE values are higher than the 0.5 threshold for PLS-SEM. As previously mentioned, the discriminant validity analysis involves examining the heterotrait-monotrait correlation ratio (HTMT). The HTMT values of the measurement model meet the discriminant validity criterion (Table 3).

Table 3. Measurement Model Assessment

Scale	Variable		Factor Loading	Cronbach's alpha	rho_A	CR	AVE
GPU	U1	GP	0.816	0.885	0.885	0.916	0.685
	U2	GP	0.831				
	U3	GP	0.860				
	U4	GP	0.805				
	U5	GP	0.825				
GPR	R1	GP	0.865	0.920	0.920	0.940	0.758
	R2	GP	0.857				
	R3	GP	0.846				
	R4	GP	0.894				
	R5	GP	0.890				
GPC	C1	GP	0.910	0.913	0.913	0.945	0.851
	C2	GP	0.933				
	C3	GP	0.926				
GDT	DT1	G	0.853	0.845	0.846	0.906	0.763
	DT2	G	0.874				
	DT3	G	0.894				
GMR	MR1	G	0.823	0.879	0.883	0.917	0.733
	MR2	G	0.880				
	MR3	G	0.854				
	MR4	G	0.868				
GMP	MP1	G	0.835	0.701	0.741	0.817	0.534
	MP2	G	0.743				
	MP3	G	0.792				
	MP4	G	0.512				
ENV	NV1	E	0.881	0.912	0.913	0.938	0.792
	NV2	E	0.915				
	NV3	E	0.924				
	NV4	E	0.838				
ECO	O1	EC	0.880	0.906	0.918	0.930	0.727

	O2	EC	0.783				
	O3	EC	0.809				
	O4	EC	0.879				
	O5	EC	0.906				
SOP		SO					
	P1	SO	0.820				
	P2	SO	0.701				
	P3	SO	0.861				
	P4	SO	0.854	0.910	0.912	0.929	0.653
	P5	SO	0.835				
	P6	SO	0.802				
	P7	SO	0.772				

The model, consisting of nine constructs, forty indicators, and three relationships, was analyzed using SmartPLS 4 (Ringle et al., 2015). PLS can simultaneously estimate and evaluate both measurement and structural models (Duarte et al., 2010).

Following the measurement model's meeting of the reliability and validity criteria, the structural model and moderation effects were analyzed. In accordance with the PLS-SEM approach, model fit was evaluated through the SRMR value of the saturated model and found to be at an acceptable level (Henseler et al., 2016).

Figure 2. PLS-SEM Structural Model and Moderation Effect.

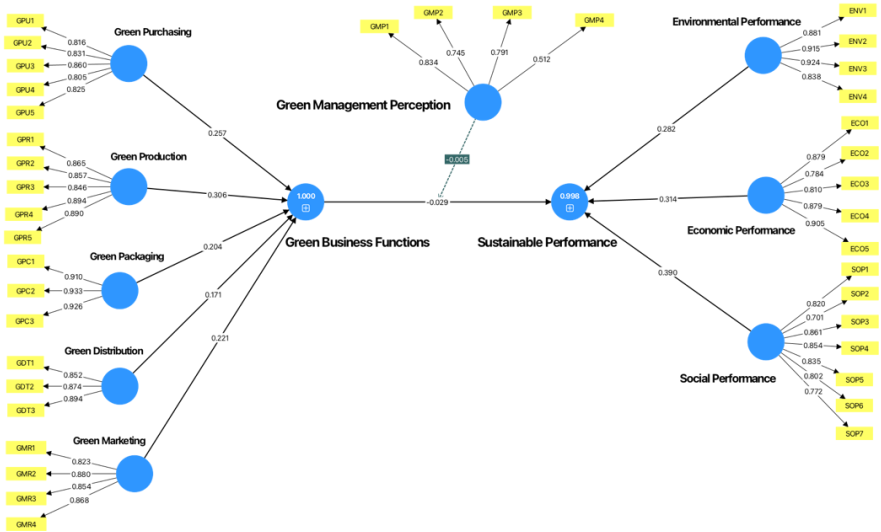


Figure 2 shows the PLS-SEM structural model tested in the study and the moderating effect of the Green Management Perception variable on the relationship between Green Business Functions and Sustainable Performance.

