AI and Human Collaboration in Welcome Hotels by ITC: A Case Study on Achieving Industry 5.0 for Resilience and Sustainability

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ABSTRACT

This case study examines how Welcome Hotels by ITC in India leverages AI-human collaboration to advance Industry 5.0 principles, focusing on enhancing guest satisfaction, operational resilience, and sustainability. It explores the strategic integration of advanced technologies with human-centric service delivery in a luxury hospitality setting. The study adopts a qualitative case study approach to analyze the implementation and impact of AI tools, including predictive analytics, chatbots, robotic process automation, and smart energy management systems. Data were collected through semi-structured interviews with hotel staff, document analysis of ITC's sustainability and operational reports, and on-site field observations. NVivo 15 was used to conduct thematic analysis and code participant responses, ensuring triangulation and depth of insight. The findings indicate that AI significantly enhances operational efficiency by automating routine processes, enabling predictive maintenance, and optimizing resource utilization. This allows hotel staff to focus on personalized guest interactions, reinforcing the human touch that is essential to luxury hospitality. AI-supported sustainability practices—such as intelligent climate control, waste reduction systems, and paperless operations—contribute to the hotel's environmental goals. The interplay between AI and human roles fosters adaptive workflows, empowers employees through skill transformation, and improves service delivery consistency, thereby building organizational resilience. In conclusion, Welcome Hotels by ITC serves as a practical example of how AI and human collaboration can be harnessed to fulfill the human-centric, sustainable, and resilient vision of Industry 5.0. This study offers valuable insights for hospitality leaders and researchers aiming to implement future-ready, empathetic, and eco-conscious hotel operations.

Keywords: AI-Human collaboration, green hospitality, guest personalization, Industry 5.0, operational resilience

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INTRODUCTION

The hospitality industry is undergoing a technological transformation, with Artificial Intelligence (AI) playing a pivotal role in reshaping operations, enhancing customer experiences, and driving sustainability (Peng & Mun, 2025). As the industry moves beyond digitalization, the integration of AI with human expertise is becoming essential in achieving Industry 5.0—a paradigm that emphasizes human-centric, sustainable, and resilient business practices (Anang et al., 2024). Unlike Industry 4.0, which focused on automation and data-driven processes, Industry 5.0 envisions a balanced collaboration between AI and human workers, ensuring that technology augments human capabilities rather than replacing them.

Welcome Hotels by ITC, a leading hotel chain in India, has been at the forefront of this transformation. By incorporating AI-driven solutions such as predictive analytics, chatbots, robotic process automation (RPA), and energy-efficient smart technologies, ITC has optimized operations while maintaining personalized guest services (Singh et al., 2011). However, achieving a balance between AI-driven automation and human expertise presents both opportunities and challenges. While AI enhances operational efficiency and sustainability, concerns around job displacement, ethical considerations, and seamless human-AI interaction remain critical areas of exploration (Valeriya et al., 2024).

This case study aims to evaluate how Welcome Hotels by ITC has leveraged AI to enhance resilience and sustainability while maintaining human-centred service excellence. It examines the implications of AI-human collaboration for operational efficiency, guest satisfaction, workforce adaptation, and environmental impact in the context of Industry 5.0.

While prior studies have addressed the operational benefits of AI in hospitality, few have critically examined how AI-human collaboration influences resilience and sustainability from a holistic Industry 5.0 perspective. Existing work typically isolates automation outcomes, failing to address the strategic and emotional dimensions of human-machine collaboration (Alves et al., 2023). This study fills that void by exploring co-intelligent systems in a real-world setting, providing both theoretical and applied contributions.

The main research problem addressed in this study is how AI-human collaboration contributes to resilience and sustainability in Welcome Hotels by ITC, and what strategies can be adopted to optimize this synergy? The objectives of this study are:

- To assess how AI tools influence operational efficiency and service personalization.
- To explore how AI-human collaboration aligns with Industry 5.0's resilience and sustainability goals.
- To analyze staff perceptions, challenges, and adaptability in adopting AI systems.
- To evaluate the role of AI in environmental sustainability practices.
- To derive strategic recommendations for optimizing AI-human synergy in hotels.

BACKGROUND OF STUDY

The hospitality industry is evolving rapidly with the integration of Artificial Intelligence (AI), driving efficiency, personalization, and sustainability. Welcome Hotels by ITC exemplifies this transformation by strategically blending AI with human expertise to achieve Industry 5.0, which emphasizes human-centric innovation and resilience (Dewangan & Kumar, 2023). Unlike Industry 4.0, which prioritized automation, Industry 5.0 fosters collaboration between AI and humans, ensuring operational efficiency without compromising personalized guest experiences (Darwish, 2024; Dollija & Gura, 2024).

In Welcome Hotels, AI plays a crucial role in enhancing guest services, operational management, and sustainability initiatives (Ghaderi et al, 2022). Intelligent chatbots and AI-driven virtual assistants provide 24/7 customer support, handling routine inquiries and allowing hotel staff to focus on personalized services (Anang et al., 2024). Predictive analytics optimize inventory management and demand forecasting, reducing waste and ensuring resource efficiency (Chaini et al, 2024). AI-driven energy management systems also contribute to sustainability by regulating lighting, temperature, and water use, significantly reducing the hotel's environmental footprint (Aheleroff et al., 2022).

