Environmental Education and Sustainable Development *Open Access*

2024, 12(4): 7-19

DOI: 10.30473/ee.2024.69794.2692

ORIGINAL ARTICLE

Investigating the Impact of Internet of Things and Artificial Intelligence on Environmental Sustainability Performance (Case Study: Hotel Industry)

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Received: 2/Dec/2023
Accepted: 21/Apr/2024

How to cite:
Bagheri Gabollagh, H., Amirfahood Bonab, Z., Youneszadeh, M., & Solatinejad, A. (2024). Investigating the Impact of Internet of Things and Artificial Intelligence on Environmental Sustainability Performance (Case Study: Hotel Industry). Journal of Environmental Education and Sustainable Development, 12(4), 7-19.
(DOI: 10.30473/ee.2024.69794.2692)

ABSTRACT

Artificial intelligence enhances energy infrastructure efficiency, reduces waste in distributed energy systems, and ensures long-term durability. Additionally, green Internet of Things technology is positively linked to green innovation practices promoting sustainability. In this context, the primary objective of this study is to examine the impact of the Internet of Things and artificial intelligence on environmental sustainability performance, considering the mediating influence of green supply chain management within the hotel industry. This study is designed as applied research, and the data collection method is descriptive and correlational. The statistical population comprises hotel managers in Urmia City, with a sample size of 34 hotels determined using "Krejcie and Morgan" and "Cohen" tables. Sixty-four questionnaires were distributed among hotel managers in Urmia City. A standard questionnaire, validated by experts, was used to collect data. Its reliability was estimated using Cronbach's alpha coefficient. Structural equation modeling was used for data analysis, revealing that the Internet of Things and artificial intelligence positively impact green supply chain management. Furthermore, a positive relationship was observed between green supply chain management practices and environmental sustainability performance. This study suggests that adopting the Internet of Things and artificial intelligence technologies can enhance the efficiency of green supply chain management processes, emphasizing the importance for managers to grasp the impact of these two emerging technologies on overall supply chain performance.

KEYWORDS

Internet of Things, Artificial Intelligence, Environmental Sustainability Performance, Hotel Industry.

آموزش محیط‌زیست و توسعه پایدار

سال دوازدهم، شماره چهارم، تابستان ۱۴۰۳ (۷-۱۹)

DOI: 10.30473/ee.2024.69794.2692

«مقاله پژوهشی»

بررسی تأثیر اینترنت اشیاء و هوش مصنوعی بر عملکرد پایدار محیط‌زیستی (موردمطالعه: صنعت هتلداری)

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تاریخ دریافت: ۱۴۰۲/۰۹/۱۱
تاریخ پذیرش: ۱۴۰۳/۰۲/۰۲

استناد به این مقاله:
باقری قره‌بلاغ، هوشمند. امیرفرهود بناب، زهرا. یونس‌زاده، محمدرضا و صولتی‌نژاد، امید. (۱۴۰۳). بررسی تأثیر اینترنت اشیاء و هوش مصنوعی بر عملکرد پایدار محیط‌زیستی (موردمطالعه: صنعت هتلداری)، فصلنامه علمی آموزش محیط‌زیست و توسعه پایدار، ۱۲(۴)، ۷-۱۹.

(DOI: 10.30473/ee.2024.69794.2692)

