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KEYWORDS	ABSTRACT
Ethical leadership; artificial intelligence adoption; employee engagement; sustainable hotel performance; hospitality industry; SmartPLS; PLS-SEM.	This study examines the relationships among ethical leadership, artificial intelligence (AI) adoption, employee engagement, and sustainable hotel performance, with a particular emphasis on employee engagement's mediating role. Drawing on social learning theory and social exchange theory, the study investigates how ethical leadership and AI adoption contribute to employee engagement and sustainable performance in the hospitality industry. The study employed a quantitative, cross-sectional design and analysed data using Partial Least Squares Structural Equation Modelling (PLS-SEM) in SmartPLS 4. The measurement model was assessed for internal consistency reliability, convergent validity, and discriminant validity, while the structural model was evaluated through path analysis and bootstrapping. The results indicate that ethical leadership positively and significantly influences employee engagement and sustainable hotel performance. Similarly, AI adoption has significant positive relationships with employee engagement and sustainable hotel performance. Employee engagement also positively influences sustainable hotel performance and mediates the relationship between ethical leadership and AI adoption and sustainable hotel performance. These findings highlight the importance of integrating responsible leadership, intelligent technologies, and employee involvement to enhance sustainability in the hospitality industry. The study contributes to hospitality management literature by integrating leadership, technological, and employee-related perspectives within a unified framework. Practically, the findings emphasise the need for hotel managers to promote ethical leadership, implement AI responsibly, and strengthen employee engagement to support economic viability, environmental responsibility, and long-term organisational sustainability.
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Introduction

The pressure on the hospitality sector to enhance organisational performance while also considering environmental sustainability, technological change and employee wellbeing is growing. Hotels use a lot of energy and water, create waste and rely heavily on staff to provide the quality of service and efficiency of operation. Therefore, sustainable hotel performance has become a key strategic priority, covering economic sustainability, environmental responsibility, and social sustainability. Artificial intelligence (AI) has created fresh possibilities for hotels to boost their operational efficiency, predict demand, optimise resource use, tailor guest experiences and make decisions on sustainability. But AI's impact on sustainable performance is not just about the technology; it also depends on leadership practices and employee engagement. The link between ethical leadership, AI use, and employee engagement is thus crucial to understanding the outcomes of sustainability in modern hospitality companies. Ethical leadership is a key mechanism in an organisation that fosters responsible behaviour, trust, and accountability. Brown et al. (2005) described ethical leadership as the demonstration of normatively appropriate behaviour and the communication, reinforcement and decision-making that promotes ethical behaviour. Ethical leaders are characterised by integrity, fairness, transparency and concern for stakeholders and set the tone for employees in the workplace. Social learning theory suggests that employees watch their leaders and imitate their behaviour as a model for appropriate organisational behaviour (Bandura, 1977). Ethical leadership is especially important in the context of the hotel industry, as staff members often have to make decisions that impact their customers, co-workers, organisational resources and environmental practices. Leaders who consistently model responsible behaviour foster an environment within the workplace that supports staff to take part in service improvement and sustainability efforts.

Another key element of organisational effectiveness and sustainable performance is employee engagement. When employees feel psychologically meaningful, safe, and available in their work, they invest their physical, cognitive, and emotional resources in their work, according to Kahn (1990). Schaufeli and Bakker (2004) also showed that the role of job resources and working conditions in the understanding of employee engagement is important. In the hotel, employees' engagement makes a difference in their service delivery, teamwork, problem-solving, and involvement in the organisation's initiatives. These behaviours are facilitated by ethical leadership, which fosters trust and fair treatment, and clearly communicates the expectations of the organisation. In terms of social exchange, the individual returns positive and equitable treatment by contributing more to the goals of the organisation and by becoming more involved in their work (Saks, 2006). Employee engagement is thus a theoretically sound mechanism by which ethical leadership impact sustainable hotel performance. In the meantime, AI has come into its own for hospitality companies aiming to streamline their operations and become more environmentally conscious. AI-powered systems aid in demand forecasting, automated communication, resource planning, inventory management, and operational data analysis. AI change the way services are delivered by doing various things depending on the intelligence needed, which gives organisations the opportunity to redesign their operations, as explained by Huang and Rust (2018). Likewise,

Tussyadiah (2020) examined the research on automation in tourism and discussed the impact of new technologies on service provision and human–technology interactions. The above developments suggest that AI help to enhance the performance of hotels, but the advantages of AI implementation will rely on the appropriateness of implementation and integration into the organisational processes. Empirical studies have also been conducted recently, which have pointed to the sustainability potential of AI in the hospitality sector. Filimonau et al. (2025) explored the synergy between AI and sustainability by interviewing 35 senior hospitality industry professionals from the UK and Spain. They found opportunities for optimising energy and water use, minimising waste, optimising resource allocation, influencing decisions in the supply chain and improving employee well-being. The study also highlighted the role of AI in promoting environmental, social, and economic sustainability. However, the use of AI doesn't necessarily mean sustainable results. It relies on the proper infrastructure, management commitment, staff training, good governance and technological applications that are aligned with sustainability goals.