However, integrating AI presents challenges, particularly regarding workforce adaptation and job transformation. Employees must develop new skills to work alongside AI, ensuring a seamless balance between automation and human touch (Valeriya et al, 2024). While AI improves efficiency, the importance of human interaction in hospitality remains irreplaceable, particularly in luxury hotels where personalized service is a key differentiator (Vyhmeister & Castañé, 2024).

This case study highlights how Welcome Hotels by ITC exemplifies Industry 5.0 principles, leveraging AI to enhance resilience and sustainability while preserving human expertise (Rane et al., 2024; Su et al, 2022). By addressing workforce challenges and optimizing AI-human collaboration, the hospitality sector can achieve greater efficiency and sustainability. The findings offer valuable insights for hotels worldwide, demonstrating that AI is not a replacement for human service but a tool to augment it, ensuring both operational excellence and superior guest experiences.

METHOD

This study employs a qualitative instrumental case study design to investigate AI-human collaboration at Welcome Hotels by ITC. The approach was chosen to allow an in-depth exploration of the implementation and impact of AI tools and systems within a real-world hospitality context, with a particular emphasis on how such collaboration contributes to Industry 5.0 outcomes: resilience, sustainability, and human-machine synergy.

Welcome Hotels by ITC was selected for its early adoption of AI-enabled sustainable practices and its reputation for integrating green luxury with human-centric service. As an Indian hospitality chain recognized for ESG leadership and operational innovation, it offers a rich context for analyzing AI-human synergy under Industry 5.0.

The property's distinct emphasis on blending traditional hospitality with cutting-edge digital transformation makes it an ideal exemplar.

Purposive sampling was used to select six participants based on their direct involvement with AI systems and hotel operations. The sample included two hotel managers, two operational staff, one IT systems officer, and one sustainability officer. This diverse mix ensured a comprehensive understanding of how AI is applied across different organizational levels. Data were collected by conducting semi-structured interviews with the six participants, guided by open-ended questions to explore AI usage, perceived benefits, challenges, and its contribution to operational resilience and sustainability, Document analysis where ITC's public reports, sustainability disclosures, and AI implementation articles were reviewed to contextualize and triangulate findings, observational notes where field visits provided supplementary insights into how AI technologies functioned in operational settings.

The study adhered to qualitative case study protocols guided by Yin's (2018) framework, which includes clear research objectives, purposeful participant selection, triangulation of data sources, and maintaining data transparency. The researcher assumed the role of a non-participant observer and interviewer, ensuring minimal disruption to ongoing hotel operations.

All participants were briefed on the study's purpose and provided informed consent prior to the interviews. Participation was voluntary, and respondents had the right to withdraw at any point. Identities were anonymized to protect confidentiality. Audio recordings and field notes were securely stored, and no personally identifiable information has been disclosed. The research adhered to the ethical norms outlined by academic regulatory bodies in India, such as the University Grants Commission (UGC), ensuring confidentiality, voluntary participation, and ethical use of data.

To ensure transparency and replicability, a comprehensive audit trail was maintained throughout the research process. This included:

1. Data Collection Records: Detailed notes of all six semi-structured interviews were logged, with timestamps, consent forms, and interview guides archived for reference.

2. Data Analysis Logs: Coding memos, theme development logs, and iterations of NVivo project files were saved at each analytical phase. This documented the transition from raw data to initial codes, categories, and final themes.

3. Reflexive Journal: The primary researcher maintained a reflexive journal to record evolving thoughts, potential biases, and decision rationales during theme formation.

4. Documented Revisions: All changes to codes and themes were documented with justifications. Versioned codebooks and NVivo query outputs were archived.

5. NVivo Outputs: Visual tools such as the hierarchy chart, word cloud, and project map were exported and saved with source references to trace thematic derivation.

To enhance the credibility of findings, member checking was conducted with four of the six original participants. Participants were provided with a summary of preliminary themes and selected verbatim quotes. They were asked to verify the accuracy of how their responses were represented: whether the identified themes reflected their perspectives, and if any key insights were omitted or misinterpreted.

Feedback received led to the refinement of two thematic categories—specifically, the distinction between "emotional labour" and "guest personalization" under the theme Human-Centric Service Augmentation. Participants confirmed that the final themes aligned with their lived experiences and accurately captured their views on AI-human collaboration at Welcome Hotels.

DATA ANALYSIS

Data were analyzed using Braun and Clarke's (2006) six-step thematic analysis with a semantic coding approach, focusing on explicit meanings in participants' responses. The steps followed included: (1) Familiarization with transcripts and documents, (2) Generation of initial codes, (3) Searching for themes across datasets, (4) Reviewing and refining themes for coherence and relevance, (5) Defining and naming themes aligned with Industry 5.0 constructs, and (6) Producing the report with thematic narratives supported by direct quotes and document

evidence. This approach was selected for its flexibility and its capacity to identify and interpret patterns of meaning across qualitative datasets. Semantic coding was applied to emphasize the explicit meanings expressed by participants while grounding the findings in the practical context of AI-human collaboration at Welcome Hotels by ITC. The following expands on each of the six steps of data analysis.

Step 1: Familiarization with transcripts and documents
This step involves conducting semi-structured interviews with six (6) employees of ITC hotels who were directly involved in AI-related work at the hotel. The interviews, along with field notes and publicly available documents from ITC's website, were read and re-read to immerse in the data. Initial reflections were noted to capture early impressions, especially regarding the interaction between technology and human roles.

