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The impact of artificial intelligence capabilities on the sustainability with the mediating role of green innovation in the Jordanian hotels sector

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A B S T R A C T

The hotel industry in Jordan plays a crucial role in stimulating economic expansion by attracting tourists and creating job prospects. The industry can benefit from the use of Artificial Intelligence (AI) to improve sustainability through the promotion of green innovation, efficient resource utilization, and reduction of environmental harm. Hence, this study designs a model to enhance the environmental, economic, and social sustainability in the Jordanian hotels Sector. The study aimed to examine the impact of the AI Capabilities (tangible, intangible and human) on social, economic, and environmental sustainability with the mediating effect of the green innovation. The population of this study is all employees in 19 eco-friendly hotels in Jordan, they were 18,850 distributed over four Jordanian regions (Amman, Aqaba, Dead Sea and Petra). A total of 377 questionnaires distributed to respondents using stratified sampling. The study used SEM with SMART-PLS 4 to analyze the data collected. The measurement model applied to analyze the reliability and reliability of the model, the path coefficient in the structural equation model used to test the study hypotheses. The results of this study supported most of the study's hypotheses, as it supported the impact of tangible and human capabilities on the sustainability, while the study did not find any direct impact of the intangible capabilities on the sustainability in the hotel sector in Jordan. The results show significant direct impact of the three AI capabilities; tangible, intangible and human on the green innovation, also the study found significant impact of the green innovation on the sustainability. The study confirms the three mediation hypotheses of the green innovation on the impact of the AI capabilities on the sustainability in the Jordanian hotel sector. The study provides important implications to the managers in the Jordanian hotel sector to enhance their environmental, economic and social sustainability by improving AI capabilities and innovation.

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1. Introduction

There are several pressing challenges in the modern world that require immediate attention. These include addressing global warming, enhancing disease diagnosis, halting plastic pollution, conserving endangered species, and combating inequality (Earth.org, 2020; Vision-2030, 2019). The United Nations (UN) has introduced the "2030 Agenda" as a response to economic, ecological, and societal challenges. This agenda aims to establish a collective approach to achieving and maintaining peace and prosperity for both people and the planet. At the heart of this agenda are the 17 Sustainable Development Goals (SDGs; UN 2015). While the Agenda only establishes a few direct connections between these goals and technology, such as promoting women's empowerment, access to financial services, and energy (UN, 2015), it is widely believed that technological innovations are crucial in making significant progress towards sustainability and achieving the SDGs (Di Vaio et al., 2020; Asadi et al., 2020).

The importance of sustainability has been steadily expanding worldwide, as there is a growing worry about the viability and efficiency of resources, infrastructure, policies, and economies in the face of climate change, excessive consumption, and global population expansion. The term 'sustainability' was first linked to policies centered on environmental concerns.

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However, it has since evolved to encompass a wider range of development-related challenges and incorporates three primary pillars: social, economic, and environmental (Early, 2020). Similar to other countries, the SDGs have been integrated into Jordan's National Development Strategies (2030) due to the significance of sustainable development in all aspects. Jordan's development plans, known as the Indicative Executive Programmed of the Government, are highly ambitious in their alignment with the Sustainable Development Goals (SDGs) (Ministry of Planning and International Cooperation, 2022). Jordan has incorporated the Sustainable Development Goals (SDGs) into various sector-specific policies and action plans, thereby enhancing and supporting existing initiatives in this domain. The National Green Growth Plan for Jordan from 2021-2025 highlights the significance of the tourism sector in the country's economy. It is considered a crucial sector in achieving sustainability across environmental, economic, and social aspects (Freihat et al., 2022).

The tourist sector must prioritize sustainable development by adhering to principles that promote responsible actions towards social, economic, and environmental aspects (Ibrahim & AlZboun, 2021). The study conducted by Balsalobre-Lorente et al. in 2023 revealed that contemporary technology, utilizing artificial intelligence capabilities, significantly contributes to the attainment of sustainable development objectives in the tourism industry. The National Charter for Artificial Intelligence Ethics in the Hashemite Kingdom of Jordan highlights the significance of AI capabilities in attaining sustainable development goals. It emphasizes the need to utilize knowledge and technology tools effectively, while adhering to values and capitalizing on existing opportunities. This approach aims to achieve economic, social, and environmental benefits, ultimately ensuring sustainability through cutting-edge technology.

The study conducted by Zhang et al. (2020) found that there is a lack of consensus among various studies regarding the impact of AI on achieving sustainable development goals. However, it was also observed that there are certain factors that can potentially facilitate the role of AI in achieving sustainability, as suggested by Schoormann et al. (2021). Another study by Di Vaio et al. (2020) recommended further research in diverse contexts, using different variables, and across various sectors to gain a better understanding of the role played by AI in achieving sustainable development goals.

