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Impact of Robotics, Artificial Intelligence, and Service Automation on the Hospitality Industry

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Abstract: *The integration of robotics, artificial intelligence (AI), and service automation in the hospitality industry has transformed service delivery, operational efficiency, and customer experiences. However, this shift has raised concerns about job displacement, ethical challenges, and the potential loss of the human touch central to hospitality. This study employs an exploratory design of study to examine the impact of the technological advancement, focusing the following objectives - balancing technological efficiency with human interaction, addressing job displacement through workforce upskilling, and evaluating ethical and socio-economic implications.*

Quantitative data was collected through structured surveys of 231 respondents, including customers, employees, and managers, to assess perceptions, satisfaction, and workforce dynamics. Qualitative insights were gathered from an in-depth study of 20 research papers. Data analysis included descriptive statistics for quantitative data and correlation and regression analysis of the qualitative data.

The findings highlighted that while robotics and AI enhance operational efficiency and customer satisfaction, there is a strong preference for human interaction in emotionally charged or complex scenarios. The study identified strategies for balancing technology with the human touch, such as hybrid service models. It also highlights the need for targeting upskilling programs to diminish job displacement and create new opportunities in an automated landscape. This research contributes to the discourse on the future of hospitality by providing evidence-based insights for practitioners, policymakers, and academics. It emphasizes the importance of a balanced approach to automation, ensuring technological advancements enhance, rather than diminish, the core values of hospitality. By addressing the trade-offs between efficiency and human interaction, proposing workforce transformation strategies, and evaluating ethical implications, this study offers a comprehensive roadmap for navigating the challenges and opportunities of automation in the hospitality industry.

Keywords -- *Hospitality Automation, Human-Robot Interaction, Workforce Upskilling, Customer Experience, Human Touch*

I. INTRODUCTION

The hospitality industry, a cornerstone of the global economy, has undergone significant transformations over the past few decades. The advent of robotics, artificial intelligence (AI), and service automation has revolutionized the way services are delivered, experienced, and managed within this sector.

These technologies have not only enhanced operational efficiency but have also redefined customer experiences, setting new benchmarks for service quality and personalization. The integration of robotics and AI in hospitality has led to the emergence of smart hotels, automated check-ins, AI-driven customer service, and robotic concierges, among other innovations (Belanche et al., 2020; Ivanov et al., 2020; Tung & Au, 2018; Murphy et al., 2019; Seyitoğlu & Ivanov, 2020; Wirtz et al., 2018; Tussyadiah, 2020; Pillai & Sivathanu, 2020; Choi et al., 2020; Tuomi et al., 2021).

However, the rapid adoption of these technologies has also raised concerns about job displacement, ethical considerations, and the

potential loss of the human touch that is often considered integral to hospitality (Ivanov & Webster, 2019; Seyitoğlu & Ivanov, 2020; Murphy et al., 2019; Kuo et al., 2017; Lu et al., 2020; Huang & Rust, 2021; Li et al., 2019).

The hospitality industry is inherently service-oriented, relying heavily on human interaction to deliver personalized experiences. However, the increasing demand for efficiency, cost reduction, and enhanced customer satisfaction has driven the adoption of advanced technologies. Robotics, AI, and service automation offer the potential to streamline operations, reduce labor costs, and provide consistent service quality. For instance, robotic room service and AI-powered chatbots have become increasingly common in hotels, offering guests 24/7 assistance without the need for human intervention (Tussyadiah & Park, 2018; Lu et al., 2020; Kuo et al., 2017; Bowen & Morosan, 2018; Gretzel et al., 2019; Huang & Rust, 2021; Li et al., 2019; Park et al., 2017). These technologies are not only transforming the operational landscape but are also reshaping the competitive dynamics of the industry, as hotels and restaurants strive to differentiate

themselves through technological innovation (Buhalis & Sinarta, 2019; Murphy et al., 2019; Gretzel et al., 2019; Ivanov et al., 2020; Belanche et al., 2020; Wirtz et al., 2018; Tussyadiah, 2020). Despite the numerous benefits, the integration of robotics and AI in hospitality is not without its challenges. One of the most pressing concerns is the potential for job displacement, as automation could render certain roles obsolete. This has significant implications for the workforce, particularly in regions where hospitality is a major employer (Bowen & Morosan, 2018; Kuo et al., 2017; Ivanov et al., 2020; Tung & Au, 2018; Seyitoğlu & Ivanov, 2020; Tuomi et al., 2021; Choi et al., 2020).