The relationship between AI adoption and employee engagement is therefore an important one to consider. While AI streamline repetitive tasks and enhances access to operational data, it also raises questions about job security, evolving roles, and the need for new skills when interacting with intelligent systems. Fully trained staff, with a clear understanding of the benefits of AI adoption, and supportive management are more likely to successfully incorporate these technologies into their work. Ethical leadership help foster this atmosphere by ensuring open communication, responsible technology choices, and employee concerns are taken into account. Employee engagement is a key factor in bringing technological capabilities to fruition in terms of operational improvements and sustainability-related practices. Sustainable hotel performance is not just about financial results; it's about protecting the environment, caring for employees and responsible organisational practices. Elkington and Rowlands (1997) coined the term triple bottom line, highlighting the interrelated aspects of economic, environmental and social performance. These dimensions apply to the hotel sector, such as operational efficiency, financial sustainability, responsible resource use, waste reduction, employee health, and service quality. Organisational capabilities basis for sustained competitive advantage if they are valuable, rare and hard to imitate (Barney, 1991). Ethical leadership, employee knowledge and AI-powered capabilities are considered complementary organisational resources used to achieve sustainability goals.

While there is an increasing interest in ethical leadership, employee engagement and AI-enabled hospitality operations, they are studied separately. While ethical leadership studies have focused on ethical conduct and employee outcomes, AI research has increasingly turned to the aspects of service transformation and sustainability applications. Their integration provides a more holistic view, as technology is not the sole reason for employee reactions and leadership is not the only reason for the contribution of intelligent systems to operational and environmental results. The mediating role of employee engagement between these organisational and technological factors and sustainable hotel performance is important and needs to be investigated. In this context, the present study aimed to explore the links between ethical leadership, AI adoption, employee engagement, and sustainable hotel performance. In particular, it explored the direct links between

ethical leadership and employee engagement, between AI adoption and employee engagement, and between employee engagement and sustainable hotel performance, as well as the link between ethical leadership and AI adoption. It also explored the role of employee engagement in the relationships between ethical leadership and AI adoption and sustainable hotel performance. The study's holistic approach, which incorporates leadership, technological, and employee-related viewpoints, enriches the existing body of knowledge in hospitality sustainability and offers practical recommendations for hotel managers aiming to align responsible leadership, purposeful AI implementation, and employee engagement for sustainable outcomes in the long term.

Literature Review

Ethical Leadership and Sustainable Hotel Performance

Due to its impact on integrity, fairness, accountability and responsible decision-making, ethical leadership has been the focus of much research in organisations. Brown et al. (2005) defined ethical leadership as the communication, reinforcement and decision-making of normatively appropriate conduct by ethical leaders that encourages such conduct by employees. Ethical leaders set the tone for behaviour, which affects the way employees act towards each other, customers and other stakeholders. Ethical leadership in a hospitality organisation foster responsible service delivery and focuses on organisational sustainability because of the decisions made by employees in service delivery and resource management. Social learning theory is used to explain this relationship. Bandura (1977) stated that people learn by watching and imitating others. This means that employees then practice responsibly if their leader models ethical behaviour and makes it clear what is expected of them in the organisation. Ethical leadership also foster trust and cooperation, which help to motivate employees to engage in sustainability efforts. However, sustainable hotel performance is also dependent on the technological resources, operational abilities and effective environmental practices. Ethical leadership is thus one of the main organisational factors that must be understood in relation to other organisational influences and is a factor that contributes to sustainability.

AI Adoption and Sustainable Hotel Performance

Artificial intelligence (AI) has brought new possibilities for hospitality companies to enhance their service provision, operational planning and resource utilisation. According to Huang and Rust (2018), AI revolutionize service operations by performing tasks that demand various kinds of intelligence. AI is used in hotels to assist with demand forecasting, customer communication, inventory management, energy monitoring, and decision-making. These applications help to increase efficiency and help organisations to recognise opportunities to minimise unnecessary resource use. The study of automation in tourism has also identified the evolution of the relationship between technology, employees and service delivery. Tussyadiah (2020) has discussed the advancements in automation and its significance for tourism organisations implementing AI and robotics. Recently, Filimonau et al. (2025) investigated the role of AI in promoting sustainability in the hospitality industry by conducting interviews with key industry stakeholders. They found

potential applications in energy and water conservation, waste reduction, resource allocation, supply-chain management and employee well-being. The results show the importance of AI in the context of sustainable hospitality. But the connection between AI usage and sustainable performance isn't guaranteed. To implement technology, investments, training of employees, infrastructure and governance are required. Moreover, operational efficiency does not necessarily bring environmental benefits unless the technologies are targeted towards the sustainability goals. Thus, the impact of AI use on sustainable hotel performance relies on the ability of hotels to incorporate the technological capabilities into their operational and environmental strategies.