Step 2: Generation of initial codes.
Using manual semantic coding, data segments were highlighted and labelled with meaningful codes. The coding was both descriptive (capturing surface-level content) and interpretative (inferring purpose or meaning). A total of 46 initial codes were developed.

Step 3: Searching for themes across datasets
Codes were grouped into preliminary themes based on conceptual similarity. These emerging themes reflected deeper patterns aligned with the research objective—particularly around the benefits and functions of AI-human collaboration within the hospitality setting.

Step 4: Reviewing and refining themes for coherence and relevance
The themes generated earlier were reviewed against the entire dataset to ensure they accurately reflected participants' perspectives. Some themes were identified, and supporting data extracts were organized.

Step 5: Defining and naming themes aligned with Industry 5.0 constructs
Each theme was clearly defined and its boundaries established. The focus was on capturing both functional outcomes and strategic alignment with Industry 5.0 principles (resilience, sustainability, and human-machine synergy).

Step 6: Producing the report
The themes were woven into a narrative supported by direct quotes, demonstrating how AI-human collaboration at Welcome Hotels contributes to Industry 5.0 outcomes: increased resilience, enhanced human engagement, and sustainability. The analysis goes beyond description, offering interpretation grounded in the participants' lived experiences.

Coding the Nodes
Next, the transcribed data were coded to generate nodes for further analysis using NVivo 15. The software was used to trace thematic derivation using visual tools such as the hierarchy chart, word cloud, project map, matrix coding, and word frequency.

RESULTS AND DISCUSSION

Data Coding and Generating Themes
The qualitative data obtained from the six semi-structured interviews, document analysis, and field observations were analyzed using thematic analysis, following Braun and Clarke's (2006) six-step process. A semantic coding approach was applied to identify explicit patterns in participant responses that align with the constructs of AI-human collaboration, resilience, and sustainability under the lens of Industry 5.0.

Initial Coding and Node Development
A semantic coding approach was employed using NVivo 15. While the initial codes were manually developed based on surface-level meanings, NVivo was used to organize, visualize, and analyze the data, facilitating theme generation and co-occurrence analysis, as shown in Table 1.

Table 1: Initial Code development using NVivo 15

Nodes	Sub Nodes
AI integration in Hotel Operations	Chatbots and Digital concierge, Predictive Maintenance, Smart Check-ins
Human Centric Service Augmentation	AI support in repetitive tasks, enhanced guest engagement, and emotional labour
Operational Resilience through AI	Proactive problem management, Workflow optimization, and Downtime Reduction
Sustainability through Intelligent Systems	Energy Optimization, Waste Reduction, Eco-Friendly Practices
Perceptions and Attitudes towards AI	Positive attitudes, fear of Replacement, and cultural Collaboration of culture

An initial set of 46 descriptive codes was generated during the first round of open coding. These codes were then categorized into five parent nodes based on conceptual similarities. Each node represented a thematic area that emerged consistently across participants and data sources. Sub-nodes were created to capture specific aspects of each broader theme (Annexure 1). The following table outlines the key themes (nodes) and their corresponding sub-nodes derived from the coding process:

Thematic Coding

Three major themes emerged that reflect the interplay between AI and human collaboration in Welcome Hotels and how this integration contributes to Industry 5.0 principles of resilience, sustainability, and human-centric value creation (Table 2). Each theme is substantiated by data excerpts and supported by multiple sources, including interviews, documents, and observational notes (Dorroh et al., 2025).

Table 2: Major Themes appearing in NVivo 15

Theme	Key Codes
Theme 1: Operational Resilience through AI	Predictive Maintenance, Proactive Problem Management, Downtime Prevention
Theme 2: Human-Centric Service Augmentation	AI Support in Repetitive Tasks, Enhanced Guest Engagement, Emotional Intelligence
Theme 3: Sustainability through Intelligent Systems	Smart Climate Control, Waste Reduction, AI-Driven Sustainability Tracking

Theme 1: Operational Resilience through AI Collaboration

This theme captures how AI tools contribute to operational continuity and preparedness by enabling proactive decision-making and risk mitigation. Participants cited various AI applications—such as predictive maintenance systems, automated monitoring, and AI-powered alerts—that help avoid service disruptions.

> *"AI notifies us in advance if something's off—whether it's a machine or guest request. That way, we can act before any problem affects the guest experience."*
> (Manager, Welcome Hotel - Hyderabad)

These AI-enabled practices align with Industry 5.0's resilience dimension, where adaptive systems collaborate with human insight to prevent downtime and improve organizational responsiveness.

Theme 2: Human-Centric Service Augmentation

Rather than replacing staff, AI was consistently described as a support system that frees up human capacity for more meaningful guest interactions. Participants emphasized that automating routine tasks enabled them to focus on emotional intelligence, personalization, and hospitality values.

> *"The chatbot handles basic questions. We spend that saved time giving guests more personal attention."* (Front Desk Executive, Welcome Hotel - Delhi)

This theme highlights the core Industry 5.0 principle of integrating smart technology while preserving and enhancing human touch, positioning the workforce not as competitors but as collaborators with intelligent systems.