Additionally, there are ethical considerations surrounding data privacy and security, as AI systems often rely on vast amounts of personal data to function effectively (Buhalis & Sinarta, 2019; Gretzel et al., 2019; Lu et al., 2020; Ivanov & Webster, 2019; Tussyadiah & Park, 2018; Huang & Rust, 2021; Li et al., 2019). Furthermore, the reliance on technology could potentially erode the human element that is central to hospitality, leading to a more impersonal service experience (Seyitoğlu & Ivanov, 2020; Tung & Au, 2018; Belanche et al., 2020; Murphy et al., 2019; Kuo et al., 2017; Pillai & Sivathanu, 2020).

This paper seeks to provide a comprehensive analysis of the impact of robotics, AI, and service automation on the hospitality industry. By examining the current state of technology adoption, identifying key trends, and exploring the implications for various stakeholders, this study aims to contribute to the ongoing discourse on the future of hospitality.

The findings of this research will be valuable for industry practitioners, policymakers, and academics, offering insights into how the hospitality sector can navigate the challenges and opportunities presented by these transformative technologies (Ivanov & Webster, 2019; Tussyadiah & Park, 2018; Gretzel et al., 2019; Belanche et al., 2020; Lu et al., 2020; Wirtz et al., 2018; Huang & Rust, 2021).

II. LITERATURE REVIEW: -

The integration of robotics, AI, and service automation in the hospitality industry has been the subject of extensive research in recent years. Scholars have explored various aspects of this phenomenon, including its impact on operational efficiency, customer satisfaction, and workforce dynamics.

This literature review synthesizes the findings of key studies, providing a foundation for the current research. **Operational Efficiency and Cost Reduction:** One of the most widely discussed benefits of robotics and AI in hospitality is their potential to enhance operational efficiency and reduce costs. According to Ivanov and Webster (2019), the use of robots in hotels can significantly reduce labour costs, particularly in repetitive and time-consuming tasks such as room cleaning and luggage handling. Similarly, AI-powered systems can optimize inventory management, pricing strategies, and resource allocation, leading to improved profitability (Buhalis & Sinarta, 2019; Belanche et al., 2020; Ivanov et al., 2020; Tung & Au, 2018; Murphy et al., 2019; Wirtz et al., 2018; Tussyadiah, 2020). These technologies also enable real-time data analysis, allowing businesses to make informed decisions and respond quickly to changing market conditions (Tussyadiah & Park, 2018; Lu et al., 2020; Gretzel et al., 2019; Bowen & Morosan, 2018; Kuo et al., 2017; Huang & Rust, 2021; Li et al., 2019). For example, AI-driven revenue management systems have

been shown to increase revenue by up to 10% in some cases (Ivanov et al., 2020; Bowen & Morosan, 2018; Seyitoğlu & Ivanov, 2020). **Customer Experience and Personalization:** The role of AI and robotics in enhancing customer experience has been a focal point of research.

AI-driven chatbots and virtual assistants, for instance, have been shown to improve customer satisfaction by providing instant, personalized responses to inquiries (Lu et al., 2020; Belanche et al., 2020; Tung & Au, 2018; Murphy et al., 2019; Kuo et al., 2017; Park et al., 2017; Pillai & Sivathanu, 2020). Additionally, the use of robots in customer-facing roles, such as concierge services, has been found to create a unique and memorable experience for guests (Murphy et al., 2019; Tung & Au, 2018; Kuo et al., 2017; Ivanov & Webster, 2019; Seyitoğlu & Ivanov, 2020; Choi et al., 2020; Tuomi et al., 2021).

However, some studies have raised concerns about the potential loss of the human touch, with guests expressing a preference for human interaction in certain situations (Kuo et al., 2017; Seyitoğlu & Ivanov, 2020; Belanche et al., 2020; Lu et al., 2020; Tussyadiah & Park, 2018; Huang & Rust, 2021; Li et al., 2019). For example, a study by Tung and Au (2018) found that while guests appreciated the efficiency of robotic services, they still valued human interaction for complex or emotionally charged situations. **Workforce Implications:**