Ethical Leadership and Employee Engagement

Employee engagement is a commitment of employees' physical, mental and emotional energies to their jobs. Kahn (1990) asserted that psychological meaningfulness, psychological safety, and psychological availability are factors that impact employees' engagement. Schaufeli and Bakker (2004) later showed that job demands and resources are crucial in understanding engagement and burnout. The individual experiences and organisational conditions are seen to affect employees' willingness to invest themselves in their work, as suggested by these perspectives. Ethical leadership help to create a culture of fairness, transparency, trust, and respect, which helps to boost employee engagement. If leaders are open and listen to employee concerns, and treat everyone equally, employees might gain more trust in the workplace and feel more motivated to help achieve organisational goals. Brown et al. (2005) also stated that employees watch the ethical behaviour of the leaders and take it as a behavioural model. Such leadership behaviours foster teamwork, service development and sustainability initiatives among employees in hotels. This relationship is also explained using the social exchange theory. Social exchange processes were shown to be relevant to employee engagement by Saks (2006), who showed that employees' experiences at work affect their desire to contribute to the organisation's goals. Ethical leadership then help to foster engagement through the creation of relationships that are based on equitable treatment and trust. Employee engagement is therefore a key concept to understand in the context of leadership practices and employee involvement and organisational outcomes.

AI Adoption and Employee Engagement

The use of AI impacts the roles, workflows, and customer interactions of employees. AI-powered systems help to minimise repetitive tasks, enhance access to information, and enable more efficient service delivery. Huang and Rust (2018) pointed out the possibility of AI changing service tasks, which means that technology changes the way that employees contribute to organisational performance. Nevertheless, technological change also generates uncertainty concerning job security, professional skills, autonomy, and changing work expectations. Tussyadiah (2020) highlighted the need to be aware of the human reactions to automation in tourism. Organisations better encourage employees to embrace AI when they offer the right training, share the goals of implementing AI, and engage employees in the process of technology change. Poorly managed adoption results in resistance and loss of trust, however. Therefore, employee engagement is a relevant concept to grasp the organisational implications of the use of AI. Employees might be more

likely to engage in technology-supported work processes if they are supported and understand how technology is used to augment their tasks. There could also be a positive impact on the working environment for employees as a result of AI adoption. The direction and intensity of this relationship, however, will vary depending on the practices used, employee perceptions, and organisational support.

Employee Engagement and Sustainable Hotel Performance

Employees are engaged in service quality, teamwork, problem-solving, and responsible operational practices, which lead to sustainable hotel performance. Kahn (1990) highlighted the psychological factors that are essential for personal involvement, and Saks (2006) linked engagement to experiences and outcomes in the workplace. These views collectively indicate that workers' commitment to their work have an impact on the way organisational goals are manifested in their daily activities. At workplaces like hotels, staff members who are engaged tend to focus more on the needs of their guests, work together with other staff members, and be involved in initiatives for improvement. They are also used to detect inefficiencies in operations, to ensure adherence to environmental protocols and to aid in the responsible use of resources. These contributions are relevant because the implementation of management policies and technological systems is through the daily activities of the hotel's employees of the hotel and is part of the hotel's sustainability of the hotel. The relationship between employee engagement and sustainability must be interpreted within the broader organisational context. Although employee engagement contributes to sustainability, it does not independently ensure financial, environmental, or social performance. Effective leadership, adequate resources, efficient operational systems, and organisational commitment are also essential for translating employee involvement into measurable sustainability outcomes.

Employee Engagement as a Mediating Mechanism

Employee engagement offers a potential mechanism to explain the relationship between ethical leadership and sustainable hotel performance and AI adoption. Ethical leadership create conducive work environments, and AI offer technological tools that transform the way work is organised and done. These organisational conditions have an impact on operational behaviour and contributions to sustainability at the employee level, which is the process of employee engagement. Bandura (1977) suggests that from a social learning point of view, employees learn responsible practices from ethical leaders. An employee's response to fair and supportive treatment from the employer is to become more involved in organisational activities (Saks, 2006), from a social exchange perspective. These views align with the idea that ethical leadership could have an impact on sustainable performance, in part, through employee engagement. Likewise, the use of AI impacts sustainable performance, in part, through employee engagement. If the employees are aware of and proficient with AI-driven systems, then technology is more likely to result in operational improvements. The indirect relationships are evaluated empirically by mediation analysis, which is based on the statistical significance of the indirect relationships, not on theory alone.

