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Achieving Sustainable Performance in Hotels Through Digital Transformation and Environmental Governance: The Moderating Role of Green Accounting and Environmental Culture

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ABSTRACT

Few studies have investigated the relationship between digital transformation (DT), environmental governance (EG), and sustainable performance (SP), despite the fact that all three factors are crucial for hotels, especially in the Egyptian context. In addition, it is still unclear how environmental culture (EC) and green accounting (GA) affect the relationship between DT and SP. Therefore, this research explores the impact of DT on SP and EG within the hospitality industry. It also examines the moderating roles of EC and GA, as well as how EG mediates the link between DT and SP. Data from 393 respondents working in five-star hotels in the Greater Cairo area, Egypt, were analyzed using Smart PLS software. Importantly, the results show that EG mediates the relationship between DT and SP, with DT positively influencing both EG and SP. Furthermore, GA and EC bolster these relationships, helping to promote SP. This study enriches the existing literature by clarifying the connection between DT and SP in the hospitality sector.

KEYWORDS

Sustainable performance, digital transformation, environmental governance, green accounting, environmental culture, hospitality.

تحقيق الأداء المستدام في الفنادق من خلال التحول الرقمي والحوكمة البيئية: الدور المعدل للمحاسبة الخضراء والثقافة البيئية

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الملخص

على الرغم من أهمية التحول الرقمي والحوكمة البيئية والأداء المستدام للفنادق، إلا أن دراسات قليلة تناولت العلاقة بينها وخاصةً في السياق المصري. إضافةً إلى ذلك، لا يزال من غير الواضح كيف تؤثر الثقافة البيئية والمحاسبة الخضراء على العلاقة بين التحول الرقمي والأداء المستدام. لذا هدفت هذه الدراسة إلى قياس تأثير التحول الرقمي على الأداء المستدام والحوكمة البيئية في قطاع الضيافة. كما هدفت أيضا الي قياس تأثير الحوكمة البيئية كمتغير وسيط على العلاقة بين التحول الرقمي والأداء المستدام. بالإضافة إلى ذلك، تقيس هذه الدراسة تأثير كلا من الثقافة البيئية والمحاسبة الخضراء على العلاقة بين التحول الرقمي والأداء المستدام. استُخدم برنامج Smart PLS لتحليل استمارات استبيان وزعت على 393 موظفا يعملون في فنادق فئة خمس نجوم في منطقة القاهرة الكبرى، مصر.وتُشير النتائج إلى أن الحوكمة البيئية تتوسط كليا العلاقة بين التحول الرقمي والأداء المستدام، وأن للتحول الرقمي تأثيرًا إيجابيًا على كلا من الحوكمة البيئية والأداء المستدام. بالإضافة إلى ذلك، أظهرت النتائج أن المحاسبة الخضراء والثقافة البيئية تقومان بتعديل العلاقة الإيجابية بين التحول الرقمي والأداء المستدام مما يُحفز تحقيق الأداء المستدام.تُساهم هذه الدراسة في إثراء المعرفة من خلال توضيح العلاقة بين التحول الرقمي والأداء المستدام في قطاع الضيافة.

الكلمات الدالة

الأداء المستدام، التحول الرقمي، الحوكمة البيئية، المحاسبة الخضراء، الثقافة البيئية، الضيافة.

1. Introduction

Sustainable performance is a clear and quantifiable strategy that incorporates several sustainable rules and practices that complement the environment and nature of the work (Malik et al., 2021; Saleh et al., 2023). It seeks to accomplish several benefits, the most significant of which are: safeguarding human and natural resources; preserving the organization's trademark; retaining current customers and attracting new ones; improving the organization's environmental reputation; and gaining a competitive environmental advantage for the company (Malik, et al., 2021; Alraja, et al., 2022; Escandon-Barbosa and Salas-Paramo, 2025). Consequently, it is essential to raise SP in hotels and determine the variables that affect it, such as DT (Chen et al., 2024).

Digital transformation is a dynamic, ever-evolving, and stimulating procedure with a variety of specializations based on contemporary digital technology (Elia et al., 2024; Naji et al., 2024). By drastically altering the organization's structure and traits and substituting cutting-edge digital technologies for manual processes, it seeks to move from traditional management to big data-driven digital management while enhancing the consumer experience (Müller et al., 2024). Additionally, digital transformation improves an organization's performance and capacities by increasing technological capabilities, maintaining sustainable processes to generate additional value for the business, and enhancing production techniques and work practices (Müller et al., 2024; Paul et al., 2024; Meier et al., 2025). Organizations can directly achieve sustainable performance by implementing DT to streamline their skills, processes, and operations (Martínez-Peláez et al., 2023; Chen et al., 2024). Although the advantages of DT are well acknowledged, implementation is challenging (Davison et al., 2023). DT may be hampered by environmental factors, employee resistance to change, and technological mismatches. Thus, academics and business managers need to comprehend how DT supports sustainable organizational performance (Daimi and Rebai, 2023; Wang and Zhang, 2025). Additionally, DT adoption can lead to the improvement of EG (Xu et al., 2022), which is one way that digital transformation could influence sustainable performance (El Sayed et al., 2025).

EG is intended to promote the adoption of eco-friendly, green, and sustainable activities and mold acceptable environmental behavior to safeguard the environment and accomplish sustainable development (He et al., 2024; Sörlin et al., 2025). This ultimately results in a healthy environment for people and the preservation of the planet (Ahmad and Saeed, 2025; Wu and Hussain, 2025). EG has policies and procedures in place that effectively manage the environment and natural resources, thus supporting and reflecting sustainable performance (El Sayed et al., 2025).