چکیده

هوش مصنوعی کارایی زیرساخت‌های انرژی را بهبود می‌بخشد و ضایعات در سیستم‌های انرژی توزیع‌شده را کاهش می‌دهد و دوام طولانی‌مدت آن‌ها را تضمین می‌کند و اینترنت اشیاء سبز نیز به‌طور مثبت با شیوه‌های نوآوری سبز که منجر به عملکرد پایدار می‌شود، مرتبط است. در این راستا، هدف اصلی پژوهش حاضر واکاوی نقش اینترنت اشیاء و هوش مصنوعی بر عملکرد پایدار محیط‌زیستی با نقش میانجی مدیریت زنجیرهٔ تأمین سبز در صنعت هتلداری است. تحقیق حاضر بر اساس هدف یک تحقیق کاربردی و همچنین بر اساس چگونگی به دست آوردن داده‌های موردنیاز، از نوع تحقیقات توصیفی و همبستگی بوده است. جامعه آماری این پژوهش را مدیران هتل‌های شهر ارومیه تشکیل می‌دهند و نمونه این تحقیق بر اساس جدول «کرجسی و مورگان» و «کوهن» ۳۴ هتل برآورد گردید. تعداد ۶۴ پرسشنامه بین مدیران هتل‌ها در سطح شهر ارومیه توزیع گردید. ابزار گردآوری اطلاعات، پرسشنامه استاندارد بوده که روایی آن توسط خبرگان تأییدشده و پایایی آن نیز با استفاده از ضریب آلفای کرونباخ برآورد شد. برای تجزیه‌وتحلیل داده‌های پژوهش از مدل‌سازی معادلات ساختاری بهره گرفته شد. یافته‌های پژوهش نشان داد که فناوری‌های اینترنت اشیاء و هوش مصنوعی بر مدیریت زنجیرهٔ تأمین سبز تأثیر مثبت دارد. افزون براین، بین مدیریت زنجیرهٔ تأمین سبز و عملکرد پایدار محیط‌زیستی تأثیر مثبت یافت شد. پذیرش فناوری اینترنت اشیاء و هوش مصنوعی می‌تواند نقش مهمی در بهبود عملکردهای مختلف مدیریت زنجیرهٔ تأمین سبز داشته باشد. ازاین‌رو، مدیران و سیاستگذاران باید درک خوبی از این دو فناوری نوظهور و چگونگی تأثیر آن‌ها بر کل زنجیره تأمین داشته باشند.

واژه‌های کلیدی

اینترنت اشیاء، هوش مصنوعی، عملکرد پایدار محیط‌زیستی، صنعت هتلداری.

Introduction

In the era of digital evolution, organizations face numerous environmental, economic, and social challenges that may limit their competitiveness. In the dynamic business environment, managers and stakeholders must focus on applying sustainable practices that can lead to sustainable competitive advantages. Environmental Sustainability performance is considered one of the critical determining factors that demonstrate the commitment of companies and organizations to sustainable standards (Yu et al., 2023). In recent decades, this commitment has become increasingly important and has garnered significant attention from managers. These standards have shifted the attitudes of shareholders, who now demand attention to environmental and social concerns alongside economic efficiency, which is crucial for the success of business operations (Ahmed et al., 2020). However, the design and development of companies' sustainable capabilities require several critical success factors that play a significant role in adopting and implementing sustainable organizational and production practices. These factors include management support, organizational culture, and the adoption of new technologies that enhance Environmental Sustainability performance (Prasad et al., 2020). Artificial intelligence (AI) technology was introduced to develop and create "thinking machines" capable of imitating, learning, and replacing human intelligence. Despite its widespread acceptance as a decision-making tool, AI has had limited use in supply chain management (Toorajipour et al., 2021). Nonetheless, AI technology is emerging as a competitive advantage. Many industries, including the hotel industry, have progressed from remote monitoring to control, optimization, and advanced systems based on AI to improve their performance (Kohtamäki et al., 2019). The objectives of the supply chain are to meet customer demand, improve responsiveness, and create a network between different stakeholders. Today, the supply chain network is becoming more diverse and transparent in terms of business structure. One of the main problems for many industries is that the overall visibility of the supply chain and the amount of information available in the industry are not optimal. Therefore, supply chain management aims to digitize business processes, integrate various stakeholders and assets to ensure products align with customer needs, and achieve goals related to the competitive advantage of the entire system (Helo & Hao, 2022). Research evidence indicates that at least 50% of global companies will adapt their IT infrastructure to AI-related technologies and transform their supply chain operations by 2023. Hospitality industries can integrate their supply chain management solutions with smart technologies to improve business processes through automation. However, the potential of AI in supply chain management has not yet been fully explored (Panetta, 2018). Additionally, the emergence of new digital industrial technology, known as the Fourth Industrial Revolution, has a positive impact on supply chain performance. Warehouses, an essential part of the supply chain, are used to store products and manage inventory levels. A robust warehouse management system can lead to cost reduction and improved customer satisfaction. Traditional models of warehouse management have become inefficient and unsuitable for the increasing demands of today's market. In recent decades, information and communication technology has been utilized for warehouse management (Mostafa et al., 2019).