Theme 3: Sustainability through Intelligent Systems
AI also plays a significant role in achieving the hotel's green and sustainability goals. Smart climate control, energy-saving automation, paperless operations, and AI-informed waste management were frequently mentioned across managerial and sustainability roles.

> *"When a guest leaves the room, the system turns off the lights and AC automatically. That alone has saved a lot of energy."*
> (Sustainability Officer, Welcome Hotel - Chennai)

This theme illustrates how sustainable intelligence is operationalized through AI, contributing to both environmental responsibility and cost efficiency, which are central to Industry 5.0's broader mission.

Tracing thematic derivation via NVivo 15 using visual tools
The following section illustrates how the various visual tools were used to derive the themes.

Word Cloud
The word cloud (Figure 1) visually represents the frequency and salience of terms extracted from the qualitative dataset, which includes interviews, observations, and documents related to AI-human collaboration at Welcome Hotels by ITC. In qualitative research, such visualizations aid in identifying dominant themes and recurring language patterns that reflect participants' perspectives and organizational practices.

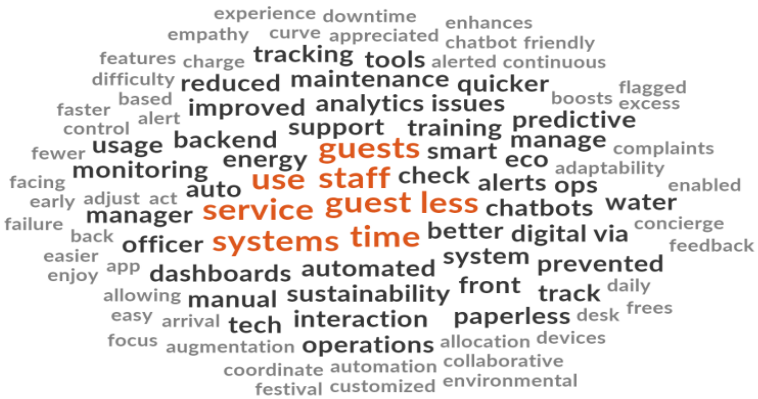

Figure 1: Word Cloud Depicting Key Concepts from Interview Data by NVivo 15

Larger words like "smart," "digital," "hotel," "AI," "innovation," and "human" recur across interviews, indicating a strong integration of smart technologies with human-centric hospitality services. These keywords support the emergence of key themes such as: AI Integration in Hotel Operations, Human-Centric Service Augmentation, Operational Resilience, and Sustainability through Intelligent Systems.

Words like "chatbots," "predictive," "guest," "collaboration," and "workflow" highlight specific sub-nodes coded under these broader themes. Terms like "resilience," "efficiency," "automation," and "energy" highlight the functional benefits of AI implementation in the hospitality context, while words such as "emotional," "personalization," and "empowerment" show how AI supports—not replaces—human roles.

Hierarchy Chart
Figure 2 below shows the NVivo-generated Tree Map visualizing the frequency and hierarchy of coding references across key themes identified from the interview transcripts.