Sustainable Hotel Performance and Research Gap

Sustainable hotel performance is a combination of economic, environmental and social aspects. The triple bottom line (TBL) approach was introduced by Elkington and Rowlands (1997) and highlighted the interrelated aspects of economic, environmental and social performance. These dimensions are operational efficiency, resource conservation, employee well-being, service quality and long-term organisational viability in the hospitality sector. Barney (1991) also suggested that the organisational resources and capabilities help to create a sustained competitive advantage. Ethical leadership, employee knowledge and AI-powered capabilities might thus be complementary resources that support sustainability goals. While there are existing studies on ethical leadership, employee engagement, AI in service delivery, and sustainability, these topics have been explored individually. Incorporating them is crucial as leadership affects organisational behaviour, AI offers technological options, and employee engagement could help to turn both of these into operational results. This study aimed to fill this gap by exploring the connections among ethical leadership, AI adoption, employee engagement, and sustainable hotel performance. It also investigated employee engagement as a mediator in the relationships between ethical leadership and AI adoption and sustainable hotel performance. This integrated framework serves as a foundation to understand the relationship between responsible leadership, intelligent technologies and employee involvement in relation to sustainability in the hospitality sector.

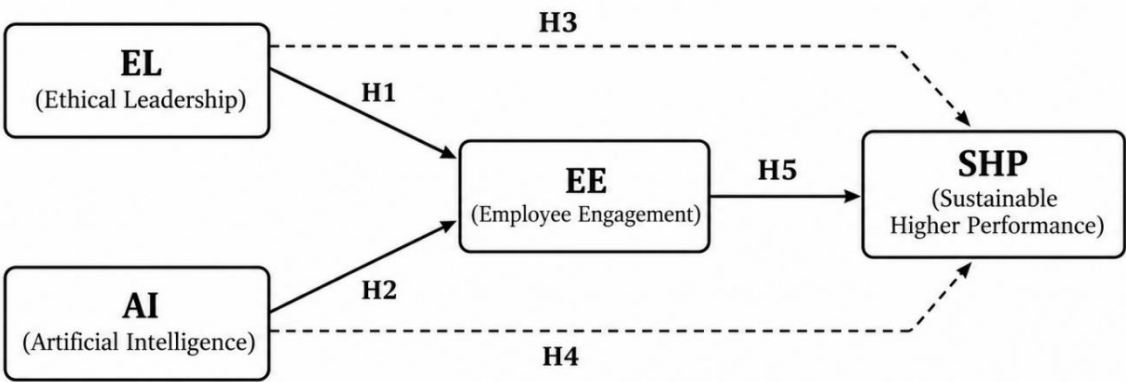


Figure 1. Conceptual Framework

Research Methodology

Research Design and Data Collection

The research design used in this study was a quantitative, cross-sectional research design. The data were gathered using a structured questionnaire that was used to obtain information from the employees and managers in the hospitality industry. The quantitative approach was suitable for the study to investigate the relationships among the study constructs as hypothesised in the study by using statistical analysis. The respondents were selected based on their experience with hotel

operations, leadership practices, AI-related technologies and sustainability-related activities. The respondents were informed about the academic purpose of the study and the confidentiality of their responses, and participation was voluntary.

Measures and Instrument Development

The questionnaire assessed four constructs: ethical leadership, AI adoption, employee engagement and sustainable hotel performance. The items for measurement were adapted from the existing scholarly literature and adapted to the hotel context. Ethical leadership was assessed with the 10-item scale of Brown et al. (2005) that measures fairness, integrity, ethical decision-making, and responsible leadership behaviour. The Utrecht Work Engagement Scale (UWES-9), developed and studied by Schaufeli et al. (2006), was used to measure employee engagement. Five items were used to operationalise the adoption of AI, which were related to the integration and use of AI-enabled technologies in hotel operations. Sustainable hotel performance was determined by nine items related to economic, environmental and social sustainability. The questionnaire thus included 33 measurement items in the four constructs. The items for adoption of AI and sustainable hotel performance were adapted to the hotel context and aligned with the relevant published items prior to administration. The answers were given on a Likert-type scale, with a higher score representing greater agreement with the statements. The questionnaire was designed to maintain construct relevance and content validity.

Sampling and Sample Size Determination

The target group included employees and managers in hotels with knowledge of organisational leadership, AI usage, employee engagement, and sustainability-related performance. The non-probability sampling method was used to access the eligible respondents who have relevant organisational experience. The participants were chosen because of their knowledge of hotel operations and the constructs of the study. The first sample size goal was based on the 1:10 item-to-response ratio, which suggests 10 respondents per questionnaire item. The questionnaire consisted of 4 constructs (ethical leadership, AI adoption, employee engagement, and sustainable hotel performance) with 33 measurement items. The preliminary sample size was determined using this guideline, which is to take the number of measurement items (33) and multiply by 10, or 330 respondents. After the data collection, the questionnaires were checked for completeness and quality of the responses. Of the 293 responses that passed the screening, 293 were used for final analysis. This last sample was not as large as the original target of 330 respondents, but was deemed adequate based on the complexity of the structural model, the number of predictors, expected effect sizes and the statistical power needed for the Partial Least Squares Structural Equation Modelling (PLS-SEM). The final sample of 293 respondents was then analysed for the measurement and structural models in SmartPLS 4.