This study aimed to address the lack of empirical research in the theoretical literature by conducting a study on the hotel industry in Jordan. The objective was to examine the influence of AI capabilities (tangible, intangible, and human) on achieving sustainable development in terms of social, environmental, and economic dimensions. The study also explored the mediating role of green innovation, which is recommended by Tussyadiah (2020) as a crucial factor in measuring the impact of AI capabilities on sustainability. Green innovation serves as a link between environmental concerns and technological advancements. This study will be conducted in the hotel sector of the Hashemite Kingdom of Jordan, which is a significant sector in the country's economy. It is worth noting that this study is the first of its kind to investigate the effects of implementing AI capabilities on achieving sustainable development goals, specifically through the intermediary role of green innovation.

2. Problem Statement

The hotel industry is considered a significant consumer of energy, water, and non-durable products within the tourism sector. This consumption leads to the possible release of harmful pollutants into the air, water, and land due to the company's role as a service provider (Oriade et al., 2021). In response to these concerns, numerous hotels worldwide have implemented sustainable tourism policies in order to mitigate the adverse effects of their operations, recognizing their obligation to safeguard the environment (Mohamed & Mohamed, 2022). The hotel industry in the Hashemite Kingdom of Jordan plays a crucial role in supporting tourism. Therefore, it is imperative to ensure that these hotels effectively pursue sustainable development objectives to prevent any adverse impacts on the environment and local community, while also achieving their economic goals (Al-Abbadi, 2021).

The Ministry of Planning and International Cooperation in Jordan's report on the Second Voluntary National Review (2022) of the Sustainable Development Goals highlighted the efforts to align the National Green Growth Action Plan (2021-2025) with the aim of achieving environmentally sustainable and socially inclusive green growth. The plan incorporates green investments in various sectors, with a particular focus on the tourism sector. It also emphasizes the integration of modern technology into the sustainable development plan to achieve economic and social objectives while addressing environmental risks and climate change. This underscores the significance of leveraging artificial intelligence capabilities to promote sustainable development in Jordan's hotel sector (Ministry of Planning and International Cooperation, 2022).

The National Strategy for Artificial Intelligence and the Executive Plan 2023-2027 have highlighted the significance of artificial intelligence in promoting sustainable growth across key industries in Jordan, including tourism. The national policy also prioritized the improvement of artificial intelligence skills and its utilization to increase productivity and attain sustainable growth across all economic sectors in the Kingdom (Ministry of Entrepreneurship and Digital Economy, 2022).

The above demonstrates the significance of artificial intelligence capabilities in attaining the various aspects of sustainable development. This is of utmost importance as it is a top priority for the Jordanian state, as indicated by reports from the Ministries of Entrepreneurship and Digital Economy, as well as Planning and International Cooperation. This study aims to assess the impact of artificial intelligence capabilities on achieving sustainable development in the hotel sector in Jordan. It is

the first of its kind in the country and focuses on measuring the influence of tangible and intangible AI capabilities on economic, social, and environmental dimensions of sustainable development. The study also examines the mediating role of green innovation in this context.

Moreover, the study will bridge the knowledge gap of the link between AI capabilities and sustainability. builds on the notion of AI capability, a necessary capacity that public organizations must foster to realize value from novel digital technologies to achieve sustainable development. Grounded on the organization's resource-based view (RBV), the researchers put forth an adapted operationalization of the notion which outlines three broad types of resources that need to be developed by public organizations: tangible, intangible, and human resources. The study argues that AI capabilities indirectly affect perceptions of sustainability outcomes by prompting the concept of green innovation. Specifically, we hypothesize that AI capabilities (tangible, intangible, and human resources) have effects on the social, economic, and environmental sustainability of the Jordanian tourism sector. This work therefore adds to the research by elucidating the key dimensions that organizations need to develop to realize value from AI, and by empirically demonstrating the mechanisms through which sustainability improvements can be realized. It also offers practitioners an understanding of how they should approach novel digital technologies such as AI, and pinpoints areas in which AI initiatives can be directed.

2.1. Research Questions

The study's main question is "Is there an impact of AI capabilities (tangible capabilities, human capabilities, intangible capabilities) on the sustainability (economic, environmental and social) with the mediating role of green innovation in the Jordanian hotel sector?"

The study will try to answer the following questions:

1. Is there any impact of the AI capabilities on sustainability in the Jordanian hotel sector?

2. Is there any impact of the AI capabilities on green innovation in the Jordanian hotel sector?

3. Is there any impact of the green innovation on sustainability in the Jordanian hotel sector?

4.Is there any mediating role of the green innovation on the impact of the AI capabilities on the sustainability in the Jordanian hotel sector?

2.2 Research Objectives

The study's main objective is to investigate the impact of AI capabilities (tangible capabilities, human capabilities, intangible capabilities) on the sustainability (economic, environmental and social) with the mediating role of green innovation in the Jordanian hotel sector.

The study will try to achieve the following objectives:

1. To determine the impact of the AI capabilities on sustainability in the Jordanian hotel sector.

2. To determine the impact of the AI capabilities on green innovation in the Jordanian hotel sector.

3. To determine the impact of the green innovation on sustainability in the Jordanian hotel sector.

4.To investigate the mediating role of the green innovation on the impact of the AI capabilities on the sustainability in the Jordanian hotel sector.