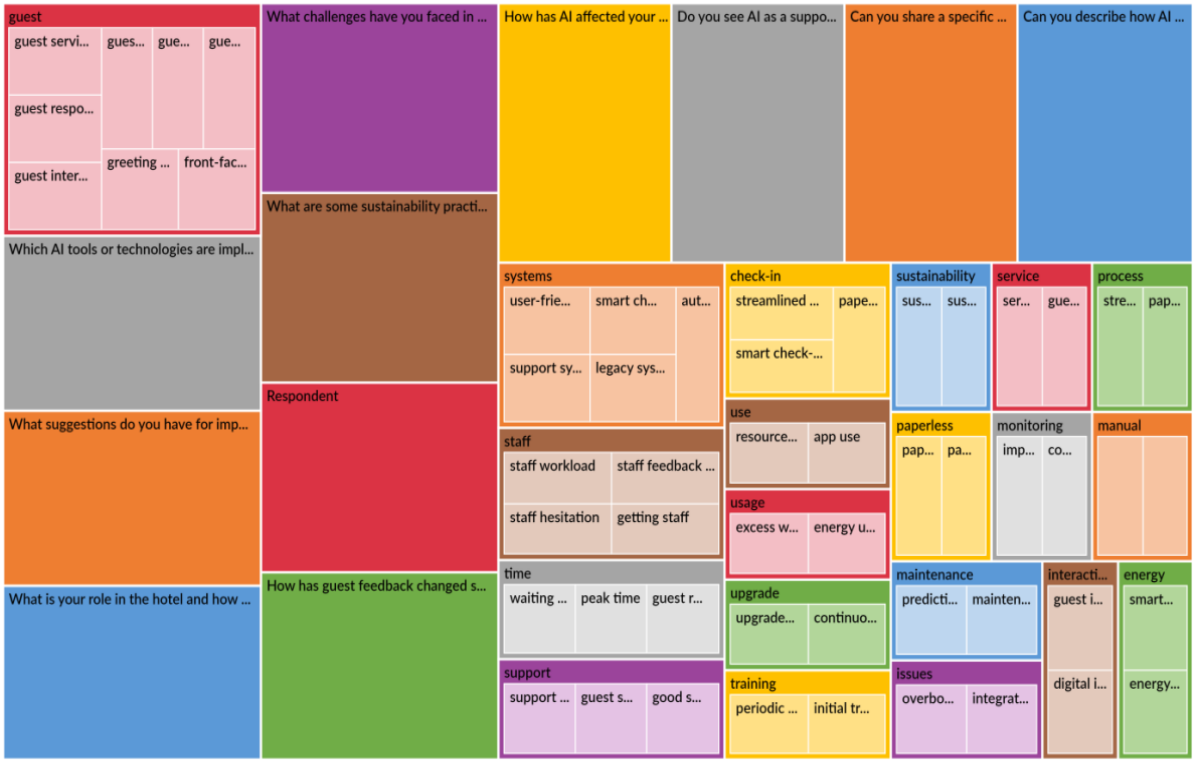

Figure 2: Tree Map Displaying Coding References by NVivo 15

Based on Figure 2, Guest-Related Themes showed the largest, followed by the sub-nodes: Guest service, Guest response time, Guest interaction, Greeting guests, and Front-facing roles. The prominence of this node indicates that enhancing guest service through AI was the most discussed topic among hotel staff. It supports the theme "Human-Centric Service Augmentation," where AI tools like chatbots handle basic queries, freeing staff to focus on personalized interactions—core to the Industry 5.0 goal of preserving human empathy.

Next is the Challenges in Adapting to AI (Purple Block), which includes the sub-nodes: Initial resistance, Training gaps, and Technical difficulties. This theme reflects the human barriers to AI adoption, such as fear of job displacement, discomfort with new systems, or lack of technical training. It directly ties into your sub-theme, "Perceptions and Attitudes Towards AI," and highlights an important aspect of resilience: how employees adapt during technological transitions.

The AI Impact on Daily Work (Yellow Block) consists of the following sub-nodes. For the Systems, the focus is on user-friendly dashboards, legacy systems, and automation. For the staff, the workload, feedback, and hesitation. For now, it is peak management and reduced waiting. This theme aligns with the focus on Operational Resilience. AI systems are streamlining backend processes, reducing repetitive tasks, and improving workflow efficiency. Staff reported having more time for emotional labor, which is consistent with your findings on service quality enhancement.

The Sustainability Practices (Brown Block) are made up of the sub-nodes paperless systems, smart energy use, and resource allocation. This block supports your theme of Sustainability through Intelligent Systems. It demonstrates how AI is helping ITC Hotels reduce their environmental footprint through smart thermostats, automatic lighting systems, and eco dashboards.

For the Check-In & Automation (Yellow-Gold Block), the sub-nodes include smart check-in and streamlined, paperless entry. This highlights front-end AI implementation, such as digital kiosks and mobile check-ins. These practices enhance guest convenience and free up staff, aligning with both guest personalization and operational efficiency.

The Support Systems and Training (Purple & Orange-Grey Blocks) are composed of the sub-nodes for staff support, periodic training, and technical upgrades. The visual underscores the importance of training and technical support for successful AI integration. As your study notes indicate, AI does not eliminate the need for humans—it requires upskilling and cultural adaptation.

The Word Frequency

The Tree Map in Figure 3 visually captures the most commonly referenced terms from the qualitative dataset of interviews, documents, and field observations on AI-human collaboration in Welcome Hotels by ITC.

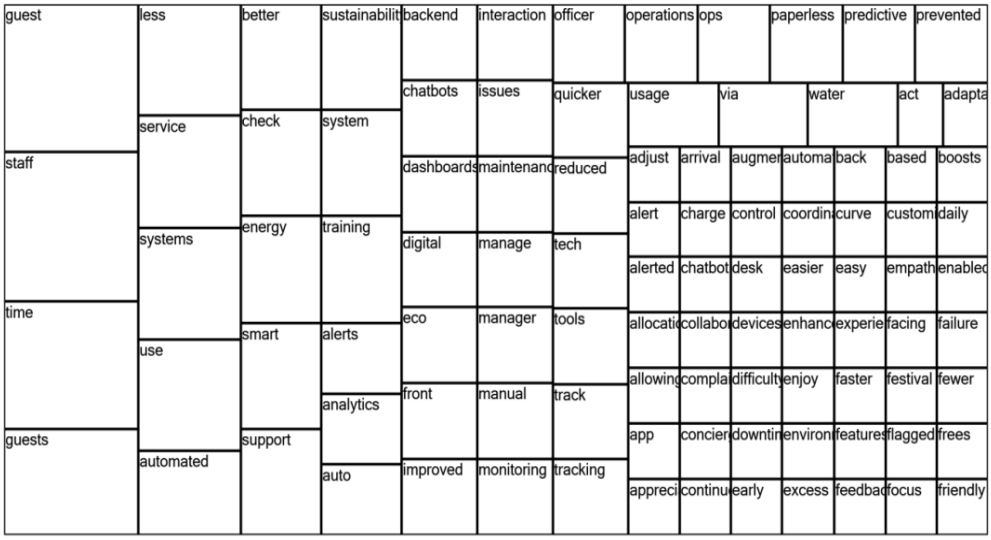

Figure 3: Word Frequency Tree Map by NVivo 15

Larger blocks indicate higher word frequency, highlighting the dominant themes in participant narratives. The term "guest" appears most prominently, emphasizing that enhancing guest service and experience remains central to AI implementation in the hospitality sector. Closely associated terms such as "service," "check," "interaction," and "feedback" underscore the importance of human-centric service augmentation, in which AI tools like chatbots and automated check-ins help staff deliver more personalized and empathetic service. Another key cluster revolves around "staff," "support," "training," and "dashboards," reflecting the adaptation challenges, up-skilling needs, and system support required for effective AI integration—core concerns aligned with Industry 5.0's emphasis on human empowerment. Terms like "alerts," "downtime," "tracking," and "quicker" underscore the operational resilience enabled by predictive maintenance and real-time monitoring tools. Furthermore, sustainability emerges as a vital concern, with frequent references to "eco," "energy," "paperless," and "water" that illustrate the environmental benefits of AI-enabled smart systems.