Data Analysis Using SmartPLS

Partial Least Squares Structural Equation Modelling (PLS-SEM) was used to analyse the data in SmartPLS 4. The measurement and structural models were evaluated using this method, as well as testing the direct and indirect relationships between ethical leadership, AI adoption, employee engagement, and sustainable hotel performance. The measurement model was evaluated based on the indicator loadings, Cronbach's alpha, composite reliability, average variance extracted (AVE), and heterotrait–monotrait ratio (HTMT) following the methodological guidance (Hair et al., 2021). The reliability coefficients of 0.70 and above and AVE of 0.50 and above were considered as general guidelines for determining the internal consistency and convergent validity. To test the discriminant validity, the HTMT was used, and the threshold was interpreted based on the methodological guidelines and the context of the study. The structural model was evaluated with variance inflation factors (VIF), path coefficients, coefficient of determination (R^2), effect size (f^2) and predictive relevance (as appropriate). Standard errors, confidence intervals and statistical significance of the hypothesised relationships were estimated using bootstrapping with 10,000 subsamples. The direct impacts of ethical leadership and AI adoption on employee engagement and sustainable hotel performance were analysed, as well as the connection between employee engagement and sustainable hotel performance. The indirect effect of employee engagement between ethical leadership and sustainable hotel performance was examined by testing the indirect effects of ethical leadership and AI adoption on sustainable hotel performance through employee engagement. Indirect effects were deemed to be statistically significant if the bootstrapped confidence interval did not contain zero.

Ethical Considerations

The study was conducted in accordance with the principles of voluntary participation, informed consent, confidentiality and responsible data handling. The participants were informed of the academic purpose of the research, and they were asked to participate voluntarily. The responses were used for academic research, and identifying information was safeguarded if collected. Where appropriate, institutional ethical approval was obtained according to relevant institutional procedures.

Results and Discussion

Assessment of the Measurement Model

The measurement model was examined to determine the reliability and validity of the study constructs prior to the examination of the structural relationships. Cronbach's alpha and composite reliability (CR) were used to test internal consistency reliability, and average variance extracted (AVE) was used to test convergent validity. The heterotrait–monotrait ratio (HTMT) was used to test discriminant validity. The criteria were assessed following the guidelines of the PLS-SEM (Hair et al., 2019; Hair & Alamer, 2022).

Reliability and Convergent Validity

Table 1. Reliability and Convergent Validity

Construct	CA	CR	AVE
Ethical Leadership (EL)	0.791	0.819	0.694
AI Adoption (AI)	0.873	0.910	0.670
Employee Engagement (EE)	0.902	0.727	0.718
Sustainable Hotel Performance (SHP)	0.714	0.736	0.745

The internal consistency reliability is satisfactory for the four constructs, as shown in the results. The Cronbach's alpha values are between 0.714 and 0.902, which is above the recommended value of 0.70. Likewise, the composite reliability values are between 0.727 and 0.910, which is considered the minimum criterion. The results of these tests suggest that the constructs have good internal consistency. AVE was used as an indicator of convergent validity. The values are between 0.670 and 0.745, which is higher than the recommended value of 0.50. This means that more than 50% of the variance of the indicators is accounted for by each construct. In general, the results are in line with the reliability and convergent validity of the measurement model.

Discriminant Validity

Discriminant validity was assessed using the HTMT criterion introduced by Henseler et al. (2015). This method evaluates whether the constructs are empirically distinguishable from one another.

Table 2. HTMT Discriminant Validity

Construct	EL	AI	EE	SHP
Ethical Leadership (EL)	—			
AI Adoption (AI)	0.641	—		
Employee Engagement (EE)	0.728	0.693	—	
Sustainable Hotel Performance (SHP)	0.802	0.756	0.783	—

The HTMT values are between 0.641 and 0.802, which are all below the conservative value of 0.85. The results show that the ethical leadership, AI adoption, employee engagement, and sustainable hotel performance are satisfactory in terms of discriminant validity. The strongest correlation is found between ethical leadership and sustainable hotel performance (0.802), and between employee engagement and sustainable hotel performance (0.783). Although there are conceptual relationships between the constructs, they are empirically distinguishable based on the HTMT criterion. The overall measurement model is reliable, valid, convergent and discriminant as indicated by the statistics.

Assessment of the Structural Model

After the measurement model assessment, the structural model was assessed to examine the hypothesised relationships between ethical leadership, AI adoption, employee engagement, and sustainable hotel performance. Path coefficients, statistical significance, coefficient of determination (R^2) and effect size (f^2) were analysed. Bootstrapping with 10,000 subsamples was used to assess the significance of the hypothesised relationships.