3. Literature Review

The AI Capabilities are categorized into three groups according to Grant (1991) and Barney (1991). Tangible resources encompass data, technology, and fundamental resources, whereas human resources encompass business and technical expertise (Mikalef & Gupta, 2021). Three essential intangible resources necessary for developing an AI capability are inter-departmental coordination, organizational change capacity, and risk proclivity. In the subsequent subsections, we present Fig. 1, which illustrates the power of artificial intelligence and the categorization of resources. Provide an in-depth analysis of each of these resources. The Resource-Based Theory (RBT) and the identification of crucial resources in the development of a competence are also significant viewpoints for practical application (Kruesi & Bazelmans, 2023). Managers and practitioners can establish precise benchmark standards and measure their preparedness in each dimension. Through this approach, they can uncover possible vulnerabilities that might be remedied through specific interventions.

3.1 AI Capabilities and Sustainability

There is a substantial influence on economic, environmental, and social sustainability from the capabilities of Artificial Intelligence (AI), which encompasses both intangible and tangible elements as well as human beings (Lee, K., 2021). Study of Issa et al. (2024) asserted that modern technology, cloud computing, and data storage are examples of tangible AI capabilities that allow firms to analyze large volumes of data, make decisions based on that data, and optimize their resources while eliminating waste. One way to reduce repair and replacement costs and maximize equipment uptime is by extending the life of machinery with AI-driven predictive maintenance. This strategy also helps to decrease downtime. According to Kliestik et al. (2023), ensuring economic sustainability involves enhancing operating efficiency, promoting long-term profitability, and conserving natural resources.

The intangible capabilities of AI, such as algorithms, software, and intellectual property, contribute to sustainability by enabling more efficient and effective processes with less environmental impact. For example, AI algorithms have the potential to optimize supply chains, which in turn reduces energy usage and greenhouse gas emissions (Ibrahim, 2024) by optimally anticipating demand and minimizing overproduction. Additionally, AI can facilitate the transition to renewable energy sources by enhancing the efficiency and reducing interference of various systems, such as wind, solar, and others, in relation to fossil fuels. Afridi et al. (2022) found that this will alleviate environmental sustainability concerns by decreasing reliance on fossil fuels and carbon footprints.

To ensure the fair and ethical use of AI technology, which supports social sustainability, human capabilities related to AI, such as understanding how to develop, deploy, and oversee AI systems, are crucial (Ahmad et al., 2021). As an example, AI-powered health diagnostics that expand access to treatment and reduce inequalities might be developed by talented AI designers (Monlezun, 2023) and used to promote social good. Furthermore, a diverse and inclusive AI workforce can better equip AI systems to anticipate and fight prejudices. According to Moon (2023), this will ensure that AI technologies are accessible to all segments of society and are used fairly. Therefore, in order to construct a sustainable future, particularly at the intersection of AI capabilities and sustainability, a holistic approach is required that considers economic, environmental, and social factors (Abulibdeh, Zaidan & Abulibdeh, 2024). The following hypotheses were tested in this investigation in light of the preceding discussion:

H_1: *There is a significant impact of the AI's tangible capabilities on the sustainability in the Jordanian hotels sector.*

H_2: *There is a significant impact of the AI intangible capabilities on the sustainability in the Jordanian hotels sector.*

H_3: *There is a significant impact of the AI human capabilities on the sustainability in the Jordanian hotels sector.*

3.2 AI Capabilities and Green Innovation

According to Almansour (2024), the hotel business is getting a major boost from green innovation thanks to AI capabilities, which include both intangible and tangible aspects as well as human-related ones. Hotels can optimize energy consumption, minimize waste, and improve water management with tangible AI capabilities like sensors, IoT devices, and smart infrastructure (Tiwari et al., 2022). By analyzing occupancy patterns and real-time usage data, AI-powered energy management systems may make adjustments to lighting, heating, and cooling. This helps to minimize energy waste and operational expenses (Alijoyo, 2024). Another way that AI-driven waste management systems might help the hotel achieve its sustainability goals is by improving the efficiency of garbage sorting and recycling. Hotels may easily adopt eco-friendly practices thanks to these tangible AI technologies, which also result in significant financial and environmental savings (Khan et al., 2021).

Through the use of data-driven decision-making and predictive analytics, intangible AI capabilities—such as sophisticated algorithms and software—improve hotel green innovation. According to Akter et al. (2023), AI algorithms have the ability to sift through mountains of data pertaining to visitor preferences, weather patterns, and seasonal variations. With this knowledge, they can optimize resource allocation and forecast demand. By predicting future occupancy rates, AI can assist hotels in reducing food waste by adjusting inventory levels of perishable commodities (Kasavan et al., 2022). In addition, platforms driven by AI can help create sustainable supply chains by finding environmentally conscious vendors and reducing carbon footprints through logistics optimization (Jubrail, 2024). With the use of these intangible AI technologies, hotels may improve operational efficiency, implement more sustainable business practices, and provide environmentally responsible services that appeal to eco-conscious guests.