Studies confirm and support the importance of the Internet of Things in inventory control and warehouses, which reduces costs related to inventory and supply chain monitoring (Agrawal et al., 2022). Researchers believe that the Internet of Things will cause unprecedented environmental and social changes. In addition, the implementation of smart logistics can limit carbon emissions and may help achieve environmental sustainability performance (Pan et al., 2020). As the largest emitter of greenhouse gases, China listed the Internet of Things as one of seven strategic emerging industries. IoT connections in China have been growing rapidly. The number of IoT vendors from China increased from 16% in 2019 to 22% in 2021. However, some studies showed that intelligent systems based on the Internet of Things can create comprehensive sustainability performance in the logistics industry. The adoption of new Internet-based transactions can exploit information for faster and more sustainable waste collection, leading to reduced environmental costs associated with the

recovery process (Garrido-Hidalgo et al., 2020). These features enable IoT to improve profitability and reduce unnecessary emissions. IoT can also contribute to a safer environment for workers and make business models more transparent for business partners. This increased transparency encourages ethical behavior among stakeholders and business partners, thereby enhancing the industry's reputation and strengthening cooperation in the logistics industry. In 2020, the United Nations estimated an investment of between 5 and 7 trillion dollars to achieve the Sustainable Development Goals. This requires a broader understanding of investor behavior and how these investments can be used to solve sustainability-related problems such as poverty, environmental degradation, pollution, and inequality. Artificial intelligence has the potential to tackle these social problems, including sustainability. Therefore, the true value of artificial intelligence lies in its ability to enhance environmental and social governance, extending beyond merely reducing pollution, poverty, and resource depletion. (Nishant et al., 2020).

Researchers believe that IoT capabilities can increase sustainability performance. In addition, the Internet of Things capability can be used to improve the integration of the green supply chain in any industry, and this integration will help the hotel industry improve its performance and increase profits. The use of the Internet of Things is gradually increasing all over the world. The use of traditional business processes and integration processes has affected the performance of companies. It is obvious that in this age of technology and the internet, old business methods do not work well. Therefore, it is necessary to abandon old business practices and adopt new technologies such as the Internet of Things and artificial intelligence, which will positively affect the performance of industries. The literature indicates that organizations should prioritize digital technologies and take steps to establish Industry 4.0. This is because technologies such as the Internet of Things and artificial intelligence, which are widely supported by hoteliers, can significantly enhance the personalized customer experience in the hotel industry. Despite numerous studies highlighting the role of artificial intelligence and the Internet of Things in helping organizations reduce costs, increase production speed, and develop new services or products in response to changing consumer needs, research on their use in promoting green supply chain processes, particularly environmentally sustainable performance, remains limited. For this reason, and to take measures to increase the use of these two emerging technologies in the hotel sector, this research is focused on identifying the relationship between these two technologies and environmental sustainability performance. To address these gaps, the present study developed a mediation model to test how the green supply chain mediates the relationship between artificial intelligence, the Internet of Things (IoT), and environmental sustainability performance in the hospitality industry. (Alreahi, 2023).

The use of emerging technologies in manufacturing companies has a significant effect on increasing environmental sustainability performance. The Internet of Things (IoT) can be defined as a new combination of physical machines with digital facilities, in which machines, computers, and people communicate and interact. IoT networks improve communication with all sensors and objects in green supply chain management and the production environment, which enables increased control and prevention of common problems in production lines (Corallo et al., 2022). IoT is seen as a next-generation system connected to the Internet, designed to integrate with green supply chain management. IoT emphasizes improving organizational practices and performance by enabling the communication of data through internet connectivity. This type of connection is considered an advanced form of the platform, which easily facilitates things that are more recognizable, identifiable, and locatable on a global platform. The Internet of Things is also defined as a digital work network that connects suitable objects to data, adding capabilities to its functionality. IoT functions work together with the integration of green supply chain management to potentially increase sustainability performance. Sustainable performance also refers to the flow of products, goods, and services to enhance green supply chain management, which may enhance IoT capabilities (Botta et al., 2016).