Structural Model and Hypothesis Testing

Table 3. Structural Model Results

Hypothesis	Relationship	β	t-value	p-value	Decision
H1	EL $\rightarrow$ EE	0.342	4.871	0.001	Supported
H2	AI $\rightarrow$ EE	0.286	3.964	<0.001	Supported
H3	EL $\rightarrow$ SHP	0.218	2.742	0.006	Supported
H4	AI $\rightarrow$ SHP	0.301	3.887	0.003	Supported
H5	EE $\rightarrow$ SHP	0.267	3.516	<0.001	Supported

The results of the structural model show positive relationships between the study constructs, which is in line with the five hypotheses. Ethical leadership and employee engagement (H1). There is a positive relationship between ethical leadership and employee engagement ($\beta = 0.342$, $t = 4.871$, $p = 0.001$). The result shows that there is a positive relationship between employee engagement and ethical leadership. Fairness, integrity and responsible decision-making by leaders help to create a workplace culture that empowers employees to be active participants in their work. Adopting AI and employee engagement (H2). There is a positive correlation between the use of AI and employee engagement ($\beta = 0.286$, $t = 3.964$, $p < 0.001$). The discovery implies that the use of AI-powered technologies in hotels is linked to higher employee engagement. AI systems assist in processing information, managing repetitive tasks, and coordinating services, allowing human workers to concentrate on tasks that demand human judgment and interaction. Ethical leadership and sustainable hotel performance (H3). The results show that there is a positive and statistically significant relationship between ethical leadership and sustainable hotel performance ($\beta = 0.218$, $t = 2.742$, $p = 0.006$). This outcome underscores the importance of ethical leadership for sustainability outcomes in organisations. Leaders who promote accountability, fairness and responsible behaviour foster practices that promote economic, environmental and social goals.

The use of AI and sustainable hotel performance (H4). Adoption of AI is positively related to sustainable hotel performance ($\beta = 0.301$, $t = 3.887$, $p = 0.003$). This discovery suggests that there is a positive correlation between the use of AI and the performance of sustainable hotels. AI-driven technologies aid in the efficiency of operations, resource management, and service planning, which help achieve sustainability outcomes. Employee engagement and sustainable hotel performance (H5). Employee engagement has a positive relationship with sustainable hotel performance ($\beta =$

0.267, $t = 3.516$, $p < 0.001$). This discovery highlights the significance of employees' engagement in the organisation's sustainability. Happy workers are part of a team, help improve services, and help put responsible practices into place at work. In general, the results show that there are positive relationships between ethical leadership, AI adoption, employee engagement, and sustainable hotel performance. The findings underscore the importance of leadership practices and technological capacities to account for employee engagement and sustainability outcomes of the organisation.

Explanatory Power and Effect Sizes

Table 4. Coefficients of Determination

Endogenous construct	R ²	Adjusted R ²
Employee Engagement	0.472	0.467
Sustainable Hotel Performance	0.648	0.641

The R² value for employee engagement is 0.472, meaning that the model explains 47.2% of the variance in employee engagement. The adjusted R² is 0.467, which means that the model has a similar R² value when the number of predictors is taken into account. The R² value is 0.648, which means that 64.8% of the variance in hotel performance is explained by the combination of ethical leadership, the use of AI, and employee engagement. The adjusted R² value of 0.641 is also similar in terms of the adjusted explanatory power. The results show that the model accounts for a significant amount of variance in sustainable hotel performance and a significant amount of variance in employee engagement.

Table 5. Effect Sizes (f^2)

Predictor relationship	f^2	Interpretation
EL → EE	0.142	Small
AI → EE	0.099	Small
EL → SHP	0.071	Small
AI → SHP	0.154	Medium
EE → SHP	0.112	Small

The effect sizes reflect the relative importance of each predictor in the model. Four relationships show small effects (0.02), 12 show medium effects (0.15), and 11 show large effects (0.35), using conventional guidelines of 0.02, 0.15 and 0.35 for small, medium and large effects, respectively. The f^2 value of 0.154 for sustainable hotel performance shows that the use of AI has a medium impact. The f^2 value for employee engagement is 0.142, which is a small effect size that is relatively strong and approaching the medium effect size. The adoption of AI has a small effect on employee engagement ($f^2 = 0.099$), and ethical leadership has a small effect on sustainable hotel performance ($f^2 = 0.071$). Sustainable hotel performance is also slightly affected by employee

engagement ($f^2 = 0.112$). The results of the R^2 and f^2 show that the model has some explanatory power, especially in the case of sustainable hotel performance. The use of AI is the biggest single factor among the reported predictors of sustainable hotel performance.

Mediation Analysis

Ethical leadership and sustainable hotel performance, as well as AI adoption and sustainable hotel performance, were analysed as mediators in the relationships between them and employee engagement. The indirect effects were evaluated with 10,000 subsamples of bootstrapping.