The impact of automation on the hospitality workforce has been a contentious issue. While some researchers argue that robotics and AI will lead to job displacement, others suggest that these technologies will create new opportunities for upskilling and role transformation (Ivanov & Webster, 2019; Bowen & Morosan, 2018; Murphy et al., 2019; Kuo et al., 2017; Gretzel et al., 2019; Tuomi et al., 2021; Choi et al., 2020). For example, the adoption of AI in hospitality has led to the emergence of new roles such as AI trainers and data analysts, which require specialized skills (Buhalis & Sinarta, 2019; Gretzel et al., 2019; Ivanov et al., 2020; Tung & Au, 2018; Seyitoğlu & Ivanov, 2020; Huang & Rust, 2021; Li et al., 2019). However, there is also evidence to suggest that low-skilled workers are particularly vulnerable to job loss, highlighting the need for targeted training and support programs (Murphy et al., 2019; Kuo et al., 2017; Bowen & Morosan, 2018; Lu et al., 2020; Belanche et al., 2020; Tuomi et al., 2021; Choi et al., 2020). A study by Bowen and Morosan (2018) emphasized the importance of reskilling programs to help workers transition to new roles created by automation. **Ethical and Social Considerations:** The ethical implications of AI and robotics in hospitality have also been explored in the literature. Issues such as data privacy, algorithmic bias, and the potential for surveillance have raised concerns among researchers and practitioners alike (Lu et al., 2020; Gretzel et al., 2019; Seyitoğlu & Ivanov, 2020; Ivanov & Webster, 2019; Tussyadiah & Park, 2018; Huang & Rust, 2021; Li et al., 2019). Additionally, the social impact of automation, particularly in terms of income inequality and job security, has been a topic of debate (Kuo et al., 2017; Seyitoğlu & Ivanov, 2020; Ivanov & Webster, 2019; Murphy et al., 2019; Belanche et al., 2020; Tuomi et al., 2021; Choi et al., 2020).

These concerns underscore the importance of developing ethical guidelines and regulatory frameworks to govern the use of AI and robotics in the hospitality industry (Tussyadiah & Park, 2018; Ivanov & Webster, 2019; Gretzel et al., 2019; Lu et al., 2020; Bowen &

Morosan, 2018; Huang & Rust, 2021; Li et al., 2019). For instance, Gretzel et al. (2019) proposed a framework for ethical AI use in tourism and hospitality, emphasizing transparency, accountability, and fairness.

1. RESEARCH GAP

Hospitality industry is a fast-evolving sector mainly influenced by the incorporation of AI, robotics, and service automation. Since the incorporation major studies have focused on efficiency and innovation, and almost no light is shed on the unanswered important question that are: -

- How will these technologies shape the future of the hospitality workforce?
- What are the feelings of the vivid cultured customer base on interacting with machines?
- What ethical safeguards are in place to protect privacy and maintain the personal touch that is the whole basis for great hospitality?

These form the gaps in the study and areas requiring critical focus and explorations to help offer insights benefiting the industry move forward responsibly and thoughtfully.

2.OBJECTIVES

The objectives for this research are: -

- To assess the impact of robotics and AI on workforce sustainability in the hospitality industry.
- To examine customer acceptance of RAISA technologies across different cultures.
- To explore ethical challenges related to data privacy and human-centered service in hospitality automation.

3.RESEARCH METHODOLOGY

The study adopts a quantitative and exploratory approach, The data set for the research combines quantitative data and qualitative study of previous researches to gain a comprehensive understanding of the impact of robotics, AI, and service automation (RAISA) in the hospitality industry. The secondary data collection was done by sequential study of 20 research papers encompassing the concept of RAISA in the hospitality sector and various advantages and implications in the incorporation and use of robotics, AI, and service automation. The primary data was collected using a structured questionnaire formulated keeping in view the objectives of the research. A survey-based exploratory research design was used to gather numerical data on workforce impacts, customer acceptance, and ethical concerns related to RAISA technologies. The questionnaire had 21 questions and was filled by 231 respondents in respect to the 250 responses targeted. The sampling technique used is stratified random sampling. This sampling technique was taken into use keeping in mind that India is a country of diverse cultures and in a local population, a structured sampling technique becomes ineffective. The collected data was then analysed using MS-Excel. Descriptive statistics was created from the collected data and then correlation and regression analysis were done to formulate the outcomes to support the objectives. The data findings were then used to form insightful conclusions that will be helpful to the Indian hospitality sector.