Green supply chain management seeks to integrate supply chain management with

environmental requirements at all stages of product design, selection and supply of raw materials, production and manufacturing, transportation, delivery to the customer, and finally, management of recycling and reuse. This integration aims to minimize and eliminate the negative effects of the supply chain on the environment by using compatible materials and reducing waste (Maleki Minbashrazgah et al., 2019). Green supply chain management can be key in providing relevant information about various sustainability indicators, leading to higher financial, social, and environmental returns. The ability of green supply chain management to provide real-time information and control can lead to improved environmental management practices (Patabandige & Galahitiyawe, 2022). The goal of implementing green supply chain management in business activities is to simultaneously improve economic and environmental performance (Rastgar et al., 2020). Environmental performance is defined as a set of company operations synchronized and compatible with the environment (Masoudizadeh et al., 2016). Studies define a company's environmental performance as its effectiveness in meeting and advancing society's expectations regarding environmental concerns (Janalizadehghazvini et al., 2022). In the current research, environmental sustainability performance is considered a consequence of environmental activities aimed at reducing negative effects on the environment. On the other hand, the dependence of green supply chain management on emerging technologies such as blockchain technology, the Internet of Things (IoT), artificial intelligence, and big data improves work quality, reduces pressure on employees, enhances productivity, and boosts environmental sustainability performance (Zelbst et al., 2020). Green supply chain management is closely related to an organization's environmental management strategy and significantly increases environmental sustainability performance (Chen et al., 2022). Additionally, green supply chain management can enhance decision-making by aiding the development of planning capabilities (Wael Al-Khatib, 2023). The study findings indicate that the use of artificial intelligence and IoT technology significantly impacts the integration of environmental processes and green supply chain management. These studies also emphasize that the integration of environmental processes and green supply chain management significantly impacts environmental sustainability performance (Helo & Hao, 2022; Li et al., 2023). The Internet of Things enhances the ability to integrate suppliers, retailers, customers, managers, and logistics processing capabilities within an organization and bridges the gap between the physical and digital worlds. The relationship between emerging technologies such as IoT and green supply chain management is recognized as highly relevant in current literature. Studies emphasize the vital role of IoT technologies in advancing and improving green supply chain management, thereby enhancing value creation in business through effective control of material and information flow (Sasikumar et al., 2023). It is worth noting that Internet of Things (IoT) technology improves green supply chain management and enables real-time control of all operations in the production environment. Additionally, IoT helps increase reliability in the production process through strict control over product quality. In the case of transportation management, IoT can improve the visibility of the supply chain (Asif et al., 2022).

Artificial intelligence (AI) is defined as a network of computers that can simulate the human mind and make decisions in various situations using different approaches. Although AI systems cannot replicate human intelligence, they can provide accurate outputs that can replace human efforts. The potential of AI, combining algorithms, fuzzy models, predictive models, and data analysis, is significant in supporting supply chain management (Duan et al., 2019). It is important to note that AI is a crucial feature that develops various functions for sustainable business growth. In business development, AI focuses on the necessary assessments, which contribute to sustainable business development (Wamba, 2022). Research evidence shows that AI techniques can be implemented in four key areas of the supply chain: optimization, forecasting, modeling and simulation, and decision support (Soleimani, 2018). The adoption of AI significantly affects green supply chain management, green innovation, and sustainable performance (Yan et al., 2022). Similarly, studies have shown that AI can

directly improve the green supply chain and the real economy by addressing information asymmetry and other issues (Sharma & Gupta, 2021).

In line with the effect of IoT on business performance, the findings of a study showed that IoT positively impacts marketing performance, business, and entrepreneurial orientation (Rajesh et al., 2022). Additionally, research on the impact of IoT on supply chain management and its benefits in the tourism industry showed that using IoT in the supply chain sector in India can strengthen agricultural development and meet users' needs in the most sustainable way (Asif et al., 2022; Ahmad et al., 2023). Therefore, based on the conducted studies, the hypotheses and conceptual model of the research can be proposed:

Hypothesis 1: Acceptance of IoT positively affects green supply chain management.

Hypothesis 2: Acceptance of AI positively affects green supply chain management.

Hypothesis 3: Green supply chain management positively affects environmental sustainability performance.