By giving organizations the means to measure and assess the environmental and social impact of their operations, green accounting facilitates analysis and measurement, which is crucial for connecting digital transformation efforts to sustainable outcomes (Jackson and Carini, 2024). GA is defined as a management tool or accounting framework that goes beyond recording traditional financial transactions and benefits but extends to include recording the costs of environmental conservation (Fina et al., 2024; Surianti et al., 2025). GA is responsible for directing organizations and companies towards adopting strategies that are consistent with the principles of

sustainability and the extent to which their decisions impact the environment to reduce risks and concerns that affect the sustainability of companies' economic activities (Pesak, 2024; Ramadhan and Pandin, 2025). GA also focuses on studying the extent of the company's impact and efficiency in managing environmental activities and their impact on the surrounding environment (Herny and Herawaty. 2024; Sumayyah et al., 2025). Additionally, GA is responsible for determining, recording, evaluating, measuring, analyzing, interpreting, allocating, presenting, and reporting the environmental contributions and costs of the company's activities during the accounting process to accurately determine the environmental burdens resulting from the company's activities and operations, whether commercial or economic (Wati et al., 2024; Saenggo and Widoretno, 2024; Rakhmawati, 2025). In addition, EC makes it easier for businesses to use digital transformation to boost social, economic, and environmental performance, which increases sustainability (Abduhakimova and Islamova, 2025). EC is essential for improving and fortifying relationships between people, organizations, businesses, institutions, and governments in facing environmental issues and striving to resolve them by increasing their dedication to environmentally sound practices that lessen adverse environmental effects (Kabiri, 2022; Ordóñez, 2024). EC also helps individuals and groups become more environmentally conscious, which improves their understanding of the environment's elements, resources, and biodiversity by encouraging optimal behavior in resource utilization and waste management that minimizes waste and supports sustainable practices (Zhao and Selamat, 2023).

While prior research has examined top management commitment (Li et al., 2018), technical preparedness (Flavián et al., 2022), and external competitive pressure (Vial, 2021) as the primary drivers of DT, not enough attention has been paid to EG, GA and EC. Despite research on DT's impact on firm sustainable performance showing improvements in sustainable performance (Martínez-Peláez et al., 2023; Chen et al., 2024), the moderating effect of green accounting and EC on the relationship between DT and sustainable development outcomes is still poorly understood. Besides, there isn't much actual data that directly connects sustainability with GA. As a result, further research is required to ascertain whether GA may improve SP (Lisnawati et al., 2024). To the best of the researchers' knowledge, this is one of the earliest studies of its sort conducted in both Egyptian and foreign contexts, looking at how green accounting and culture may moderate the connection between digital transformation and sustainable performance. This work significantly broadens the corpus of information regarding the green perspective in general and the hospitality industry in particular.

Although many researchers (e.g., El Sayed et al., 2025) have recognized the positive effects of EG on SP, its role as a mediator between DT and SP has not been studied in the context of the hospitality industry. This research fills a significant gap in the literature on DT and sustainable performance by examining the little-known relationship between digital transformation, EG, and sustainability performance in the field of hospitality. Thus, determining how DT influences SP in five-star hotels is the aim of this study. Additionally, it looks at how GE functions as a mediating factor in

the interaction between DT and SP. It also investigates the moderate impacts of green accounting (GA) and environmental culture (EC).

2. Literature review

Digital transformation and sustainable performance

Digital transformation can also be defined as the integration of digital technologies, technological capabilities, virtual reality, digital competencies, and various formulae of communications into the workplace and its working techniques to enhance internal innovation, improve systems and operations, and increase the organization's capacity to deal with economic disruptions and external changes, all of which increase the competitiveness of the business (Crusoe et al., 2024; Dubey et al., 2024 ; Mulyana et al., 2024). In addition, sufficient internal support must be provided for digital transformation processes, along with the necessary investments to initiate these transformations, leading to the improvement and redesigning of business models, production and operational procedures, and resource management within the organization. There must also be necessary means to integrate technological advancement with available human resources to enhance the ability to make wise decisions based on continuous data analysis (Bilal et al., 2024; Gutierriz et al., 2025; Hasan et al., 2025).

Digital transformation includes four dimensions: digital transformation strategy, strategic alignment, digital and information technology assets, and digital and information technology innovation (Barba-Sánchezet al., 2024; Ben Ghrbeia and Alzubi, 2024). To identify and prioritize digital transformation efforts with the organization of its implementation priorities, the first dimension refers to the methodical, focused, and strategic approach to achieving compatibility and suitability between the organization's objectives and digital development. This ensures that the desired digital transformation is achieved and implemented within the organization (Barba-Sánchezet al., 2024; Hasan et al., 2025). The organization's capacity to supply the capital and investments required to deploy digital technologies in line with its goals and strategy is demonstrated by the second dimension (Barba-Sánchez et al., 2024). Information technology and digital assets evaluate an organization's proficiency using digital technologies (Barba-Sánchezet al., 2024; Zhao et al., 2024). Lastly, the fourth dimension pertains to digital innovation, which is crucial for both guaranteeing accurate and timely reporting and the variety of components supporting the technological innovation process within the firm (Barba-Sánchezet al., 2024; Mulyana et al., 2024).

Digital transformation has several benefits: strategic, informational, transactional, transformational, societal and environmental (Elia et al., 2024). Strategic benefits refer to the organization's ability to easily integrate with local and regional markets and businesses by using digital technology to recognize global market possibilities and obstacles (Ben Ghrbeia and Alzubi, 2024), as well as creating and enhancing goods and services in response to market events and advancements (Bilal et al., 2024). Additionally, these advantages facilitate resource allocation by boosting innovation opportunities, which raises the organization's operational level within the organization (Banihashemi et al., 2024) (Banihashemi et al., 2024). Informational benefits describe

how having simple access to information and the capacity to manage and evaluate data effectively can eliminate any time and space constraints (Egbumokei et al., 2024). By lowering the cost of all transactions and promoting collaboration and transparency during research, this feature helps the company solve issues and reach wise conclusions (Dubey et al., 2024). Transactional advantages enhance the value of the company by: generating new value for the business; gaining new customers, services, and products for the company through a variety of means, chief among them being the creation of new channels for sales and marketing; satisfying all the preferences of prospective consumers; and developing the abilities and creative thinking of the establishment's staff (Ben Ghrbeia and Alzubi, 2024; Piccoli et al., 2024). According to Müller et al. (2024), transformational benefits also include greater efficacy, flexibility, and continuity of the organization's work while attaining sustainability processes through the integration of digital technologies with organizational strategies and the human element, as well as the opening of internal communication channels between employees, which boosts productivity (Porfírio et al., 2024). Lastly, the environmental and societal advantages of digital transformation help the company adapt to its surroundings, which lowers energy consumption, pollution, waste, and costs while simultaneously optimizing resource utilization in line with sustainability procedures (Piccoli et al., 2024; Gutierriz al., 2025).