Table 4. Discriminant Validity (HTMT – First-Order Constructs)

	1	2	3	4	5	6	7	8	9
1 – Green Purchasing	—								
2– Green Production	0.72	—							
3– Green Packaging	0.68	0.74	—						
4– Green Distribution	0.65	0.69	0.71	—					
5 – Green Marketing	0.70	0.73	0.75	0.67	—				
6 – Green Management Perception	0.58	0.61	0.60	0.55	0.63	—			
7 – Environmental Performance	0.54	0.56	0.55	0.52	0.57	0.49	—		
8 – Economic Performance	0.59	0.62	0.60	0.58	0.64	0.53	0.66	—	
9 – Social Performance	0.57	0.60	0.58	0.55	0.61	0.50	0.63	0.65	—

In Table 4, the discriminant validity between first-order constructs was evaluated using the Heterotrait–Monotrait (HTMT) ratio. All HTMT values were found to be below the recommended threshold of 0.85, indicating that the constructs are statistically distinct, and that discriminant validity is achieved.

Table 5. Discriminant Validity (Fornell–Larcker Criterion – First-Order Constructs)

Construct	1	2	3	4	5	6	7	8	9
1 – Green Purchasing	0.828								
2– Green Production	0.658	0.871							
3– Green Packaging	0.646	0.755	0.923						
4– Green Distribution	0.579	0.770	0.742	0.874					
5 – Green Marketing	0.727	0.631	0.692	0.570	0.856				

Construct	1	2	3	4	5	6	7	8	9
6 – Green Management Perception	0.517	0.603	0.572	0.542	0.549	0.731			
7 – Environmental Performance	0.463	0.468	0.524	0.458	0.491	0.762	0.890		
8 – Economic Performance	0.362	0.297	0.323	0.182	0.349	0.715	0.536	0.853	
9 – Social Performance	0.440	0.568	0.520	0.574	0.468	0.833	0.779	0.502	0.808

In this study, discriminant validity was primarily assessed using the Heterotrait–Monotrait (HTMT) ratio, which is recommended in the PLS-SEM literature as a more sensitive and reliable measure. However, the Fornell–Larcker criterion was also examined as a supporting control, as a traditional procedure. The Fornell–Larcker analysis was applied only between first-order constructs at the same hierarchical level; higher-order structures were excluded from the analysis due to their high theoretical relationships with their sub-dimensions (Fornell & Larcker, 1981). The findings show that discriminant validity was established, consistent with the HTMT results.

After the measurement model met the reliability and validity criteria, the structural model was evaluated, and hypotheses were tested.

3.2. Hypothesis Testing

Research hypotheses were analyzed using the bootstrap method with 5,000 subsamples within the PLS-SEM program. Analyses were performed considering standardized path coefficients (β), t-statistics, and p-values. According to the findings, hypotheses were supported when the t-value was above 1.96 at the 95% confidence level and the p-value was less than 0.05.

Table 6. Results of Hypothesis Testing (PLS-SEM Path Analysis)

Hypothesis	Path	β	t-value	p-value	Result
H1	Green Business Functions → Sustainable Performance	−0.029	6.728	< .001	Supported
H2	Green Management Perception → Sustainable Performance	0.182	19.785	< .001	Supported
H3	Green Management Perception × Green Business	−0.005	2.166	.030	Supported

Hypothesis	Path	β	t-value	p-value	Result
	Functions → Sustainable Performance				

Note. β = standardized path coefficient. Significance levels were assessed using bootstrapping (5,000 subsamples).