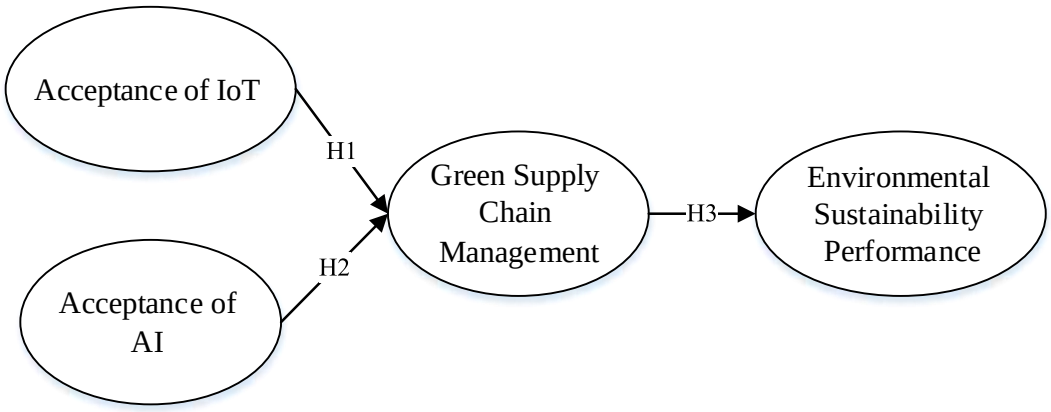

Figure 1. Conceptual Model (Wael Al-Khatib, 2023; Benzidia et al., 2021)

Research Methodology

The current study is applied research and, in terms of nature and method is a descriptive survey. Library and field studies were employed to collect data, and the data collection tool was a standard questionnaire. The statistical population of this research consists of hotel managers in Urmia city (three- to five-star hotels), and the sample was estimated to be 34 hotels based on the table of Karjesi, Morgan, and Cohen. 64 questionnaires were distributed among hotel managers in Urmia city using a simple probability sampling method. Since Urmia is one of the important tourist destinations both domestically and internationally, and because of the variety of reasons for traveling to it, it was used as the statistical population for this research.

To collect data, a standard questionnaire with 18 questions based on an ordinal scale and a five-point Likert scale was used. The current study also adopted the Kaiser-Meyer-Olkin (KMO) sampling adequacy criterion to evaluate the appropriateness of the sample size for factor analysis. The significance level (sig) was calculated to be less than 5%, and the KMO index was 0.74, indicating an adequate sample size for performing exploratory factor analysis. After a comprehensive review of the existing literature, the scales used in this study were selected. The Q-Sort method was employed to determine whether the classification by the expert panel of structures aligned with the literature (Gehlbach & Brinkworth, 2011). The researchers held a preliminary meeting with academic professors (four from the management and entrepreneurship group) to ensure the validity of the construct measurement items. The experts were able to arrange the variables based on four theoretical constructs, demonstrating the face and content validity of these constructs. Additionally, a 5-point Likert scale, from 1 (strongly disagree) to 5 (strongly agree), was adopted to measure all items.

Research Findings

The partial least squares structural equation

modeling (PLS-SEM) method was used to analyze the data. PLS analysis includes two steps: measurement model and structural model estimation. This sequence ensures that the items related to the constructs are valid and reliable before reaching conclusions about the relationships between the constructs. In Table 1, the demographic characteristics of the studied sample are presented.

Table 1. Demographic Characteristics

Demographic characteristics		Frequency	Percentage	Demographic characteristics		Frequency	Percentage
Gender	Female	21	32%	Education	Diploma	8	12.5%
	Male	43	68%		Associate Degree	14	21.8%
Marital status	Single	9	5%		Bachelor	33	51%
	Married	55	85%		Master	6	9.3%
					Ph.D	3	5.4%
Age	20-29	4	7.1%	Work experience	Less than 5	9	14.1%
	30-39	16	25%		5-10	37	57%
	40-49	37	57%		11-15	13	20.3%
	50^{+}	7	10.9%		16-20	5	8.6%

The indicators of average variance extracted, composite reliability, Cronbach's alpha, and the coefficient of determination were used to evaluate the fit of the measurement model and the structural model, as well as to assess the measurement indicators and the validity of the model, as depicted in Table 2.