Dynamic resource-based capability theory (DRBC) is examined in this work because it is important to investigate how businesses expand and adjust their capacities to achieve sustainability. This theory defines a company's ability to integrate, develop, and reconfigure internal and external competencies in a rapidly changing environment. According to DRBC, a company can achieve sustained success by strategically transforming its business functions with the use of dynamic capabilities. To attain sustainable performance, businesses combine, construct, and reorganize internal and external resources (Teece et al., 1997; Chen et al., 2024).

For any firm, achieving sustainable performance is crucial. The triple-bottom-line strategy highlights the significance of people, planet, and profit, underscoring the necessity of embracing digital transformation (Xu et al., 2023). Digital resources and efficiency increase company productivity, which enhances the long-term performance of goods, services, and businesses (Melo et al., 2023). The key to increasing a company's efficiency and sustainability is through digital transformation that makes use of its technical resources (Ahmad et al., 2021).

Upgrading and enhancing the company's long-term performance requires a digital transformation (Park and Mithas, 2020). The enterprise's ability to maximize market potential because of digital transformation contributes to the firm's long-term success (Melo et al., 2023). Additionally, Fatooh et al. (2023) found that adopting a digital transformation policy and deploying digital technologies in advanced industrial facilities aids in the activation and implementation of environmental governance mechanisms, ensuring improved environmental and operational performance. Chen et al. (2024) and Zhou et al. (2025) confirmed this by finding that digital transformation has a major impact on the long-term performance of businesses. Therefore, the following hypothesis is made.

H1: Digital transformation has a positive impact on sustainable performance.

Digital transformation and Environmental governance

Environmental governance refers to a dynamic system that includes a collection of laws, regulations, organizations, programs, procedures, and guidelines that govern how people and organizations work together to manage natural resources (Al Amosh and Khatib, 2024). Another way to describe environmental governance is as a network of interrelated policies, programs, mechanisms, rules, regulations, practices, and environmental approaches that guarantee collaboration, equilibrium, and the sharing of environmental knowledge and expertise between institutions, governments, and individuals (Al Amosh and Khatib, 2024; Salihi et al., 2024; Namagembe et al., 2025). This balance and equilibrium facilitate the resolution of environmental issues and the adoption of environmental technologies, leading to wise environmental choices that lessen environmental deterioration, save biodiversity, and encourage the use of clean energy (Al Amosh and Khatib, 2024; Iwasaki, 2025).

Environmental governance includes three principles: a focus on comprehensive environmental protection, environmental justice, and sustainable development (Lun et al., 2015; Bodin, 2017). According to the first principle, environmental governance is all-encompassing since it encompasses not only the natural environment, which includes resources like water and air, but also all biological aspects, which are represented by all living things in the immediate environment, as well as social aspects, such as social customs and traditions (Lemos and Agrawal, 2006; Lun et al., 2015). The goal of environmental justice is to improve the connection between public health and a clean environment while addressing the social effects of environmental issues. The foundation of environmental justice is the availability of equitable chances for resource distribution among individuals and the preservation of these resources across generations, as well as the fight against poverty in all its manifestations by providing a minimum number of resources for every human (Holley et al., 2013). The third principle is sustainable development, through which, human behavior should be guided to strike a balance between providing for individual needs and conserving biological and cultural diversity using resources in a way that guarantees sustainability procedures (Bodin, 2017).

Environmental governance is also in charge of creating strong and stringent environmental laws and regulations that require different organizations and people to use natural resources in an environmentally responsible manner (Bergougui and Satrovic, 2025; Kaki et al., 2025). Additionally, environmental governance reduces the negative effects of fossil fuels as well as, reducing environmental damage from carbon emissions by establishing an environment that is suitable for environmentally friendly practices, using clean, green, and sustainable renewable energy, and getting rid of non-renewable energy and environmentally unfriendly behaviors, whether by individuals or businesses (Al Amosh and Khatib, 2024; Wu and Hussain, 2025). Furthermore, environmental governance improves the economy, society, and environmental spheres by encouraging environmental innovation processes that strike a balance between the use of natural resources and what is compatible with environmental needs (He et al., 2024; Kaki et al., 2025). Moreover, environmental governance seeks to put laws into place that guarantee the fair allocation of resources to all stakeholders (Bergougui and Satrovic, 2025). These regulations restrict the

overuse of natural resources by taxing environmentally damaging activities and offering rewards for economic and environmental gains brought about by responsible individual use of natural resources while depending on sustainable substitutes (Sörlin et al., 2025; Wu and Hussain, 2025).

Since digital technologies like artificial intelligence, blockchain, cloud computing, and big data have developed so successfully in recent years, digital transformation has emerged as a new catalyst for businesses to grow environmentally. Businesses are under pressure to boost environmental governance and investment in environmental protection to project a positive public image of their environmental protection efforts. Mining companies' environmental governance is much enhanced by digital transformation (Xu et al., 2022). Additionally, in advanced industrial facilities, digital transformation strategies and triggering environmental governance mechanisms are statistically correlated (Fatooh et al., 2023). Businesses that have access to more digital technology can increase their digital scouting skills, gather information quickly and thoroughly, detect changes in the market, and comprehend client expectations, all of which boost ESG performance. Furthermore, businesses that have a more technologically diverse digital transformation structure are better equipped to improve their digital scenario planning skills, break down informational barriers, and encourage the sharing of knowledge and the distribution of resources, all of which will help them achieve a variety of ESG objectives (Wei and Zheng, 2024). Moreover, there are four primary ways that digital transformation improves a company's ESG performance: increasing internal governance, boosting green innovation, improving capacity utilization, and reducing financial restrictions (Zhou et al., 2025). The following hypothesis can be established considering the previously mentioned:

H2: Digital transformation has a positive impact on environmental governance.

Environmental governance and sustainable performance

According to Kovilage (2021), Le et al. (2024), and Mokbel Al Koliby et al. (2024), sustainable performance is a comprehensive and integrated approach that combines economic performance with the establishment's environmental and social performance while achieving alignment and compatibility among them to meet all the establishment's needs, both financial and non-financial. Additionally, the establishment's sustainable performance seeks to ensure that workers use natural resources in an ethical manner so that they are preserved and not depleted for the benefit of future generations (Rehman et al., 2021; Khan et al., 2024).