Enabling green innovation also requires human AI capabilities, such as the knowledge and talents of hotel employees to manage AI systems. In order to find and execute sustainable practices, such as tracking energy consumption trends and improving operational procedures, trained personnel can use AI tools (Khaled & Alena, 2021). By addressing potential biases in AI algorithms and making sure that AI-driven initiatives are in line with the hotel's sustainability objectives, human capabilities also guarantee the ethical use of AI. Hotel employees can make better use of artificial intelligence (AI) tools by encouraging a culture of constant learning and innovation, which in turn leads to a greener and more sustainable kind of hospitality (Scatiggio, 2020). According to Khan et al. (2024), the hotel business is experiencing a state of complete green

innovation thanks to the combination of human capabilities with both tangible and intangible AI resources. The following hypotheses were tested in this investigation in light of the preceding discussion:

H_4: *There is a significant impact of the AI tangible capabilities on the green innovation in the Jordanian hotels sector.*

H_5: *There is a significant impact of the AI intangible capabilities on the green innovation in the Jordanian hotels sector.*

H_6: *There is a significant impact of the AI human capabilities on the green innovation in the Jordanian hotels sector.*

3.3 Green Innovation and Sustainability

The economic, environmental, and social components of sustainability are all profoundly impacted by green innovation in hotels. Economically, hotels can significantly reduce their operating expenses by adopting green practices including energy-efficient lighting, water-saving systems, and trash reduction techniques. There will be immediate financial benefits for hotels (Gu, 2023) if they cut down on energy use and trash. This is because hotels pay less for utilities and trash disposal. Additionally, hotels can boost their brand image with green technologies, which in turn attracts eco-conscious customers who are ready to pay more for sustainable lodgings. Profitability, a more formidable market position, and higher revenues are all possible outcomes of this (Rai, Anirvinna & Shekhar, 2024).

Green innovation in hotels is crucial in lowering the carbon footprint and overall ecological impact of the industry, according to environmentalists. The authors Yue (2021) Renewable energy, waste reduction programs, and sustainable material procurement are some of the practices that help reduce emissions of greenhouse gases and preserve natural resources (Okogwu et al., 2023). In addition, hotels may optimize their operations with green innovations like smart building technologies and AI-driven energy management systems, which reduce energy consumption and waste (Qi, 2024). These initiatives contribute to a healthier world and wider global sustainability goals by reducing the environmental effect of the hotel business.

Green innovation in hotels promotes a culture of sustainability that is advantageous to both staff and visitors (Kuo et al., 2022). By putting an emphasis on environmentally conscious practices, hotels may produce a healthier and more sustainable work environment for their employees, lowering the risks connected with chemical hazards and unnecessary waste. Additionally, green technologies can improve the guest experience by providing a stay that is more ecologically conscious; this, in turn, can increase client satisfaction and loyalty (Soni et al., 2022). Community involvement programs, such as working with regional vendors and taking part in environmental preservation activities, also contribute to social sustainability (Szetey et al., 2021). In addition to bolstering the local economy, these activities deepen the hotel's connection to the community, encouraging a collective commitment to sustainability. The following hypothesis was tested in this investigation in light of the preceding discussion:

H_7: *There is a significant impact of the green innovation on sustainability in the Jordanian hotels sector.*

3.3 Green Innovation as mediation

The role of green innovation was investigated in this study as a mediator between the three types of AI capabilities (tangible, intangible, and human resource capabilities) and the sustainability results for economic, social, and environmental aspects. The technological foundation for creating tangible innovations is provided by the AI innovation capabilities, such as cutting-edge computing infrastructure and data processing tools (Roux et al.,2023). According to Constantinini et al. (2017), these innovations have the potential to improve resource use and energy consumption, thus lowering environmental impact. At the same time, they can raise economic performance by reducing operational costs and increasing productivity. AI-driven green innovations assist businesses in striking a balance between profitability and environmental stewardship by facilitating the development of environmentally friendly technology and processes (Lodhi et al., 2021).

According to Lee et al. (2021), intangible AI capabilities like proprietary algorithms, data insights, and intellectual property play a big role in green innovation and sustainability. Innovative solutions to certain sustainability issues, including optimizing supply chains, lowering carbon emissions, or improving waste management, can be created by companies with these capabilities (Moshood et al., 2021). By supporting community-beneficial behaviors like improving air and water quality or increasing access to renewable energy, green innovation, supported by these intangible assets, can promote social sustainability (Galindo-Martn et al., 2020). A company's reputation and long-term viability are bolstered by this good impact on social and environmental sustainability, which in turn strengthens economic sustainability (Le, 2022).

The ability to drive green innovation and achieve sustainability goals depends on the human resource capabilities, which include the knowledge, expertise, and skills of employees in AI and green technology. AI experts can spot chances to incorporate eco-friendly procedures into company operations, create sustainable goods, and cut down on energy use (Abdullah

& Lim, 2023). According to Chowdhury et al. (2023), a culture of innovation that supports sustainability goals can be created through the efficient utilization of human resource capabilities in AI. By fostering the simultaneous pursuit of economic prosperity, social well-being, and environmental protection, green innovation enhances overall sustainability performance as it gets ingrained in corporate practices (Afum et al., 2021). In highlighting the mediating function of AI on sustainability through green innovation, this synergy emphasizes the critical role of human resource capabilities in AI. Based on the above discussion, this study examined the following hypotheses:

H_8: *There is a mediating effect of the green innovation on the impact of the AI tangible capabilities on the sustainability in the Jordanian hotels sector.*

H_9: *There is a mediating effect of the green innovation on the impact of the AI intangible capabilities on the sustainability in the Jordanian hotels sector.*

H_{10}: *There is a mediating effect of the green innovation on the impact of the AI human capabilities on the sustainability in the Jordanian hotels sector.*

3.6 Theoretical Framework

The theoretical model of the recent study drawn based on theories; The Resource-Based View (RBT) suggests that AI capabilities (tangible, intangible and human resource) can enhance the sustainability environmentally socially and economically, also the dynamic capability theory support this relationship as AI capabilities (tangible, intangible and human resource) can be dynamic capability in order to achieve the sustainability. The model of the study examines the AI capabilities (tangible, intangible and human resource) as independent variables, the dependent variable is the sustainability measured by three dimensions; environmental, economic and social. Moreover, the study examines the green innovation as mediator in the impact of the AI capabilities (tangible, intangible and human resource) on sustainability (environmental, economic and social) The suggested model, based on (Mikalef & Gupta, 2021; Srouji et al.,2023; Vinuesa et al.,2020; Schoormann et al., 2022; Mikalef et al., 2023) will be empirically evaluated in the Jordanian hotel sector. Fig. 1 theoretical framework:

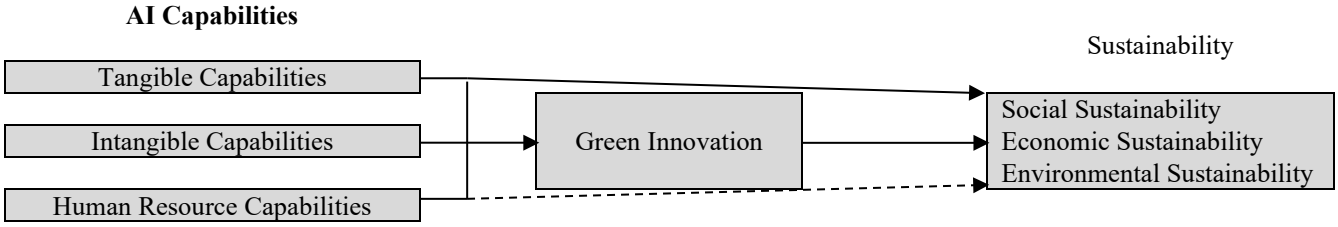

Fig. 1. Theoretical model of the study

4. Research Methodology

4.1 Design and Procedures

The research design in the recent study is quantitative approach, the hypotheses formulated to examine the impact of AI capabilities (tangible capabilities, human capabilities, intangible capabilities) on the sustainability (economic, environmental and social) with the mediating role of green innovation in the Jordanian hotel sector. The data collection process from all administrative and non-administrative employees in 19 eco-friendly hotels in Jordan. Secondary data from previous studies that had already explored the same topics. The programmes used for data analysis were SPSS and SMART-PLS for the purposes of descriptive statistics and cause-effect in order to attain the study objectives.

4.2 Population and sample

The population of this study is all administrative and non-administrative employees in 19 eco-friendly hotels in Jordan; the number of hotel workers in Jordan at the point of data collection was 18,850 employees distributed over four Jordanian regions (Amman, Aqaba, Dead Sea and Petra), according to the website of the Ministry of Tourism in Jordan for the year 2023. A total of 377 questionnaires will be distributed to respondents in the four regions using stratified sampling. Stratified random sampling employed as sampling technique in the recent study, to cover all Jordanian regions (Amman, Aqaba, Dead Sea and Petra). Table 1 explains the stratified random sampling to choose the respondents of the study.

Table 1
Stratified random sampling of the study

Region	Employees	The portion	No. in the sample
Amman	7800	2 %×7800	156
Aqaba	6450	2 %×6450	129
Dead Sea	4150	2 %×4150	83
Petra	450	2 %×450	9
Total	**18850**		**377**

The whole number of employees is (18850) and the sample size for (18850) population is (377) based on the (Krejci & Morgan 1970). Each region has the portion of (377/18850= 0.20) from the sample that will be distributed randomly to the hotels in the regions.

4.4 Measurement

The AI capabilities, the independent variable of this study conceptualized based on the study of Mikalef and Gupta, (2021) as tangible capabilities, intangible capabilities, and human capabilities. The measurement of these three independent variables adapted from the same of Mikalef and Gupta (2021), tangible capabilities were measured by five items; intangible capabilities were measured by five items, also human capabilities were measured by five items. Moreover, sustainability is the dependent variable of this study measured by three sub-constructs; environmental, social, and economic, the measurement of sustainability adapted from the study of (Mondejar Jimenez et al., 2016). Finally, green innovation which was examined in this study as mediation measured by four items adapted from the study of (El-Kassar & Singh, 2019).

4.5 Data Analysis

The next is data analysis will be conducted with SPSS and SMART-PLS path modeling. Measurement model conducted for the reliability test internal consistency, and the validity test; discriminant validity and convergent validity. All results will be displayed in the following sections. Moreover, the structural model analysis conducted to establish the causal impact between constructs to test the study hypotheses.