The presence of words like "empathy," "enjoy," and "experience" reveals that, despite technological augmentation, emotional engagement and guest satisfaction remain crucial, echoing Industry 5.0's vision of balancing intelligent automation with human value creation. This tree map visually reinforces the study's key thematic pillars: guest personalization, operational efficiency, environmental sustainability, and workforce empowerment.

Project Map

To enhance the rigor and transparency of the qualitative analysis, a project map was generated using NVivo 15 to visually represent the interconnections between codes, themes, and interview questions. This project map (Figure 4 below) offers a network-based visualization that captures the relational density of the most salient constructs derived from the data, based on co-occurrence and linkage across sources.

At the core of the project map are highly interconnected nodes representing key analytical categories, including guest experience, staff workload, AI tools and technologies, operational challenge*s*, and perceptions of AI-human collaboration. The visualization indicates that participants' discussions were not isolated but instead revealed strong thematic convergence. For instance, responses coded under smart check-in systems, chatbot assistance, and predictive maintenance were frequently linked to themes of guest satisfaction, improved response times, and staff empowerment. This evidences a central tenet of Industry 5.0—technological augmentation that complements human-centric service delivery.

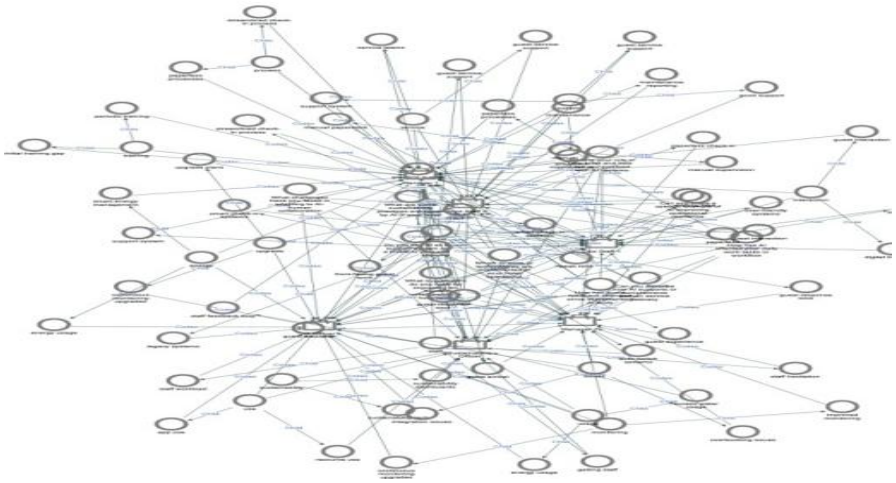

Figure 4: Project Map Visualization of Thematic and Coded Relationships by NVivo 15

The project map further demonstrates how the theme of sustainability through intelligent systems is relationally tied to codes such as paperless operations*,* energy optimization*, and* waste reduction*.* These environmental initiatives emerged not as stand-alone efforts but as strategically embedded within the AI-enabled operational workflows. Similarly, human resource-related nodes such as *training, hesitation,* and *adaptability* formed a cluster around *AI support systems* and *legacy integration issues*, highlighting how the transition to AI in hospitality settings requires both technological upgrades and workforce re-skilling.

The dense interconnectivity among the central nodes of the project map confirms the findings of the thematic analysis: AI integration in Welcome Hotels by ITC operates through a multidimensional framework that combines digital transformation with human-centric innovation. This visualization not only validates the thematic coding structure but also illustrates the systemic interdependence between resilience, sustainability, and human-AI collaboration—core constructs of Industry 5.0.

This case study advances understanding of AI-human collaboration in the hospitality sector by situating it within the evolving Industry 5.0 framework. While prior research often highlights automation and efficiency as the primary benefits of AI (Tussyadiah, 2020; Ivanov & Webster, 2019), this study highlights an emerging shift towards co-intelligent systems that enhance human empathy, strategic resilience, and sustainability—especially in high-touch service contexts such as luxury hotels.

Unlike the general literature, this study delves into the unique operational culture of Welcome Hotels by ITC, where AI is not imposed uniformly but is adapted locally to match guest profiles, property size, and staff capabilities. For instance, participants noted that predictive systems were more robust in urban properties. At the same time, human touch was prioritized in leisure destinations, showing a nuanced application of technology that reflects the brand's hybrid service strategy.

Importantly, the findings expose under-discussed tensions in AI adoption. Staff reported initial skepticism, particularly regarding data privacy and fears of being replaced—concerns that echo broader ethical debates in AI implementation (Wirtz et al., 2018). These anxieties were mediated not only through formal training but also through peer-led support systems and real-time problem-solving sessions, suggesting that organizational culture plays a vital role in AI-human integration—a theme underexplored in current research. As illustrated in Appendix 2, each research objective corresponds to a theme in the findings, ensuring coherence between the study's aims and its analytical outcomes.