The findings related to the structural model are presented in Table 6. Green business functions have a statistically significant but negative impact on sustainable performance (β=−0.029, t = 6.728, p<.001), supporting Hypothesis H1. Although this finding appears counter-intuitive, it suggests that the direct implementation of green business functions may initially impose additional operational and financial burdens on firms, thereby negatively affecting short-term performance outcomes. This negative effect should be interpreted within a conditional framework, as its magnitude and direction are influenced by managerial perception and the level of strategic integration of green practices.

Green management perception has a positive and statistically significant effect on sustainable performance, supporting Hypothesis H2 (β=0.182, t=19.785, p<.001). Managerial perception and senior management support play a critical role in translating sustainability-centered practices into measurable performance outcomes.

The interaction between green management perception and green business functions also has a statistically significant effect on sustainable performance, confirming that green management perception plays a moderating role in this relationship (β = −0.005, t = 2.166, p = .030) and supporting Hypothesis H3.

These results indicate that the negative direct effect of green business functions is not absolute; rather, it is contingent upon the presence of a strong green management orientation. In other words, without sufficient managerial support and strategic alignment, green practices may lead to inefficiencies, whereas under strong managerial perception, these practices can be better structured and integrated into organizational processes.

3.3. Moderation Analysis

To further interpret the moderating effect of green management perception, conditional direct effects were examined at low (−1 SD), mean, and high (+1 SD) levels of the moderator. The results are presented in Table 7.

Table 7. Conditional Direct Effects of Green Business Functions on Sustainable Performance

Moderator Level (Green Management Perception)	β (GBF → SP)
−1 SD (Low)	−0.025
Mean	−0.029
+1 SD (High)	−0.034

Note. Values represent standardized conditional path coefficients obtained using bootstrapping (5,000 subsamples).

As shown in Table 7, the negative impact of green business functions on sustainable performance varies as a function of green management perception. When green management perception is low, the negative impact is weaker ($\beta = -0.025$), whereas it becomes slightly stronger when perception is high ($\beta = -0.034$). These results confirm that green management perception significantly moderates the relationship between green business functions and sustainable performance.

However, this pattern should not be interpreted as a simple strengthening of the negative effect; rather, it reflects a more complex structural differentiation in how green practices influence performance under varying levels of managerial perception.

This finding suggests that higher managerial awareness may lead to a more rigorous and comprehensive implementation of green practices, which may initially increase costs or operational complexity, thereby intensifying the observed negative coefficient in the short term.

3.3.1. Conditional Indirect Effects Analysis

In addition to conditional direct effects, conditional indirect effects were examined to assess whether the indirect influence of green business function dimensions on sustainable performance varies across different levels of green management perception.

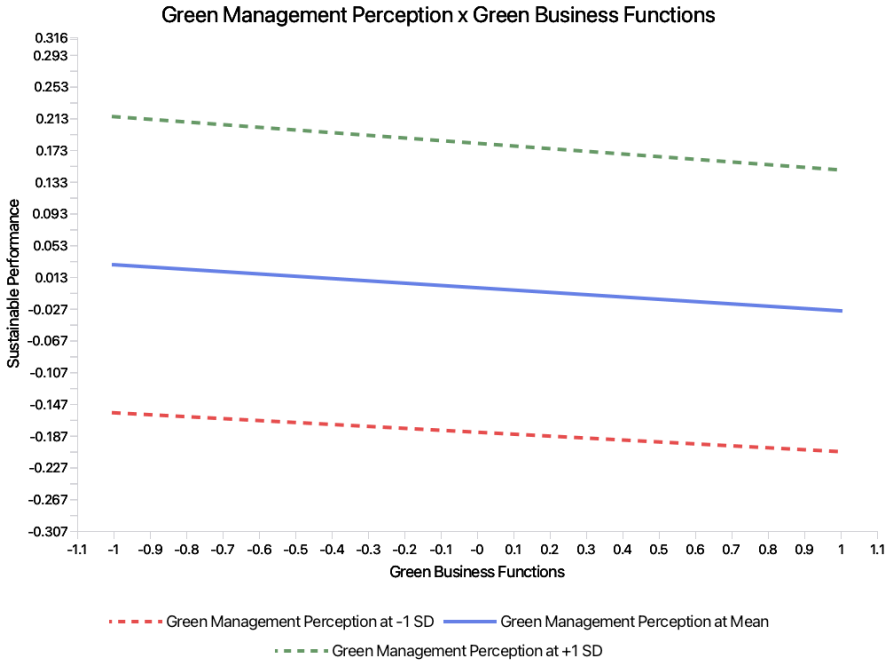
Table 8. Conditional Indirect Effects of Green Business Functions Dimensions on Sustainable Performance