4.5.1 The Structural Equation Modelling (SEM)

Structural Equation Modelling (SEM) is a technique used to evaluate the study model by path modelling to analyze the data in a two-step approach. The first stage is conducted to evaluate the measurement model, by checking the items' reliability and validity, and the second stage, namely the structural model, which is conducted to test the significance of the path coefficients and calculating the R2 and F2 value of the study model.

3.5.2 Measurement Model Evaluation

To determine the reliability of the individual items, and the internal consistency reliability of the constructs study measurement model evaluated. Another output of the measurement model is the discriminant validity, content validity and convergent validity. All acceptable levels of the measurement model reliability and validity illustrated in the study of Hair et al., (2014). The study measurement model displayed in Fig. 1.

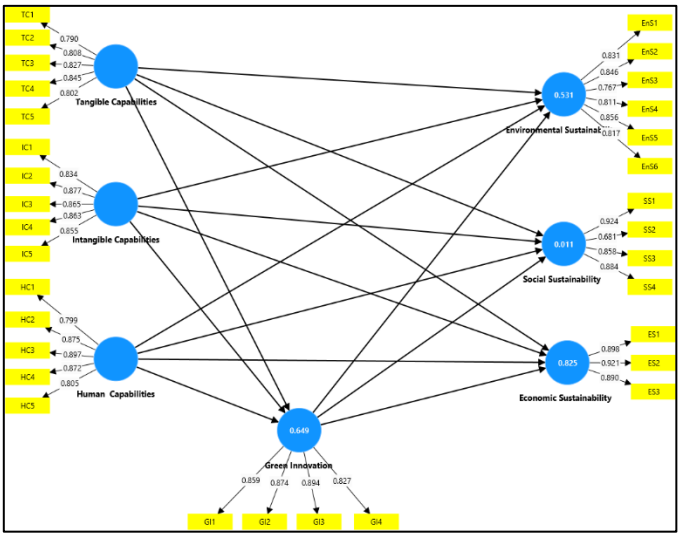

Fig. 2. The measurement model of the study

The item's outer loadings of the latent constructs are shown in figure2, the results shows that all items have loadings satisfied with the level of 0.40 suggested by (Hair et al., 2014). Further, the results of the internal consistency reliability, Cronbach's alpha, and composite reliability which are used to quantify the internal consistency and reliability of a scale, particularly one with numerous components are displayed in Table 2 as part of the assessment of the measurement model.

Table 2
Assessment for Measurement Model

Construct	Sub Construct	Items (Indicators)	Indicators Reliability loading	Internal CR	Convergent AVE	Reliability Cronbach's
Tangible Capabilities		TC1	0.79	0.908	0.664	0.874
		TC2	0.808			
		TC3	0.827			
		TC4	0.845			
		TC5	0.802			
Intangible Capabilities		IC1	0.834	0.934	0.738	0.911
		IC2	0.877			
		IC3	0.865			
		IC4	0.863			
		IC5	0.855			
Human Capabilities		HC1	0.799	0.929	0.723	0.903
		HC2	0.875			
		HC3	0.897			
		HR4	0.872			
		HC5	0.805			
Green Innovation		GR1	0.859	0.922	0.746	0.886
		GR2	0.874			
		GR3	0.894			
		GR4	0.827			
Sustainability	Environmental Sustainability	ENS1	0.831	0.926	0.675	0.904
		ENS2	0.846			
		ENS2	0.767			
		ENS4	0.811			
		ENS5	0.856			
		ENS6	0.817			
	Social Sustainability	SS1	0.924	0.906	0.709	0.897
		SS2	0.681			
		SS3	0.858			
		SS4	0.884			
	Economic Sustainability	ES1	0.898	0.93	0.816	0.887
		ES2	0.921			
		ES3	0.89			

Table 2 shows that the composite reliability CR of all constructs exceeds the acceptable level 0.70 of Hair, et al. (2014), internal consistency of reliability (CR) applied to evaluate the internal consistency of reliability, the result of CR indicates good internal consistency of the all constructs. Moreover, the study's convergent validity as assessed by the average variance extracted (AVE), the threshold for which AVE is considered satisfactory should exceed the values of 0.5 as suggested by (Hair, et al., 2014). The Average Variance Extracted (AVE) coefficients in Table2 show convergent validity is acceptable for all constructs in this study.

Table 3
Fornell-Larcker approach

	Economic Sustainability	Environmental Sustainability	Green Innovation	Human Capabilities	Intangible Capabilities	Social Sustainability	Tangible Capabilities
Economic Sustainability	**0.903**						
Environmental Sustainability	0.624	**0.822**					
Green Innovation	0.901	0.646	**0.864**				
Human Capabilities	0.736	0.603	0.77	**0.85**			
Intangible Capabilities	0.504	0.502	0.517	0.4	**0.859**		
Social Sustainability	0.06	0.032	0.063	0.067	0.016	**0.842**	
Tangible Capabilities	0.45	0.58	0.494	0.413	0.68	0.035	**0.815**

In addition to reliability, Table 3 displays that of the constructs. Discriminant validity indicates that a measurement model is free from redundant items in each construct, by empirical standards, it is actually distinct from other constructs. In SMART-PLS discriminant validity is measured by Fornell and Larcker method. The discriminating validity assessment proved the study measurements' validity. In the Fornell-Larcker approach the constructs correlation utilizing to test measurement model discriminant validity is shown in Table 3

Based on the study of Fornell and Bookstein (1982) if the calculation of AVE square root exceeds the correlation between the factors accounting for each pair, the discriminant validity occurs. This is displayed in bold in Table 3. In this study's correlation matrix, the value should exceed the other off-diagonal entries in both the rows and columns. These results indicate that the requirements for the measures' ability to differentiate between different constructs have been satisfied.