Furthermore, this study contributes original insight by demonstrating how AI can foster emergent sustainability behaviours. For example, staff began proactively adjusting operational settings (such as HVAC timing and resource allocation) after receiving real-time feedback from AI dashboards, indicating a shift from compliance to agency in sustainable practices.

This layered interpretation moves beyond the dichotomy of AI as either a threat or a savior. Instead, the case illustrates a spectrum of adaptive interactions, where success depends on organizational readiness, emotional

labour, and cultural receptivity. This complexity is often lost in overly deterministic narratives of technological progress, thereby enriching our understanding of AI in service-driven sectors.

Lastly, by using a thematic framework grounded in participant experience, rather than imposing theoretical categories upfront, this research embraces an inductive orientation while still aligning with Industry 5.0 goals. It shows how frameworks must remain flexible to capture local innovation and adaptation, especially in an industry as diverse as hospitality.

In summary, Table 3 illustrates how the research objectives are mapped to emergent themes.

Table 3: Mapping of Research Objectives to Emergent Themes

SL No	Research Objective	Corresponding Theme(s)	Supporting NVivo Node(s)
1	Objective 1: To assess how AI tools influence operational efficiency and service personalization.	Operational Resilience through AI Collaboration	Predictive Maintenance, Smart Check-ins
		Human-Centric Service Augmentation	AI Support in Repetitive Tasks, Guest Engagement
2	Objective 2: To explore how AI-human collaboration aligns with Industry 5.0's resilience and sustainability goals.	All three major themes	All nodes contribute collectively to this objective
3	Objective 3: To analyze staff perceptions, challenges, and adaptability in adopting AI systems.	Human-Centric Service Augmentation	Emotional Labour, Fear of Replacement, Training Gaps
4	Objective 4: To evaluate the role of AI in environmental sustainability practices.	Sustainability through Intelligent Systems	Smart Climate Control, Waste Reduction, Eco-Friendly Practices
5	Objective 5: To derive strategic recommendations for optimizing AI-human synergy in hotels.	Synthesized from all three themes	Cross-analysis of node intersections in the project map and the word cloud

CONCLUSION

This research provides empirical evidence that AI-human collaboration in Welcome Hotels by ITC exemplifies the transformative potential of Industry 5.0 in the hospitality sector. By integrating intelligent systems with human intuition and empathy, the hotel chain has successfully navigated the dual objectives of operational efficiency and personalized service. The thematic analysis revealed three interconnected pillars—operational resilience, human-centric service augmentation, and sustainability through intelligent systems—through which AI is leveraged not only for functional gains but for strategic excellence.

The study advances theoretical understanding by repositioning AI not as a disruptive force, but as a co-creative agent that amplifies human capacity. It contributes to the literature by emphasizing that digital transformation in hospitality can coexist with the core values of emotional intelligence, guest engagement, and environmental responsibility. From a practical perspective, the findings offer a replicable framework for hotel operators seeking to embrace AI without undermining the human touch. The incorporation of staff perceptions into the analysis also provides valuable insight into change management and training strategies that can mitigate resistance and foster acceptance.

Future research should explore cross-cultural variations in AI adoption and examine longitudinal impacts on workforce roles, guest loyalty, and ESG (Environmental, Social, Governance) metrics. Quantitative studies assessing return on AI investments and hybrid performance indicators would also complement the qualitative insights provided herein. As the hospitality sector continues to evolve, the balanced integration of AI and human elements will remain pivotal in shaping sustainable, resilient, and guest-centric futures.

This study advances scholarly understanding by demonstrating how AI-human collaboration operates not only as a functional upgrade but as a transformative force aligned with Industry 5.0 values. It bridges the gap between automation narratives and human-centric innovation, offering a contextualized model for strategic AI deployment in hospitality.

LIMITATION OF STUDY

Despite its rich insights, the study is limited by its single-case design, which restricts generalizability. The findings are context-specific to Welcome Hotels by ITC and may not fully apply to budget or international hotel chains. The qualitative nature also relies on subjective interpretations, despite methodological rigor. Future research could adopt comparative or longitudinal designs to validate and extend the insights across different hospitality contexts.

IMPLICATION OF THE STUDY

The findings of this study carry significant implications for both academic research and hospitality industry practice, especially in the context of integrating artificial intelligence with human capabilities to achieve Industry 5.0 objectives. From a theoretical standpoint, this research contributes to the emerging discourse on human-AI collaboration by providing an empirically grounded case of how co-intelligent systems function within a luxury hotel setting. It shifts the narrative from technology-driven automation toward a more balanced, human-centric approach that values empathy, adaptability, and sustainability alongside efficiency. The study also expands the scope of Industry 5.0 research by contextualizing it within the hospitality domain, a sector that has traditionally been underrepresented in Industry 5.0 literature. By aligning thematic findings with the core principles of Industry 5.0—resilience, sustainability, and human-centric innovation—the study offers a conceptual model that can inform future interdisciplinary research across service sectors.