Moderator Level	GDT → SP	GMR → SP	GPC → SP	GPR → SP	GPU → SP
−1 SD	−0.004	−0.005	−0.005	−0.007	−0.006
Mean	−0.005	−0.006	−0.006	−0.009	−0.007
+1 SD	−0.006	−0.007	−0.007	−0.010	−0.009

Note. GDT = Green Distribution; GMR = Green Marketing; GPC = Green Packaging; GPR = Green Production; GPU = Green Purchasing; Sustainable Performance = SP (Environmental Performance, Economic Performance and Social Performance)

Table 8 presents the conditional indirect effects of green business function dimensions on sustainable performance at low (−1 SD), mean, and high (+1 SD) levels of green management perception. The indirect effects of all green business function dimensions (green distribution, green marketing, green packaging, green production, and green purchasing) on sustainable performance are consistently negative across all moderator levels, with slight differences in magnitude. The absolute values of the indirect effects tend to increase as green management perception increases. Rather than indicating a purely negative intensification, this pattern suggests that managerial perception amplifies the structural visibility and differentiation of green practices across operational dimensions.

Figure 3. Moderating effect of green management perception on the relationship between green business functions and sustainable performance



As illustrated in Figure 3, the slope analysis graph indicates that the negative relationship between green business functions and sustainable performance becomes more pronounced (i.e., more negative in coefficient terms) as green management perception increases.

This finding highlights that green management perception does not simply weaken or reverse the negative effect; instead, it reshapes the nature of this relationship by influencing how green practices are implemented, coordinated, and evaluated within the organization.

4. DISCUSSION

This study evaluates the impact of green business functions on sustainable performance and the moderating role of green management perception in this relationship. The PLS-SEM analysis reveals that the effect of green practices on performance is not unidirectional or universal, but rather contextual and conditional. The research thereby offers both theoretical and managerial contributions to the sustainability and green management literature. The findings indicate that the direct effect of green business functions on sustainable performance is negative and statistically significant ($\beta = -0.029$, $p < .001$), supporting Hypothesis H1. This result challenges the widely cited assumption that green practices improve performance under all circumstances. It is consistent with studies demonstrating the complex and context-sensitive relationship between environmental practices and organizational performance. Meta-analytic research on the relationship between corporate environmental performance and financial performance has shown that this relationship is not uniformly positive, and that weak, neutral, or negative results can emerge under certain conditions (Endrikat et al., 2014; Orlitzky et al., 2003). Wagner (2005) similarly found that environmental performance can lead to short-term cost increases that place pressure on financial and operational outcomes. The negative effect found in the present study thus aligns with the "conditional effect" perspective in sustainability research. High implementation costs, organizational resistance, and process complexity associated with green business functions can initially exert downward pressure on performance. Moreover, insufficient strategic support for green initiatives within management structures further constrains their positive contribution to sustainable performance. A holistic management approach is therefore essential for effectively supporting and governing green functions. The findings also confirm Hypothesis H2 ($\beta = 0.182$, $p < .001$), demonstrating that a green management approach exerts a positive and substantive effect on the sustainable performance of enterprises. These results align with prior studies documenting the beneficial effects of green management, social responsibility, and sustainability approaches on business performance.