Three aspects of sustainable performance are the social, economic, and environment (Oduro, 2024; Ullah et al., 2024). The first aspect involves both non-financial and financial parts of the organization to achieve several benefits, including: preserving the organization's economic and financial standing; boosting investment returns by broadening the company's market base and drawing in more new customers (Le et al., 2024; Mokbel Al Koliby et al., 2024). The organization's economic aspect can be assessed using several criteria, the most significant of which are the amount of income, the volume of production, the ratio of expenses to profits, and the caliber of the products and raw materials offered to customers (Martins et al., 2021; Mokbel Al Koliby et al., 2024; Escandon-Barbosa and Salas-Paramo, 2025).

According to Alraja et al. (2022), the environmental aspect quantifies the effects of the establishment's numerous operations and activities on the environment. Additionally, the environmental components seek to evaluate how well the organization implements all required safeguards to lessen adverse effects and damage when utilizing natural resources. These practices and actions include several elements that will support biodiversity preservation while upholding environmental standards to protect these natural resources. Among the most crucial of these elements are avoiding the use of chemicals or other materials that are hazardous to human health, lowering the emissions of harmful gases, avoiding the use of sewage water, and minimizing the use of solid waste (Martins et al., 2021; Mokbel Al Koliby et al., 2024; Hidayat-ur-Rehman and Hossain,2024).

In addition to guaranteeing the welfare of beneficiaries, the establishment, employees, customers, and the local community, the social aspect of a business involves upholding its reputation in both domestic and international markets. Additionally, social dimensions seek to enhance living and health circumstances, give workers a proper working environment, and teach people how to use resources in a way that is compatible with the type and quality of the resources being preserved (Martins et al., 2021; Mokbel Al Koliby et al., 2024).

Environmental governance is a key tool for achieving sustainable development. Good environmental governance contributes to and reflects sustainable performance by defining rules and practices that efficiently manage the environment and natural resources. This results in transparency, attracting investments, improving the efficiency of resource allocation, and enhancing the company's reputation in the eyes of stakeholders (El Sayed et al., 2025). Additionally, improved governance and disclosure ease financial limitations (Hao, 2023), which gives businesses the money they need to improve their environmental performance and investments (Yang et al., 2025). According to published research, there is a positive correlation between sustainable performance and environmental governance. Consequently, the following hypothesis is made.

H3: Environmental governance has a positive impact on sustainable performance.

Taking into account the positive association between environmental governance and an improvement in sustainable performance, it can be inferred that environmental governance influences the connection between digital transformation and sustainable performance: if digital transformation enhances environmental governance, it will impact sustainable performance. The augmentation of environmental governance is one possible method that digital transformation may impact sustainable performance, considering hypotheses 2 and 3. Based on the aforementioned, the following hypothesis can be developed.

H4: Environmental governance positively mediates the relationship between digital transformation and sustainable performance.

Green accounting as a moderator

GA can be defined as an accounting application, method, approach or process responsible for integrating environmental, social and economic aspects and information related to investments and costs into the financial reporting system (Fina

et al., 2024) and also, the presentation of its results with the financial results of operations and cost analysis of the company to preserve the environment and improve the company's image (Etim et al., 2024; Ridayati et al., 2024; Baene et al., 2025). GA also provides information about a company's operational performance based on how it protects the environment and transmits it to various parties to evaluate and improve the company's environmental performance (Darsono et al., 2024; Romandhon et al., 2025), while reducing risks related to the company's environmental reputation and taking sustainable measures by innovating environmentally friendly products while creating a positive relationship with the surrounding community (Ridayati et al., 2024). All this will positively impact the company's value and financial performance (Dewi and Anggara, 2024; Gow and Gunawan, 2024; Ratmono et al., 2024; Rasyid et al., 2025).

By using tactics that are defined by disclosure, commitment, transparency, and trustworthiness in delivering adequate information about the company, green accounting has a good effect on business performance (Pesak, 2024; Romandhon et al., 2025). This information revolves around corporate social responsibility regarding environmental conservation costs and the implementation of environmentally, socially, economically, and technologically friendly activities (Gow and Gunawan, 2024; Pamungkas et al., 2024; Romandhon et al., 2025). A company's commitment to more ecologically friendly operating procedures is also demonstrated by the implementation of green accounting. By saving the necessary funds for environmental conservation, these policies help businesses preserve their reputation and build their brand, which raises the organization's value (Dewi and Anggara, 2024; Van, 2024). Green accounting also entails a company's commitment to more ecologically friendly operating practices (Wati et al., 2024; Surianti et al., 2025) and making administrative, economic, and investment decisions that minimize energy use, reduce health and environmental risks and issues brought on by human activity, and prevent conflicts resulting from pollution and natural disasters (Darsono et al., 2024; Etim et al., 2024; Sumayyah et al., 2025). According to Dewey and Angara (2024) and Fan et al. (2024), these rules will boost the organization's value and consumer loyalty by preserving its reputation and strengthening its brand. These eco-friendly policies will also boost the company's sales volume, draw in more investors, expand its market share internationally, and boost the organization's profitability by winning over stakeholders like governments, public, and those who are interested in sustainable business practices (Putri, 2024; Ramadhan and Pandin, 2025).

Several essential criteria must be met while supplying green accounting data, such as the data's integration, relevance, dependability, transparency, and comparability (Boyer, 1990; Abdelkader and Jamal, 2021). Integration means that when preparing green accounting reports, they must include social, financial, and environmental information. While relevance refers to the extent to which this information is compatible and appropriate to customers, so that this information works to meet the users' needs and is provided promptly to facilitate the decision-making process (Abdelkader and Jamal, 2021). Reliability emphasizes that green accounting information must be accurate, precise, and measurable to evaluate both economic and non-economic events (Chandhoke, 2003; Abdelkader and Jamal, 2021). Transparency

demonstrates that green accounting information is presented with complete transparency, credibility, and honesty so as not to negatively impact the evaluation process and decision-making. The final criterion, comparability, indicates that green accounting information must be consistently comparable to each other, at any time, from time to time, and across different periods (Axtmann, 2004; Abdelkader and Jamal, 2021).