From a practical perspective, the study offers actionable insights for hotel operators, policymakers, and technology vendors. For hospitality managers, the findings demonstrate how AI can be strategically implemented to support staff, rather than replace them, thereby improving service quality while maintaining the essential human touch that guests expect. The case of Welcome Hotels by ITC provides a replicable model for other hotel chains aiming to implement intelligent systems without compromising personalized service. For technology developers, the study underscores the need to design AI solutions that are user-friendly, culturally adaptive, and supportive of employee workflows rather than disruptive. Policymakers and industry regulators can also draw from these insights to shape guidelines that encourage ethical AI adoption, workforce upskilling, and sustainable innovation across the hospitality sector.

Overall, the study reaffirms that the future of hospitality lies not in choosing between humans and machines, but in fostering meaningful collaboration between them to build resilient, sustainable, and guest-centric hotel experiences.

RECOMMENDATIONS TO THE STUDY

This study's findings underscore the transformative potential of AI-human collaboration in advancing Industry 5.0 objectives in the hospitality sector. To fully harness these benefits, several strategic recommendations are proposed. First, hospitality organizations should develop structured frameworks for AI-human integration that clearly delineate roles, responsibilities, and interaction points between intelligent systems and human staff. Rather than viewing AI as a replacement for human labour, hotel management should adopt a co-intelligence model where AI handles repetitive, analytical, or routine tasks—such as check-ins, energy monitoring, and data processing—while human employees focus on emotional intelligence, guest engagement, and service personalization. Such frameworks must ensure that AI complements, rather than overrides, human judgment and hospitality values.

Second, the importance of continuous staff training and up-skilling cannot be overstated. As AI technologies evolve, hotel staff must be equipped with relevant competencies in AI literacy, digital interfaces, data interpretation, and decision-making in AI-supported environments. Training modules should also address emotional intelligence and adaptability, helping staff transition confidently into hybrid roles. This not only enhances efficiency but also reduces resistance to technological change and fosters a culture of innovation.

Third, AI systems should be leveraged more extensively to deepen guest-centric personalization. Hotels can use AI to analyze guest preferences, behaviour, and feedback in real time to deliver tailored recommendations, personalized room settings, and curated dining and activity options. However, this must be approached with cultural sensitivity and privacy considerations, ensuring that AI-enhanced experiences feel intuitive rather than intrusive.

Fourth, environmental sustainability efforts should be directly integrated with AI capabilities. Innovative systems that control HVAC, lighting, water use, and waste disposal should be embedded in daily operations and linked to dashboards that provide actionable insights to staff. These tools can guide real-time decision-making, minimize

environmental footprints, and promote resource optimization. In turn, this helps hotels meet both sustainability benchmarks and cost-efficiency targets.

Fifth, as AI becomes more prevalent in frontline operations, it is essential to establish ethical oversight mechanisms. Hotels must address concerns such as algorithmic bias, data privacy, transparency in AI decisions, and potential deskilling of human employees. This can be achieved through regular ethical audits, anonymized data-handling policies, and clear communication with both guests and employees about the use of AI systems. Sixth, the successful implementation model seen in Welcome Hotels by ITC should be scaled across other properties and hotel chains.

However, such replication must account for local operational, technological, and cultural contexts to ensure relevance and effectiveness. Tailoring AI-human collaboration strategies to specific hotel segments—such as urban business hotels versus leisure resorts—can help maintain consistency in guest experience while maximizing the benefits of AI integration. Finally, cross-functional collaboration among hotel departments, technology vendors, and academic researchers should be encouraged to co-develop future-ready AI tools and frameworks tailored for hospitality. Collectively, these recommendations provide a robust foundation for advancing AI-human collaboration that is ethically grounded, strategically aligned, and deeply responsive to the evolving demands of Industry 5.0 in hospitality.

AUTHOR CONTRIBUTION

P.A: Conceptualization, Literature Review, Research Design, Data Collection, Data Analysis, NVivo Coding, Interpretation of Findings, Writing – Original Draft, and Visualization.
S.S.M: Supervision, Methodological Guidance, Validation of Results, Critical Review, Writing – Review & Editing, and Final Approval of the Manuscript.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this paper. The research was conducted independently, and no financial, commercial, or personal relationships influenced the study design, data collection, analysis, or interpretation of the results.

DECLARATION STATEMENT

The authors declare that this manuscript is an original work and has not been published previously, nor is it under consideration for publication elsewhere. All data used in the study were collected ethically and responsibly. The authors have read and approved the final version of the manuscript and agree to its submission to the journal. There are no conflicts of interest, and all sources of support have been acknowledged.

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ANNEXURE 1: Codebook

Industry 5.0

Codes

Name	Files	References
AI operation in Hotel Operations	1	49
Chat Bots and Digital Concierge	1	4
Predictive Maintenance	1	18
Smart Check ins	1	6
Human Centric service augmentation	1	27
AI support in repetitive task	1	16
Emotional labour	1	15
Enhanced guest engagement	1	17
operational resilience through Ai	1	56
Downtime reduction	1	15
Proactive problem management	1	17
Workflow optimization	1	21

Name	Files	References
Perception and attitude towards AI	1	15
collaboration of culture	1	9
fear of replacement	1	5
Positive attitudes	1	28
Sustainability through intelligent systems	1	8
ECOFRIENDLY PRACTICES	1	10
ENERGY OPTIMIZATION	1	8
WASTE REDUCTION	1	6