Table 2. Structural and Measurement Model Indicators

Variables and Factor items	λ	AVE	CR	α
Acceptance of Internet of Things	-	0.625	0.892	0.848
I think our hotel has the tools and software needed to operate Internet of Things systems if needed.	0.888	Wael Al-Khatib, 2023		
Our hotel can use Internet of Things technologies to monitor the flow of materials from origin to distribution locations.	0.792			
I think using the Internet of Things technology will improve productivity and sustainable performance.	0.778			
In my opinion, using the Internet of Things technology brings a sense of pleasure.	0.799			
I think the Internet of Things technology can help to improve the recognition and presence of the human mind.	0.681			
Acceptance of Artificial Intelligence	-	0.654	0.883	0.826
In my opinion, artificial intelligence can help us design our hotel's products and services specifically.	0.736	Benzidia et al., 2021		
In my opinion, artificial intelligence can manage and optimize supply chains and reduce transportation costs.	0.837			
In my opinion, artificial intelligence makes more accurate predictions of the existing demand.	0.813			
In my opinion, artificial intelligence accelerates the strategic decision-making process by accurately measuring marketing predictions.	0.844			
Green Supply Chain Management	-	0.588	0.873	0.820
Our hotel guarantees customer satisfaction with green design and production.	0.899	Nejati et al., 2017		
Our hotel provides green guidelines to suppliers.	0.904			
Our hotel cooperates with suppliers for green purposes.	0.885			
Environmental criteria are considered when selecting suppliers.	0.661			
Our hotel cooperates with customers for green packaging.	0.793			
Environmental Sustainability Performance	-	0.768	0.930	0.898

Variables and Factor items	λ	AVE	CR	α
Environmental management in our hotel helps to reduce waste.	0.779			
Environmental management can control energy consumption in our hotel.	0.883	Benzidia et al., 2021		
Environmental management in our hotel reduces the purchase of non-renewable materials and chemicals.	0.921			
Environmental management in our hotel saves all costs.	0.884			

The reflective measurement model is evaluated to confirm its validity and reliability. As shown in Table 2, the measurement model meets all quality and reliability criteria. First, all factor loadings are higher than 0.7, composite reliability is higher than 0.7, and values of average variance extracted are higher than 0.5. Discriminant validity is acceptable when the average variance extracted for each construct is greater than the shared variance of that construct with other constructs in the model. As shown in Table 3, the values on the main diagonal of the matrix are greater than all the values in the corresponding columns.

Table 3. Discriminant Validity

Research variables	1	2	3	4
1. Environmental Sustainability Performance	0.876			
2. Green Supply-Chain Management	0.768	0.767		
3. Acceptance of the Internet of Things	0.718	0.657	0.790	
4. Acceptance of Artificial Intelligence	0.609	0.485	0.688	0.809

The structural model of this study is evaluated through the coefficient of determination (R^2), predictive relevance (Q^2), goodness of fit (GOF), and hypothesis testing. Values of 0.19, 0.33, and 0.67 are considered weak, medium, and strong fits of the structural part of the model by the R^2 criterion. According to Table 4, all R^2 values indicate a strong fit for the structural part of the model. The obtained Q^2 values show that the model has sufficient predictive relevance because they are above the threshold of 0.000. Given that the model meets all criteria, it can be suggested that the structural model is good. The GOF index in the PLS model is used to check the overall fit of the model. The appropriate value for this index is between zero and one where 0.1 is considered weak, 0.25 is medium, and 0.36 is strong. Values close to one indicate good model quality. According to the value obtained for the overall model fit as 0.633, the goodness of fit of the model is confirmed (Table 4).

Table 4. The goodness of Fit of the Model

Communality	Q^2	R^2	Variables
0.625	-	-	Acceptance of Internet of Things
0.654	-	-	Acceptance of Artificial Intelligence
0.588	0.3689	0.594	Green Supply-Chain Management
0.768	0.4216	0.622	Environmental Sustainability Performance
$\boldsymbol{GOF = \sqrt{\overline{Communalities} \times \overline{R^2}} = \sqrt{0.658 \times 0.608} = 0.633}$			

Figure 2 shows the software's output in the estimation mode of path coefficients and coefficients of determination (R^2). The numbers on the paths indicate the path coefficients. The numbers inside the circles represent the endogenous variables and show the value of the coefficient of determination. The numbers on the arrows of the hidden variables indicate the factor loadings.