For green accounting to be implemented in a variety of businesses and organizations, two prerequisites must be met. The first requirement refers to the use of accounting rules that are compatible with an accounting system that is characterized by its ability to produce reports that are characterized by accuracy, simplicity and clarity, including all social and environmental aspects, i.e., not limited to economic aspects only. This accounting system must also be subject to external audit, including both the environmental and social practices of the organization (Putri, 2024; Rashwan and Al-Farjani, 2023). The second requirement includes the use of appropriate green accounting standards through two basic methods: the first is to integrate an environmental accounting system into the company's traditional accounting system, and the second method is to have an independent environmental ecosystem responsible for collecting the company's social and environmental data, so that it is not limited to the notes and explanations attached to the published financial statements (Ramadhan and Pandin, 2025; Rashwan and Al-Farjani, 2023).

Green accounting helps turn digital initiatives into concrete sustainability strategies, like better resource management or fewer mistakes (Shaheen et al., 2024). Green accounting also improves decision-making by giving managers clear insights into sustainable performance, allowing them to make well-informed decisions about their technology investments and concentrate on projects that have the most positive effects on the environment and society (Pesak, 2024; Ramadhan and Pandin, 2025). By acting as a link between digital transformation to enhance operations and sustainable performance, green accounting also connects digital performance to sustainability. This indicates that without an accounting framework to direct it, digital transformation does not always result in sustainable performance (Lisnawati et al., 2024). Therefore, by providing the data and analyses required to measure and evaluate environmental and social performance, green accounting acts as a moderating variable in the relationship between digital transformation and sustainable performance. This allows institutions to incorporate sustainability into their digital strategies and reap the benefits of its integrated nature. Consequently, the following hypothesis is proposed.

H5: Green accounting moderates the relationship between digital transformation and sustainable performance.

Environmental culture as a moderator

Environmental culture is a key component of personal culture, which encompasses people's traits, views, actions, attitudes, knowledge, dedication, values, beliefs, and environmental concerns regarding how to protect and preserve the environment (Ordóñez, 2024; Abduhakimova and Islamova, 2025). Environmental culture reflects people's resolve to achieve a balance between their personal needs and the preservation of nature and its resources when interacting with the environment and facing environmental challenges. This helps in creating a positive environment that

facilitates individuals' adaptation to the environment and maintains the process of sustainability (Abdujabbarovna, 2024; Abduhakimova and Islamova, 2025).

Environmental culture includes two basic elements: environmental knowledge and awareness; environmental attitudes (Kabiri, 2022; Ordóñez, 2024; Abduhakimova and Islamova, 2025). Environmental knowledge and awareness refer to the ability of institutions and individuals to recognize and be aware of various environmental issues to adopt practices that ensure environmental protection (Abduhakimova and Islamova, 2025). Lack of environmental awareness and ignorance may lead to environmental deficiencies (Kabiri, 2022; Ordóñez, 2024). Environmental awareness also ensures that individuals have sufficient environmental information that works to improve the ecosystem, protect natural areas, and develop protected areas. The second element is environmental attitudes, which express positive or negative feelings or beliefs regarding the environment and its various issues (Kabiri, 2022; Ordóñez, 2024). Attitudes are the best way to determine the environmental behavior of individuals and institutions and the extent to which they adopt sound environmental behaviors and practices towards nature and the surrounding environment (Kabiri, 2022; Ordóñez, 2024). Green innovation and eco-friendly practices are promoted by green culture (Zhao and Selamat, 2023). To lessen the severity of environmental difficulties and issues, it also promotes people and organizations to embrace sustainable technology and new ideas in their varied consumption patterns (Tran et al., 2024; Abduhakimova and Islamova, 2025). This culture makes it easier for businesses to use digital transformation to boost social, economic, and environmental performance, which increases sustainability. Because it can either amplify the benefits of digital transformation for sustainability or lessen any potential drawbacks, green culture can thus act as a moderating (reducing or enhancing) variable in the relationship between digital transformation and sustainable performance. Thus, the following hypothesis was constructed considering this theoretical background.

H6: Environmental culture moderates the relationship between digital transformation and sustainable performance.

Based on the literature research and ideas put forward, this study proposes the hypothetical framework shown in Figure 1.

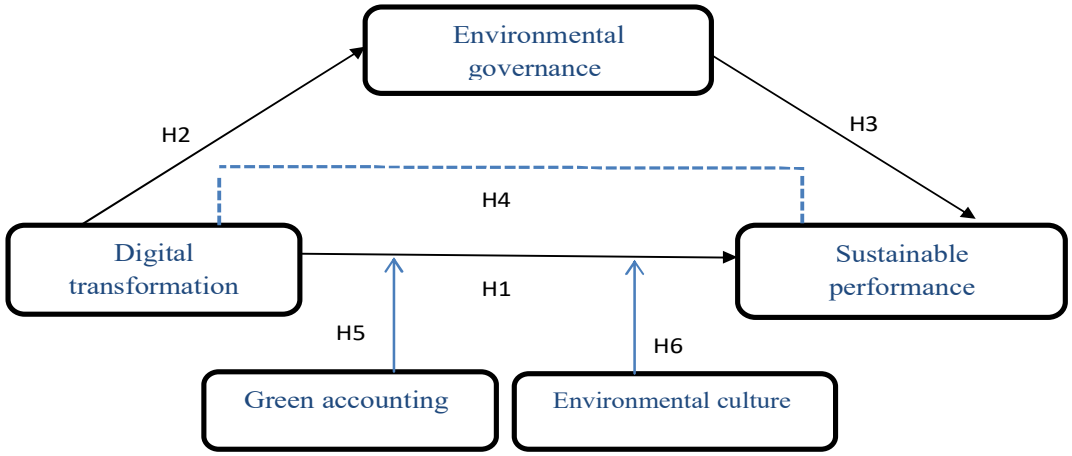

Figure1. Hypothetical framework

3. Research 3.

Methodology

3.1. Measures and instrument development

Five academics majoring in hotel studies and three HR managers from Cairo's five-star hotels assessed the survey's scales, language, organization, and substance. After that, the questionnaire was changed considering the input obtained. Additionally, the validity of the instrument utilized is confirmed by the fact that all the scales in this study were used and evaluated by earlier researchers. Ten hotel staff members also tested the questionnaire to make sure it was understandable and appropriate. After receiving comments, the instrument was finished and updated.