4.5.3 Structural Model Findings

The value and significance of structural parameter estimates, displayed as one-headed arrows in the path diagrams, are not considered in the evaluation of structural parameters. This assessment concludes by validating the precision of the structural model, which is determined by examining the hypothesized links between the identified and assessed variables. The Partial Least Squares Structural Equation Modeling (PLS-SEM) technique employed in this study. Also, bootstrapping with 5000 replicates to assess the structural model and validate the hypotheses. The tests conducted in this study included the inner model R^2, F^2, and p-value tests (Hair et al., 2014). Figure 3 displays the internal structure of the model, including the p-value and beta coefficient of construct correlations.

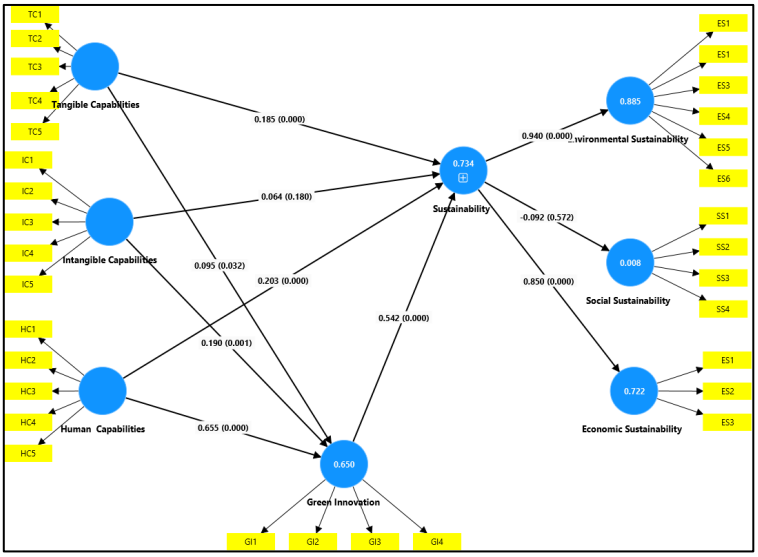

Fig. 3. The Structural Model path coefficient and P value of the study

The coefficient determination R^2 for each endogenous variable of the study shown in Table 4, Fig. 2 shows the results the R^2, which was show good value for all endogenous variables.

Table 4
R^2 of the Endogenous Variables

Variables Relation	R^2	R^2 Adjusted
Sustainability	0.734	0.731
Green innovation	0.650	0.646

As shown above in Table 4 the tangible capabilities, intangible capabilities, human capabilities and green innovation explain 73.4% of the variation of sustainability, while tangible capabilities, intangible capabilities, human capabilities explain 60.5% of the variation of the green innovation in the hotel sector in Jordan. Another result can be extracted from the structural model is the effect size F^2. The effect size F^2 is an approach that can be used to assess the significance of a predictor's influence on an endogenous variable. The F^2 statistic is used to assess the significance of an exogenous construct's contribution to an endogenous one. Based on the study of Cohen (1988) the value of the effect sizes of F^2 0.35, 0.15 and 0.02 are regarded as high, medium and small effect sizes respectively. Table 5 presents the assessments of the coefficient of effect size F^2.

Table 5
Effect Size of the Exogenous Constructs

Construct Relation	F^2	Effect Size
Tangible Capabilities→ Sustainability	0.123	Medium
Intangible Capabilities → Sustainability	0.001	Small
Human Capabilities → Sustainability	0.004	Small
Tangible Capabilities→ Green Innovation	0.009	Small
Intangible Capabilities → Green Innovation	0.075	Medium
Human Capabilities → Green Innovation	2.003	High
Green Innovation → Sustainability	0.870	High

As shown in table 5, the effect size of the exogenous constructs on the endogenous ones ranged between small, medium and high based on the study of (Cohen, 1988).

4.5.4 Hypotheses Testing (Path Coefficient)

This section discusses the findings of the path coefficient which used to examine the hypotheses of the study. The finding of direct (H1 to H7), are presented in Fig. 2 also in Table 6. The numbers in the bracket represent the p-value in, and the values next to the bracket represent the coefficient value (beta value).