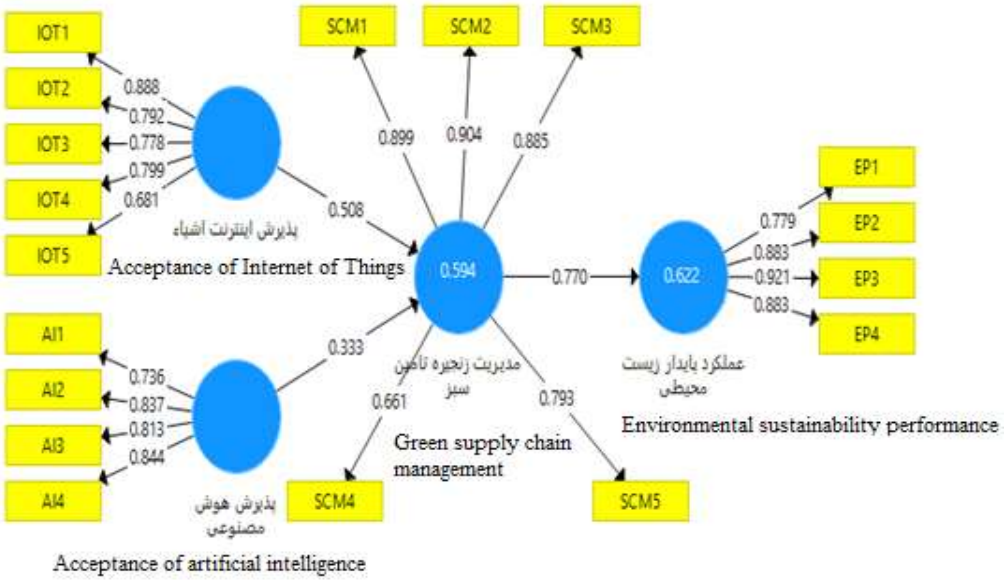

Figure 2. Path Coefficients and Factor Loadings of the Research Model

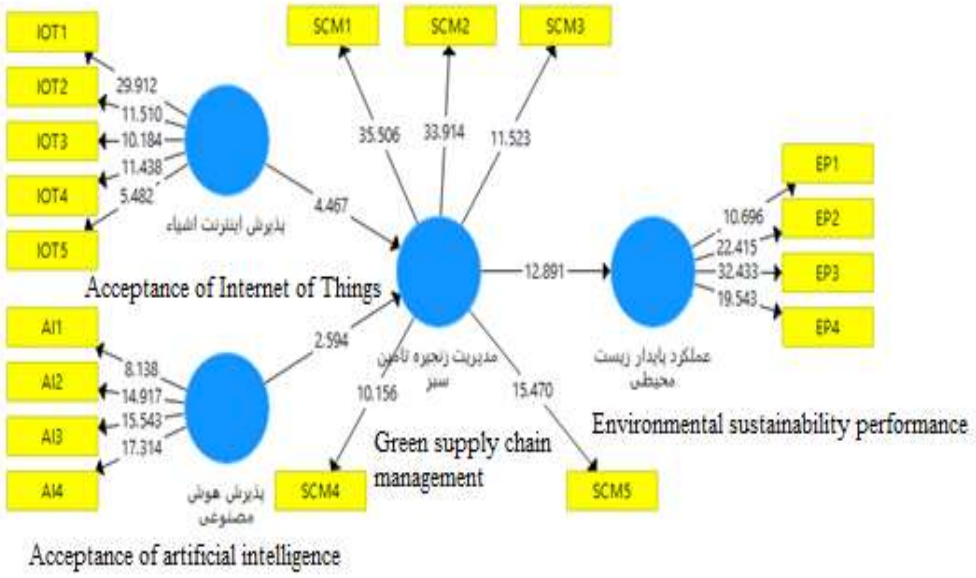

Figure 3. Significance of Path Coefficients (T-values)

In Figure 3, the numbers marked on the arrows indicate T-values. To test the hypotheses of the research model at the 95% confidence level values greater than or equal to the absolute value of 1.96 indicate a direct relationship between the two variables. Additionally, the bootstrapping method was used to test and confirm the validity of the research hypotheses using the beta coefficient and t-statistics.

Table 5. Results of bootstrapping analysis

Result	T Statistics	P Values	β	Hypothesis
Confirm	4.467	0.000	0.508	Acceptance of IoT positively affects green supply chain management
Confirm	2.594	0.000	0.333	Acceptance of AI positively affects green supply chain management
Confirm	12.891	0.000	0.770	Green supply chain management positively affects environmental sustainability performance

As shown in Table 5, all the proposed hypotheses are confirmed.

Conclusion

The purpose of this study is to clarify the impact of the Internet of Things (IoT) and artificial intelligence (AI) on environmental sustainability performance, with the mediating role of green supply chain management.