An online survey was utilized to gather the data; it was first written in English, translated into Arabic, and then analyzed in the English form. Five constructions and 53 items make up the survey instrument, which was modified from earlier research. The sample item of digital transformation was taken from the study of (Li, 2022; Nguyen et al., 2025) (5-item). The sample of the item of DT: "*Using digital technologies to build strong networks between organizations and various corporate procedures*". Sustainable performance was adapted and modified from Ishaq et al. (2025) (7-item). Item of SP: "*The hotel may adopt, uphold, and create a prevention strategy as an essential part of a sustainable development policy to safeguard the environment and halt its degradation*". Environmental governance was assessed via an 18- item by Daimi and Rebai. (2022). Examples of elements include: "*The hotel has a clear vision to contract with suppliers that provide supplies that do not harm the environment*". Green accounting was adapted and modified from Khan and Gupta (2024) (11- item). Item of GA: "*Green accounting reduces costs and improves resources when dealing with waste and depreciation*". Environmental culture was evaluated utilizing a 12- item scale developed by Sabherwal et al. (2023), featuring statement such as: "*My managers set a good example in terms of environmentally sustainable behaviour*". Five-point Likert scale was used to gather responses in addition to the demographic questions.

3.2. Sampling and data collection

To ensure the content validity of the constructs, this study builds on previous studies. In the Greater Cairo region of Egypt, we collected information from thirty-five-star hotels (Ministry of Tourism, 2021). Egypt's hotels are dispersed throughout many, far-flung regions; for convenience, this analysis only included hotels in the Greater Cairo area. The five-star chain hotels were picked because of the characteristics of these establishments, which include substantial employment and significant investment, and the managerial and marketing methods of the five-star hotels (DT, SP, EG, GA, and EC). In terms of a self-reported survey, it also requires less time than alternative methods. Similarly, the most effective method to gather evidence for research in an unknown population is to use a random sample. High worker response rates were obtained using the self-administered questionnaire to collect empirical data. The survey was sent to hotel staff members. The sample size for this research study was 500 questionnaires in total, which we received back. However, several questionnaires were missing values and others were filled out incorrectly. As a result, 480 completed surveys were included for data analysis after 20 questionnaires were eliminated. 78.6% was the effective response rate (393). The hotels received a formal letter from

the HR department requesting their agreement for questionnaire research. Participants' mail addresses were used to send well-crafted, thorough Google Forms, which was used to collect data online between December 2024 and May 2025. Before mailing the letter, the responders were contacted. They received gentle reminders to complete the questionnaire once it was sent. Due to its high suitability for remote communication and rapid data gathering, Google Forms are increasingly frequently utilized for data collection. Because they can finish the questionnaire whenever it is most convenient for them, it is equally convenient for the responders (Kapade, 2017). Additionally, there is very little chance of missing data and no need to enter it separately.

3.3. Data analysis

The research's quantitative data analysis will use partial least squares (PLS) as the estimation method in conjunction with structural equation modeling (SEM). SEM-PLS fits the study's setting because it is ideal for examining intricate interactions and works especially well with lower sample sizes. SEM makes it possible to assess both direct and indirect effects by allowing for the simultaneous analysis of several interactions within a theoretical framework. PLS is a strong technique in SEM that works well with complex models and latent variables, providing accurate parameter estimates even for data that is not normally distributed (Khairy et al., 2023; Abdel Majeed et al., 2025; Ibrahim et al., 2025). To guarantee robustness, data validation and reliability checks will be carried out before SEM-PLS analysis. These checks will include evaluating the validity and reliability of the measurement scale and verifying that the gathered data satisfies SEM-PLS assumptions.

4. Results

4.1. Participant's profile

Table 1 shows that 393 respondents make up the study sample profile. Of the 393 participants, 332 (84.5%) were men and 61 (15.5%) were women. In all, 157 people (39.9%) were younger than 25, 168 people (42.8%) were between 25 and 45, and 17.3% were older than 45. Furthermore, a bachelor's degree was held by most respondents (n = 311, 79.1%). Additionally, 120 (30.6%) had three to less than seven years of job experience, 50 (12.7%) had 7 to 10 years, 61 (15.5%) had more than 10 years, and 162 (41.2%) had less than three years.

Table 1. Employees' profiles (N = 393).

		Frequency	Percent
Gender	Female	138	35.0
	Male	255	65.0
Age Group	<25 years	157	39.9
	From 25 to 45 years	168	42.8
	>45 years	68	17.3
Education	High/Technical school	74	18.9
	Bachelor's degree	311	79.1
	Master/ PHD	8	2
Experience	< 3 years	162	41.2
	3– less than 7 years	120	30.6
	7–10 years	50	12.7
	> 10 years	61	15.5

4.2. Assessment of Measurement Model

The reliability and validity were assessed using Cronbach's alpha, composite reliability, and the average variance extracted (AVE). According to Hair et al. (2016), item loading more than 0.5 is deemed appropriate. All the anticipated item loadings for the current investigation, which ranged from 0.701 to 0.844, were deemed appropriate. Table 2 shows that all variables have Cronbach's alpha and composite reliability values more than 0.7, suggesting that the range of α and CR of the constructs in this investigation is acceptable. Furthermore, AVE values above 0.5 (range from 0.500 to 0.597) were discovered, confirming the scales' validity in accordance with the Hair et al. (2020) criterion.

Table 2. Reliability and validity results

Constructs	items	loading	α	C.R	AVE
Digital transformation	DT -1	.730	.822	.875	.501
	DT -2	.787			
	DT -3	.801			
	DT -4	.775			
	DT -5	.800			
Sustainable performance	SP -1	.811	.770	.802	.500
	SP -2	.806			
	SP -3	.800			
	SP -4	.783			
	SP -5	.747			
	SP -6	.783			
	SP -7	.799			
Environmental governance	EG -1	.777	.881	.893	.509
	EG -2	.780			
	EG -3	.771			
	EG -4	.801			
	EG -5	.766			
	EG -6	.794			
	EG -7	.801			
	EG -8	.786			
	EG -9	.840			
	EG -10	.844			
	EG -11	.790			
	EG -12	.708			
	EG -13	.752			
	EG -14	.800			
	EG -15	.766			
	EG -16	.788			
	EG -17	.795			
	EG -18	.780			
Green accounting	GA -1	.786	.899	.901	.597
	GA -2	.807			
	GA -3	.800			
	GA -4	.798			
	GA -5	.803			
	GA -6	.806			
	GA -7	.776			
	GA -8	.780			
	GA -9	.811			

Constructs	items	loading	α	C.R	AVE
	GA -10	.800			
	GA -11	.787			
Environmental culture	EC-1	.749	.887	.890	.564
	EC -2	.769			
	EC -3	.804			
	EC -4	.776			
	EC -5	.800			
	EC -6	.805			
	EC -7	.799			
	EC -8	.709			
	EC -9	.800			
	EC -10	.787			
	EC -11	.801			
	EC -12	.794			

In addition, the constructs' HTMT values and discriminant validity test were performed. The findings in Table 3 and 4 reveal that the AVE value is bigger than the maximum common value for each variable. These findings, according to Hair et al. (2020), verify the research model's reliability and validity.