Table 6
Structural Model Assessment for the direct effect hypotheses

		Path coefficient Beta	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values	Decision
H1	Tangible Capabilities→ Sustainability	0.185	0.053	3.492	0	Supported
H2	Intangible Capabilities → Sustainability	0.064	0.048	1.341	0.18	Not Supported
H3	Human Capabilities → Sustainability	0.203	0.058	3.519	0	Supported
H4	Tangible Capabilities→ Green Innovation	0.095	0.044	2.149	0.032	Supported
H5	Intangible Capabilities → Green Innovation	0.19	0.057	3.344	0.001	Supported
H6	Human Capabilities → Green Innovation	0.655	0.039	16.75	0	Supported
H7	Green Innovation → Sustainability	0.542	0.066	8.241	0	Supported

Notes: Significant level at ** = $p < 0.05$,

Table 6 shows the results of the direct effect hypotheses; the result shows that the first hypothesis H2 which is formulated to examine the impact of the intangible capabilities on sustainability was not supported. While all other direct effect hypotheses were supported, the supported hypotheses H1 which is related to the impact of the tangible capabilities on the sustainability, H3, related to the impact of the human capabilities on the sustainability, H4 which is related to the impact of the tangible capabilities on the green innovation, H5 which is related to the impact of the intangible capabilities on the green innovation, H6 which is related to the impact of the human capabilities on the green innovation, and H7 which is formalized to find the impact of the green innovation on the sustainability within hotel sectors in Jordan.

4.5.5 Indirect effects (Mediation Effect) of the SC Sustainability

The study examines the mediating role of green innovation on the impact of the tangible capabilities, intangible capabilities, human capabilities as independent variables on the sustainability. Table 7 shows the mediation bootstrapping output using Preacher & Hayes (2008) method.

Table 7
The meditation effect of green innovation

No.	Hypothesis	Indirect effect (β)	p-value	Confidence Interval (BC)		**Decision**
				LL	UL	
H8	Tangible Capabilities →Green innovation → Sustainability	0.051	0.034	0.008	0.103	Supported
H9	Intangible Capabilities → Green innovation → Sustainability	0.103	0.004	0.037	0.175	Supported
H10	Human Capabilities → Green innovation → Sustainability	0.355	0.000	0.269	0.438	Supported

The result of the study shows that all mediating hypotheses were supported. The result of the study support H8 which related to the mediation impact of the green innovation on the impact of the tangible capabilities on the sustainability, H9 which related to the mediation impact of the green innovation on the impact of the intangible capabilities on the sustainability and H10 which related to the mediation impact of the green innovation in the impact of the human capabilities on the sustainability within hotel sector in Jordan.

5. Discussion and Conclusion

Most of the assumptions in the model that are related to the mediating impact of the green innovation on the influence of AI capabilities (tangible capabilities, human capabilities, intangible capabilities) on the sustainability (social, environmental, and economic) in the Jordanian hotel sector are supported by the findings of the study. The findings of the study do not provide evidence to support the hypothesis that intangible capabilities on the sustainability (social, environmental, and economic) in the Jordanian hotel sector. This result can be explained by the necessity of this industry to improve the AI's intangible capabilities in order to improve the sustainability (social, environmental, and economic. This can be accomplished by improving Inter-departmental coordination, an organizational change capacity, and risk proclivity as three critical intangible resources that build an AI capability can achieve the sustainability (social, environmental, and economic). The result of the previous studies in the literature, such as the study of Zhang, Song & He (2020) confirms the study result of the significant direct impact of AI tangible capabilities on the sustainability. In addition, the result of the significant impact of AI human capabilities on sustainability is confirmed by many studies in the literature (Ogbeibu et al.,2024). The findings of the study

conducted by Almansour (2024) provide further evidence of the impact of AI tangible, intangible and human capabilities on green innovation. There are a number of studies that support the role of green innovation in the context of AI tangible, intangible and human capabilities on sustainability (Khan et al.,2024; Almansour, 2024; Imran, Alraja & Khashab, 2021).

6. Limitations and Future Research

The findings of the recent study confirm the AI capabilities as tangible, intangible and human as an important determinant of the firm's sustainability, environmentally, economically, and socially. Moreover, the recent study confirms the role of green innovation in the impact of AI capabilities as tangible, intangible and human on sustainability (environmental, economic, and social).

The data collection in this study was conducted using a questionnaire with a survey methodology. In addition, this study utilized a cross-sectional approach, which only records the participants' opinions at a specific moment in time. It is suggested that future studies consider employing longitudinal research designs to more properly establish cause-and-effect linkages. One further constraint of this study pertains to its methodology. Specifically, the study solely employed a quantitative technique to assess the influence of the factors under investigation. Future research in the field of AI capabilities and sustainability could concentrate on exploring the "depth" of the subject matter rather than solely focusing on its quantitative aspects, as was done in this study. The qualitative approach can offer novel perspectives and enhance understanding of the matter under consideration. The qualitative and quantitative approaches are mutually beneficial, enhancing the overall outcomes.

The study model was empirically tested in the hotel sector in Jordan and the study applied only to the administrative and non-administrative employees in 19 eco-friendly hotels in Jordan. For future research, the model of the study can be tested in other fields or industries, such as manufacturing or service industries, to compare the results with the study results. Also, the model can be examined in another context and in other countries or cultures. Another limitation of the recent study is that it examines green innovation as a mediator, for future research suggested to add moderators in the impact of the AI capabilities and sustainability.

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