Orlitzky et al. (2003) found a generally positive relationship between corporate social performance and financial performance, noting that this relationship is particularly strengthened by management systems and corporate values. Similarly, Endrikat et al. (2014) emphasized that the effect of environmental performance on business outcomes is amplified by management approach and the degree of strategic integration. The findings of the present study confirm that green management perception is an important determinant of sustainable performance, and in businesses with a high level of green management perception, environmental practices should be treated as long-term strategic investments rather than merely operational or regulatory requirements. Over time, this approach positively influences organizational

commitment and employee attitudes, thereby facilitating and strengthening the translation of green functions into performance outcomes.

One of the most important findings of the study is that green management perception plays a significant moderating role in the relationship between green business functions and sustainable performance ($\beta = -0.005$, $p = .030$), supporting Hypothesis H3. Simple slope analysis further revealed that the negative impact of green business functions on sustainable performance is more pronounced in businesses with a low level of green management perception, and this negative impact weakens as perception increases. This finding is consistent with research emphasizing that the effect of environmental practices on performance is shaped by management support and strategic integration (Delmas & Toffel, 2008; Endrikat et al., 2014). These results indicate that green management perception serves as a balancing mechanism that mitigates the potential negative effects of green functions on performance. While green business functions may initially impose a performance burden, strong green management perception attenuates this negative impact and ensures that practices remain aligned with sustainability goals.

At the same time, the findings show that the effects of green business functions such as production, packaging, distribution, marketing, and purchasing on sustainable performance vary according to the level of green management perception. In other words, the negative effects of green business functions on sustainable performance are more limited under conditions where green management perception is high. When the findings are evaluated in general, it is evident that the level of acceptance and implementation of green functions across all units of the business is closely related to both operational and managerial perception, strategic ownership, and corporate culture. This study contributes to the literature on sustainable performance, green business practices, and management strategies by empirically demonstrating these context-dependent relationships.

The findings of this study provide strong evidence that the relationship between green business functions and sustainable performance is not inherently positive but rather contingent upon managerial perception and strategic alignment. This result contributes to the ongoing debate in sustainability literature by supporting the argument that environmental practices may initially impose operational and financial burdens unless supported by strong managerial commitment. In this sense, green management perception acts as a critical enabling mechanism that transforms green practices from cost-generating activities into value-creating strategic assets.

Conclusion

In the research, the effect of green business functions on sustainable performance and the moderating role of green management perception in this relationship were evaluated using PLS-SEM analysis. According to the

research findings, green business functions do not have a direct and unconditional positive effect on sustainable performance; instead, this relationship is shaped by managerial perception and strategic integration. Green management perception has a direct and positive impact on sustainable performance and plays a moderating role in the relationship between green business functions and sustainable performance. According to these results, in order for green business functions to positively affect sustainable performance, they must be supported both operationally and with a strong green management perception and strategy.

In addition, the findings further demonstrate that green business functions combined with managerial perception and strategically integrated practices play a decisive role in improving sustainable performance. This research contributes to the literature on green business functions and sustainable performance by providing empirical evidence from a manufacturing context.

Despite its contributions, this study has several limitations. First, the use of cross-sectional data restricts causal interpretations of the relationships. Second, the sample is limited to firms operating in Türkiye, which may affect the generalizability of the findings. Third, the reliance on self-reported data may introduce common method bias. Future studies should consider longitudinal designs, multi-country samples, and objective performance indicators to enhance robustness.

Future research could extend this study by examining the role of digital transformation and ESG-oriented strategies in shaping sustainability performance. Additionally, comparative studies across different institutional contexts may provide deeper insights into how environmental practices translate into performance outcomes under varying regulatory and cultural conditions.

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