Table 3. Discriminant Validity- Latent Variable Correlations

	EG	DT	SP	GA	EC
Environmental governance (EG)	**.756**				
Digital transformation (DT)	.321	**.779**			
Sustainable performance (SP)	.288	.290	**.789**		
Green accounting (GA)	.407	.188	.311	**.796**	
Environmental culture (EC)	.399	.255	.276	.201	**.783**

Table 4. HTMT Ratio

	EG	DT	SP	GA	EC
Environmental governance (EG)					
Digital transformation (DT)	.851				
Sustainable performance (SP)	.817	.755			
Green accounting (GA)	.852	.840	.732		
Environmental culture (EC)	.863	.831	.654	.640	

4.3. Structural Model

To investigate the proposed structural model of the current study, path coefficient, p-value, and R-square (R^2) were evaluated. To determine the size of the effect of the endogenous latent variables, the coefficient of determination (R^2) was also examined. According to Falk and Miller (1992), the minimum acceptable value for R-squared is 0.10. Moreover, the model's predictive relevance (Q^2) was also examined. The values of Q^2 are greater than zero (.68), supporting the assumption that this study model has appropriate predictive power according to Cha's (1994) criteria.

Table 5. Coefficient of determination (R^2) and (Q^2) of the model

Endogenous latent construct	(R^2)	(Q^2)
	.79	**.68**

The hypothesis testing in this research can be observed in the Path Coefficient table, which functions to test whether a hypothesis can be accepted or rejected. As per Table 6, the results revealed that digital transformation had a significant effect on sustainable performance (ß = 0.414, p < 0.01), thus supporting H1. These results are in line with past studies that demonstrate how the use of digital transformation approaches improves environmental governance mechanisms (e.g., Fatooh et al., 2023; Wei and Zheng, 2024; Zhong and Shang, 2025). Regarding the positive association between digital transformation and environmental governance in H2, the result supported this hypothesis (ß = 0.730, p < 0.01). This result agrees with past studies that demonstrate how digital transformation greatly improves corporate environmental governance (e.g., Xu et al., 2022; Fatooh et al., 2023; Zhong and Shang, 2025). H3, which referred to the significant and positive relation between environmental governance and sustainable performance, also strongly supported (ß = 0.530, p < 0.01). These findings confirm earlier studies that there is a direct and positive correlation between environmental governance and sustainable performance (Hao, 2023; El Sayed et al., 2025; Yang et al., 2025).

Table 6. Coefficients calculation results

Hypo.	Path	Beta (β)	t-Values	p-Values	Results
H1	**DT → SP**	.414	6.155	.001	Accepted
H2	**DT → EG**	.730	14.110	.001	Accepted
H3	**EG → SP**	.530	9.830	.001	Accepted

Table 7 presents the mediation analysis of EG on the relationship between DT and SP. The results of the bootstrapping analysis revealed a significant indirect impact (β = 0.302) with a t-value of 5.401. Additionally, following the guidelines of Preacher and Hayes (2008), the indirect effect of 0.211, with a 95% bootstrapped confidence interval (LL = 0.129, UL = 0.275), does not include zero within the interval, indicating the presence of mediation. Therefore, the mediation effect is deemed statistically significant, thus providing support for H4. This finding concurs with previous studies (e.g., Ding et al., 2024) which confirmed that DT makes EG procedures easier by enabling businesses to gather and evaluate vast volumes of data regarding their environmental performance. This aids businesses in improving their environmental practices and making more informed decisions about sustainability. In addition, this finding indicates that strong EG practices, empowered by DT (Xu et al., 2022; Fatooh et al., 2023), contribute to enhanced resource efficiency (Bergougui and Satrovic, 2025), less of an impact on the environment (Wu and Hussain, 2025), and improved green innovation (Kaki et al., 2025), resulting in improved SP over time.

Table 7. Mediation analysis

	IV→ Mediator	Mediator → DV			Bootstrapped Confidence Interval		
	Path a	**Path b**	**Indirect Effect**	**SE**	**t-value**	**95% LL**	**95% UL**	**Decision**
H4	0.701	0.302	0.211	0.035	5.401	0.129	0.275	**Mediation**

The effect size (F^2) of the exogenous constructs was also measured. Following Cohen's (1998) criteria, Table 8 showed that DT has a small effect size on SP (F^2 =

0.094) and EG (F^2 = 0.088), and EG has a medium effect size on SP (F^2 = 0.225). Additionally, GA and EC have a large effect size on SP (F^2 = 0.398) and (F^2 = 0.400).

Table 8. F^2 Values

Constructs	F^2	Results
Environmental governance → Sustainable performance	.255	Medium
Digital transformation → Sustainable performance	.094	Small
Green accounting → Sustainable performance	.398	Large
Environmental culture → Sustainable performance	.400	Large
Digital transformation → Environmental governance	.088	Small

Furthermore, a moderation analysis was conducted to investigate the moderating influence of GA and EC on the association between DT and SP. H5 and H6 are confirmed by the results in Table 9, which indicate that GA and EC significantly moderate the association between DT and SP (β =.033, p < 0.001) and (β =.051, p < 0.001). Figures 2 and 3 visually demonstrate that GA and EC effectively diminish the positive association between DT and SP. Our findings are in line with earlier studies by Li and Lin (2024), which showed that digital transformation improves environmental performance through green capacity. As green culture increases, so does this indirect influence. Additionally, these results also concur with the study of Lisnawati et al. (2024) which found that digital transformation does not always lead to sustainable success if it is not guided by an accounting framework.

Table 9. Moderation analysis results.