Table 6. Indirect Effects through Employee Engagement

Indirect relationship	Indirect effect (β)	t-value	p-value	Decision
EL $\rightarrow$ EE $\rightarrow$ SHP	0.081	2.826	<0.001	Significant
AI $\rightarrow$ EE $\rightarrow$ SHP	0.076	2.621	0.004	Significant

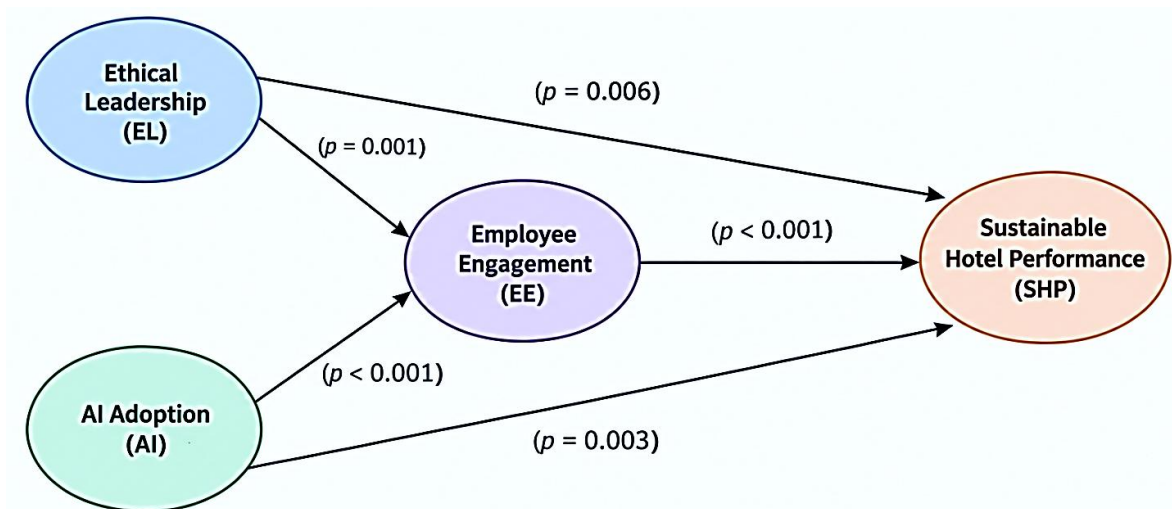


Figure 2. Structural Model

The results show that employee engagement is positively and significantly related to sustainable hotel performance, with a beta value of 0.081 ($t = 2.826$, $p < 0.001$). The result indicates that there is a relationship between employee engagement and sustainable hotel performance via ethical leadership. A responsible working environment is achieved through ethical leadership, and employee engagement is used to turn this working environment into contributions to organisational sustainability. The indirect effect of the use of AI on the sustainable performance of the hotel through employee engagement is also positive and statistically significant ($\beta = 0.076$, $t = 2.621$, $p = 0.004$). This finding suggests that employee engagement is another channel through which the use of AI impacts sustainable hotel performance. While AI-driven technologies enhance the way

things are done, people are still crucial for embedding technological capabilities into daily operations and sustainability-related practices. These findings, combined, provide support for the mediation of employee engagement in both relationships. The direct relationships between ethical leadership and sustainable hotel performance, as well as between AI adoption and sustainable hotel performance, are also positive and reported as statistically significant. This is similar to complementary partial mediation, where both direct and indirect relationships help to account for sustainable hotel performance.

Discussion

The results show the importance of ethical leadership, AI usage, and employee engagement in the context of sustainable hotel performance. The positive correlation between ethical leadership and employee engagement is in line with the social learning approach of Brown et al. (2005), which suggests that employees learn appropriate behaviour from their leaders. Kahn (1990) also highlighted the psychological factors which facilitate employees' involvement in the job. In the hotel setting, ethical leadership build trust, fairness and responsibility, which will motivate employees to be actively involved in the activities of the organisation. The correlation between employee engagement and AI adoption underscores the organisational impact of technology adoption. Huang and Rust (2018) discussed the role of artificial intelligence in service work, and Tussyadiah (2020) discussed the implications of automation in tourism. In the hospitality industry, AI systems assist in handling information, coordinating services, and handling routine tasks in hotels. The results indicate that there is a relationship between the use of technology and employee engagement, and the benefits of implementing technology are dependent on the readiness of employees, suitable training, and managerial support. AI is best used in conjunction with the capabilities of employees and not as a replacement to improve employee engagement. The positive relationships between ethical leadership and AI adoption and sustainable hotel performance suggest that the sustainable outcomes are relevant to the hotel's sustainable performance. Ethical leadership help foster accountability and responsible decision-making, and the use of AI helps improve operational efficiency and resource management. The relationships are especially significant for the hotel sector, where the economic performance is closely related to environmental responsibility and social outcomes. The cross-sectional research design means that the results of this study only show the relationship between the variables studied and not causal relationships.