First, according to the literature on artificial intelligence technology and the Internet of Things (Ahmad et al., 2023), the results of the first hypothesis show that the Internet of Things positively affects green supply chain management. It can be argued that IoT solutions for the hotel industry are beneficial not only for the hotel owner, customer, and society but also for fulfilling the social responsibility of the business. IoT can help address the frequent challenge of unexpected delays in the supply chain. Using IoT applications, global supply chain managers can reroute vehicles and adjust automated delivery systems. Additionally, IoT helps hotels improve their green supply chain management. Using the Internet leads to long-term benefits, improves relations with suppliers, and increases the sustainable performance of the hotel. The Internet of Things technology is one of the most promising technologies for controlling and enhancing supply chain performance. Warehouses, as the key parts of the supply chain, contribute to the success of any industrial organization. Consequently, new technologies have garnered widespread attention from various companies aiming to improve performance and reputation, thereby attracting more customers and increasing profits. Research evidence shows that IoT technology has several benefits for hotels, especially in encouraging green hotel practices. IoT can be used by hotel managers to integrate green practices in their hotel operations, support the environment, and promote sustainability. IoT devices, such as smart sensors, can track guest movements throughout the hotel, allowing managers and staff to be more responsive to their needs. Moreover, the Internet of Things will change how hotels interact with their guests. Smartphones and tablets can now be used to check in, access hotel services, and even control temperature and lighting. By using the power of the Internet of Things, hotels can offer a more personalized and customized experience to their guests.

In line with the findings of the second hypothesis, it can be concluded that artificial intelligence positively affects green supply chain management. The supply chain is crucial in moving products over large distances and supporting the connection between different stakeholders such as raw material suppliers, manufacturers, retailers, logistics companies, and consumers. Therefore, an effective and efficient supply chain ensures these connections are made accurately, quickly, and at minimal cost. Critical success factors for the supply chain include information sharing, process integration, and collaboration. Thus, the supply chain must be digitized and increasingly dependent on technology in the form of artificial intelligence and sensors throughout the supply chain, allowing them to collect data in real time. The impact of artificial intelligence on sustainable practices in the hospitality industry is increasingly significant as businesses seek innovative ways to reduce their environmental footprint while enhancing the customer experience. AI is also used to minimize food waste, an important issue in the hospitality industry. Through machine learning algorithms, AI can predict the amount of food needed for a particular course based on factors such as the number of guests, the season, and past consumption patterns. This not only reduces food waste but saves costs and promotes a sustainable environment.

The results of the third hypothesis showed that green supply chain management positively affects environmental sustainability performance. The main goal of today's key businesses is to have an efficient and reliable supply chain. The integration of the Internet, artificial intelligence, and green supply chain management has had a favorable impact on sustainable development across various industries, including the hotel industry. According to stakeholder theory, companies can satisfy the environmental demands of stakeholders and improve organizational efficiency to adapt to changes in the external environment, leading to improved company reputation and long-term relationships with suppliers and customers. Many researchers believe that green supply chain policy can improve the environmental performance of hotels, and green supply chain management can

have a significant positive impact on the environment and economy (Xu et al., 2020). Research conducted in this area has only focused on designing and explaining the green human resource management model, its effect on environmental performance, and the role of social capital components in the performance of environmental non-governmental organizations (Janalizadehghazvini et al., 2022). The impact of artificial intelligence and the Internet of Things, as two emerging technologies, on environmental performance has been neglected.

Finally, to realize the research findings, some suggestions are presented for planners and policymakers:

First: The hotel industry should emphasize digital transformation. In creating artificial intelligence in green supply chain management, data is the most important factor. Second: Regarding cooperation with main suppliers, suppliers as important stakeholders in artificial intelligence should consider green supply chain management to coordinate expectations and create a synergistic effect. Third: A large industry should promote industrial progress and develop an influence on the ecosystem. Artificial intelligence influences green supply chain management by external stakeholders to lead to major changes in sustainability measures and requirements of artificial intelligence in the supply chain and to influence the implementation and strategies of sustainable performance in the hospitality industry. The hotel industry should maintain a positive attitude towards artificial intelligence and sustainable performance to effectively increase environmental performance. In this regard, managers of five-star hotels can invest in the latest tools, sensors, and software based on the Internet of Things system and use them to improve the sustainable management of these hotels. This study also suggests that supply chain managers in five-star hotels can benefit from IoT in collecting data related to environmental and social aspects, such as carbon emissions or waste information in operations, which helps to reduce environmental problems.

The present study has several limitations, including the lack of scientific and research resources conducted by other researchers on this topic (lack of applied research in Iran in this field) and the lack of access to some hotel managers to complete the questionnaire.

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