Hypo.	Path	Beta (β)	t-Values	p-Values	Results
H5	Moderating effect 1 → Sustainable performance	.033	2.086	.001	Accepted
H6	Moderating effect 2 → Sustainable performance	.051	2.099	.001	Accepted

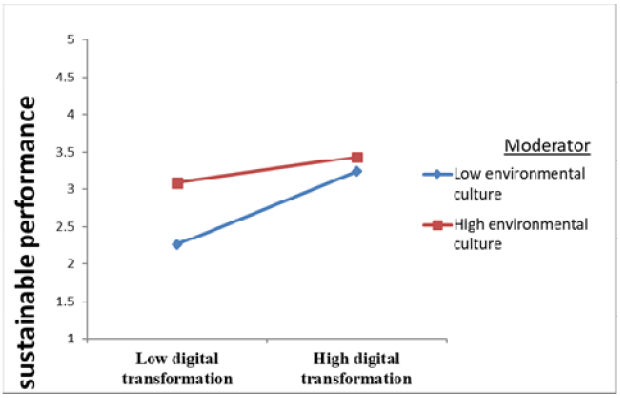

Figure 2. The moderating effect of GA on the relationship between DT and SP.

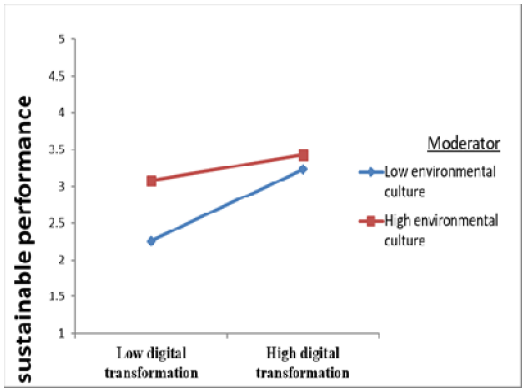

Figure 3. The moderating effect of EC on the DT-SP relationship.

5. Conclusion and implications

This research examines how digital transformation affects environmental governance and sustainable performance in the hotel industry. It investigates how environmental governance mediates the relationship between digital transformation and sustainable

performance and explores the moderating role of environmental culture and green accounting. The study highlights the moderating impacts of GA and EC as well as the mediating role of EG. The results show that DT has a major impact on both EG and SP, and that EG mediates the relationship between DT and SP. Additionally, the link between DT and both EG and SP is strengthened by both GA and EC, suggesting that it has a moderating effect. In four different ways, this study added theoretical insights to the literature on three research variables (DT, EG, and SP) in the context of hospitality. First, the study's findings resulted in a more thorough understanding of the ideas behind the variables listed in the hotel sector. Second, the results underscored the importance of EG serving as a mediator in the relationship between DT and SP. Third, the research on SP, digital transformation, and environmental governance was expanded to include Egyptian hotels. Fourth, GA and EC can help promote SP, as this study showed by highlighting their strong moderating influence on the links between DT and SP. As a result of this finding, the literature on GA and EC should be included in the framework of sustainable performance since they are important concepts in the study of sustainable performance.

It is advised to invest in digital technologies that promote sustainability, fortify environmental governance frameworks to direct digital investments, incorporate environmental performance indicators into digital strategies, and promote cooperation between technology and sustainability teams. The practical steps that hotels can take to improve the DT that fosters sustainable performance are as follows: (1) hotels can make sure that their digital transformation strategies and sustainability objectives are in line and work together by investing in sustainability-enhancing technologies like artificial intelligence, big data analytics, and the Internet of Things (IoT), as well as by creating performance indicators that gauge digital and environmental goals; (2) hotels must implement strong environmental governance through the establishment of official policies and procedures that guarantee environmental factors are incorporated into every facet of the digital transformation process. Additionally, stakeholders such as staff, clients, suppliers, and regulatory agencies must be involved in the development and application of environmental governance strategies; (3) hotels need to develop their cultural and institutional capacities. This can be accomplished by cultivating a culture of environmental innovation and training staff members on how to use digital tools to accomplish sustainability goals; (4) hotels should improve transparency and reporting by implementing transparent reporting models for sustainability performance connected to digital transformation and utilizing data gathered from digital platforms; (5) Research and development as well as innovation are essential for hotels. This is accomplished in two ways: first, by promoting cooperation with outside partners, including academic institutions, research centers, and startups, to create creative digital solutions that improve sustainable performance; and second, by leveraging the data produced by digital transformation to find new prospects for more sustainable business models, like performance-based service models or the circular economy; (6) It is imperative for hotels to cultivate a robust environmental culture. This can be accomplished through the creation of training and awareness programs for staff members that emphasize the value of sustainability and their part in it through digital transformation, the encouragement of staff members to

submit concepts for environmentally friendly projects that can be aided by digital technology, and the establishment of systems to recognize and assist staff members who contribute to the accomplishment of environmental objectives; (7) To record and monitor environmental and social costs and benefits, hotels must integrate green accounting methods into their system. This entails using data produced by the digital revolution, and (8) hotels should define environmental performance indicators to create a green accounting system. To evaluate the organization's environmental and sustainable performance, this entails creating and integrating sustainability-related key performance indicators (KPIs) into its accounting and reporting systems.

Limitations and Avenues for Future Research

Various constraints of this research, as well as potential areas for future investigation, need to be acknowledged. Initially, the research is restricted by specific places and time constraints. The study focused exclusively on hotels in Greater Cairo, potentially limiting the applicability of the findings to a broader context. Future research has the potential to broaden the investigation on the correlation among DT, EG, and SP to additional Egyptian urban areas. Additionally, the findings were based on information gathered during a particular timeframe (December and May 2025). Therefore, it would be advantageous to perform additional empirical longitudinal research to offer more dependable insights. Also, this study only concentrated on hotels. Hence, to make the findings more applicable, it would be advantageous to investigate the connections found in this research in various hospitality environments such as restaurants, to determine the importance of DT, EG, GA, EC in the industry. Moreover, this study assessed the effect of DT as a single construct on SP. Future research must, however, determine the importance and influence of each DT dimension (i.e., digital transformation strategy, strategic alignment, digital and information technology assets, and digital and information technology innovation) on SP, given the favorable results for both researchers and practitioners. In addition, it would be beneficial (and intriguing) to compare the results of this study with those of other studies conducted on four- and three-star hotels. In conclusion, most of the sample was made up of inexperienced young workers. Although this might be a representation of the younger hotel industry workforce, senior managers' and experienced employees' perspectives might be different. Future research could therefore investigate whether these perceptions vary depending on age and experience.

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