Employee engagement is also shown to have a positive correlation with sustainable hotel performance. This discovery reinforces the notion that workers are crucial to the process of making organisational practices a reality in the workplace. Happy staff help with the quality of service, teamwork and the adoption of sustainability measures. Saks (2006) pointed out the importance of workplace exchanges as a theory to explain employee engagement, which will be used to investigate the relationship between organisational conditions and employee contributions. The mediation results also suggest that employee engagement is an indirect link between ethical leadership and sustainable hotel performance, as well as between AI adoption and sustainable hotel performance. The results indicate that the connections between responsible leadership,

technology adoption and sustainability are not limited to their direct connections, but also include the connection between responsible leadership and employee engagement. Employee engagement is thus an important mechanism in the organisation that connects leadership, technological practices and sustainability-related performance. The model's explanatory power helps to make the integrated framework relevant. The model accounts for 47.2% of the variance in employee engagement and 64.8% of the variance in sustainable hotel performance. The effect size for the adoption of AI is also the highest of the predictors of sustainable hotel performance reported. The findings highlight the need to take into account technological capabilities, as well as ethical leadership and employee engagement when looking at hotel sustainability. In conclusion, the study highlights the need for a holistic approach to ethical leadership, purposeful AI use, and employee engagement in the context of the hospitality industry. To ensure ethical guidelines are set, support and training are given for the implementation of AI in hotels, and the employees are involved in sustainability initiatives. This holistic approach supports hotels in achieving their operational efficiency and economic, environmental and social goals.

Conclusion and Recommendations

Conclusion

The aim of this study was to explore the relationships between ethical leadership, the adoption of artificial intelligence (AI) in the hotel industry, employee engagement, and sustainable hotel performance, focusing on the mediating effect of employee engagement. The results suggest that ethical leadership and AI use have a positive impact on employee engagement and sustainable hotel performance. Moreover, employee engagement has a positive effect on sustainable hotel performance and acts as a mediator between ethical leadership and sustainable hotel performance, as well as between AI adoption and sustainable hotel performance. The findings suggest that ethical leadership is one of the critical factors in the organisation that contribute to employee engagement. Leaders who set a positive example in terms of fairness, integrity, transparency and ethical decision-making foster a positive work culture where staff feel valued and motivated. Likewise, the use of AI has a positive impact on employee engagement, indicating that the implementation of AI tools helps employees carry out their duties more efficiently and meet evolving business needs.

The results also reveal that ethical leadership and the use of AI are positively and directly related to the performance of the hotel in relation to sustainability. AI adoption had a relatively high direct impact on sustainable hotel performance, suggesting that technological innovations play a role in enhancing hotel performance and sustainability outcomes. The direct impact of AI adoption on sustainable hotel performance was higher compared to ethical leadership, indicating that AI contribute to hotel performance and sustainable outcomes. The positive impact of employee engagement on sustainable hotel performance was also significant, highlighting the need for employees to be motivated, dedicated, and engaged in the organisation's goals. The mediation analysis also showed that the relationships between ethical leadership and sustainable hotel

performance, as well as between AI adoption and sustainable hotel performance, were partially mediated by employee engagement. This means that leadership practices and technology solutions both directly and indirectly impact hotel performance through their ability to enhance employee engagement. In conclusion, the study highlights the need for a holistic strategy that includes ethical leadership, successful implementation of AI, and employee engagement to achieve sustainable performance in the hospitality industry. The results provide valuable information for hotel managers who want to enhance the performance of their organisations and contribute to their sustainability.

Recommendations

From the results, some recommendations are given for the hotel management and future researchers. First, hotel management must foster ethical leadership by providing leadership development programmes focused on integrity, fairness, accountability, transparency and responsible decision-making. Managers must ensure that organisational values are clearly communicated, that employees are engaged in decisions that are relevant to them and that there are equitable processes for dealing with issues in the workplace. Second, there is a need to strategically implement AI technologies in hotels based on their operational needs and sustainability goals. AI is used in various applications, including customer service, demand forecasting, energy management, resource allocation, and predictive maintenance, to enhance operational efficiency and contribute to environmental sustainability. Implementing such a program is also dependent on employee training, technical assistance and communication to minimise uncertainty and resistance to technological change. Third, hotel managers must increase employee engagement by acknowledging employee efforts, offering staff development, engaging employees, and fostering positive work environments. Frequent feedback, equitable reward systems, and promotion opportunities improve employee motivation, commitment and engagement in organisational objectives.

Fourth, there is a need to embed ethical leadership, employee engagement, and the use of AI in the wider scope of sustainability plans in hotel management. Performance indicators include financial results, resource efficiency, service quality, employee health and wellbeing and environmental performance. Regular performance evaluations help uncover opportunities for improvement and ensure that the investments in technology support long-term sustainability goals. Lastly, future studies are called upon to investigate these relationships in various hotel types, geographical areas and cultural settings. Longitudinal research helps explore the dynamic changes of these relationships, and qualitative studies help gain more insight into employees' experiences of ethical leadership and the implementation of AI. Other mediators and moderators, such as organisational culture, employee digital competence and organisational support, could also be investigated in further research. To sum up, sustainable hotel performance is achieved through a holistic strategy that encompasses responsible leadership, strategic use of AI, and employee engagement. This is a practical way of improving the effectiveness of the organisation and moving towards long-term sustainability.

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