4.DATA ANALYSIS FINDINGS & DISCUSSIONS

The data was summarized using MS Excel, firstly the data was coded and prepared for analysis then summary statics was done from the coded data followed by correlation and regression analysis of the data. The code book and heat map generated from the correlation analysis and the final regression analysis model have been added at the last. The findings are:

Summary Statics

- **Employment Impact & Workforce Adaptation:** - The analysed data showed a strong belief for AI and automation limiting the employment options with a mean of 4.25 and skewedness towards agreement. Whereas, AI being the driving force for creating new jobs in the Indian hospitality sector had mixed opinions with a mean of 1.40. A strong mean of 1.31 for incorporation of AI in the sector necessitating the need for AI training in the hotel industry highlighted a majorly unanimous agreement.
- **Customer Interaction & Experience:** - The data set on analysis displayed a strong belief for AI improving the guest experience and AI-driven hospitality services being highly comfortable with a mean of 1.39 and 4.44 respectively. Preference for personalized service with human interaction or automated services had mixed inputs.
- **Ethical & Privacy Concerns:** - The respondents showed worries in respect to the ethical considerations of AI with need for transparency on data collection and data privacy having a mean of 4.54 and 1.27. Displaying that overall satisfaction with AI in hospitality sector of India is positive but the ethical constraints are still significant.
- **Cultural & Regulatory Considerations:** - The collected data showed acceptance of AI being influenced by the cultural vividness with a mean of 1.34 displaying that the adoption to AI is highly deterred by population and geography. The support for strict AI laws was significant with a mean of 2.22. The influence of AI on workforce sustainability and employment was also recognized by the respondents with a high mean of 4.52.

Correlation Analysis: -

- **AI's Impact on Employment & Job Security:** - The data on correlation analysis highlighted the doubtful opinions of the respondents on AI's job creating ability indicated by the weak yet substantial negative correlation (-0.42) between AI decreasing job prospects and AI producing new jobs. Whereas, the data also showed the concerns about job displacement with weak negative correlation (-0.37) between the influence of AI on employment and the perception of roles at risk in the Indian hospitality sector.
- **Training & AI Adaptation:** - The dataset showed a generalized perception of training enhancing the service quality and delivery highlighted by the significantly moderate positive correlation (0.73) between necessity for AI training and AI – enhance customer experience. Also, the strong positive correlation (0.84) between AI training and privacy concerns depicts that education on AI can help shape the ethical perspectives.
- **Customer Experience & Service Preferences:** - The acceptance of

AI based services does not eliminate the concerns of job displacement and employment anxieties as Comfort with AI services moderately correlates with job loss concerns (0.48) also supported by the negative correlation of -0.41 for preferring human touch and personalization over AI based services in the Indian hospitality sector.

- Ethical & Regulatory Considerations: - Support for stronger AI rules is strongly correlated with transparency in AI data collecting (0.80), emphasizing a need for more transparent governance. Ethical concerns and privacy risks negatively correlate with overall satisfaction (-0.62 & -0.66), highlighting the need for responsible AI implementation.

Regression Analysis: -

- Impact of Robotics and AI on Workforce Sustainability: - Employment losses are somewhat contributed by AI integration, owing to a small positive association ($R = 0.44$, $R^2 = 0.20$, $p = 1.3E-12$), although it is not the main or the only contributor, other outside factors are also at play. AI-related job risks are not perceived to be very important, supported by the weak negative correlation ($R = -0.35$, $R^2 = 0.12$, $p = 3.4E-08$). Increased AI incorporation tends to lowers the perceived need for training of the hospitality staff in respect to AI, indicating resistance to change, showed by a moderately negative correlation ($R = -0.59$, $R^2 = 0.35$, $p = 5.1E-23$). The low p-values confirm that these relationships are statistically significant. This highlights that, although AI integration shows a weak link to job reduction but employment can be sustained by workforce upskilling.
- Customer Acceptance of RAISA Technologies Across Different Cultures: - A substantial positive connection ($R = 0.83$, $R^2 = 0.69$, $p = 1.2E-60$) shows how cultural characteristics highly influence how people view AI's potential to improve customer service. Though the effect is varied, but the moderately positive correlation ($R = 0.72$, $R^2 = 0.51$, $p = 8.1E-38$) indicates that people from different cultures have a mixed mindset but mostly prefer human interaction over AI-driven services. Cultural differences significantly influence privacy issues, making the adoption of AI difficult in some areas, highlighted by a substantial positive association ($R = 0.81$, $R^2 = 0.66$, $p = 2.4E-55$). These associations are confirmed to be very statistically significant by the incredibly low p-values. Cultural differences strongly influence AI's perceived customer experience, staff preference, and data privacy concerns.
- Ethical Challenges Related to Data Privacy and Human-centred Service: - Demand for transparency in AI data gathering appears to be rising in relation to ethical concerns, showcased by somewhat positive correlation ($R = 0.66$, $R^2 = 0.44$, $p = 1.5E-30$). Stronger concerns about the privacy of personal data are correlated with higher ethical concerns, as indicated by the moderately negative association ($R = -0.66$, $R^2 = 0.43$, $p = 3.9E-30$), suggesting problems with AI service ability to be trusted. The moderately positive connection ($R = 0.66$, $R^2 = 0.44$, $p = 1.2E-30$) suggests that people who are concerned about moral AI activities are also favour of more stringent AI laws. These relations have high statistical significance supported by the extremely low p-values. Transparency in use of AI data will help

reduces concerns, but privacy risks drive demand for stricter regulations. Ethical concerns highlight the need for clearer legal frameworks to address AI's impact on jobs and privacy.

General Discussions: -

- The integration of AI and robotics in the hotel sector offers both advantages and disadvantages, impacting labour sustainability, ethical concerns, and customer acceptability. Even while automation increases the likelihood of job losses, cultural differences affect how AI is accepted; some individuals still prefer human interaction even when AI increases service efficiency.
- Ethical considerations, particularly those pertaining to data protection and transparency, underscore the necessity of implementing AI responsibly. These issues need to be resolved by staff training, clear regulations, and regulatory measures if AI adoption in the hospitality sector is to be morally and sustainably done.

III.CONCLUSION

The following conclusions were drawn from the data analysis and discussions on the dataset collected and the study of 20 previous researches. The conclusions are: -

- **Workforce Sustainability:**
- The data analysis shows that serious concerns have been raised about job displacement as a result of automation and AI integration, which is believed to limit employment opportunities in the Indian hospitality industry.
- Although opinions on AI-driven job creation vary, upskilling employees and providing AI training are essential for preserving jobs and improving service quality.
- Opposition to AI training underscores the necessity for proactive measures to ensure staff adaptation and automation success.
- **Customer Acceptance Across Cultures:**
- Despite the fact that AI enhances visitor experiences and service efficiency, cultural differences significantly influence acceptance of AI based service automation and robotics in the Indian hospitality industry as many customers still prefer in-person interactions.
- Adoption of AI-based hospitality services is influenced by demographic diversity and geographic disparities, which calls for specialized implementation strategies.
- Transparency in AI applications and regulatory oversight can improve acceptance from the customers and trust across the Indian cultural divides.

Ethical and Privacy Concerns:

- The ethical problems around AI-driven data collection of the customers, remains a major issue, emphasizing the need of transparency and customer confidence.
- The need for tighter legal frameworks and more severe AI governance is directly related to privacy concerns in the Indian hotel sector.
- It will be necessary to implement AI responsibly and in accordance with established ethical standards to ensure long-term adoption while protecting consumer rights and confidence.

General Conclusions for Indian Hospitality Sector's Future:

- Using AI in the Indian hospitality sector is a coin with one side being benefits and the other being drawbacks. Artificial intelligence (AI)-powered automation increases output and service quality, but ethical and employment concerns must be addressed through education and policy, to help move the AI services hand in hand with human touch in personalization.
- AI adoption is heavily influenced by cultural diversity, thus a one-size-fits-all approach won't work. The findings emphasize how important it is for the Indian hospitality sector organizations and influential personnels to have a comprehensive integration strategy that respects customer preferences while utilizing modern technologies like Ai, Robotics and Service Automation.
- The findings are beneficial to the Indian hospitality business as they clarify the influence of AI, robotics and service automation on ethical dilemma, workforce sustainability, and customer acceptability.
- The study offers suggestions that can be helpful for the Hospitality professionals and companies to develop AI-driven solutions that satisfy industrial needs in ethical and sustainable manner.

SUGGESTIONS FOR THE INDIAN HOSPITALITY SECTOR

Based on the data findings, discussion and conclusion the following suggestions can be made for the Indian hospitality sector: -

- Investment in upskilling the workforce for a broader outreach and acceptance of AI, robotics and service automation: - The Hospitality industry professionals can create training programs in AI and robotics to give workers in the hotel industry the skillset required to sustain their jobs and provide better services to the consumers.
- Implementation of hybrid service model and standard operating procedures for a better future: - Strategies can be developed to integrate human engagement with AI-driven automation to maintain a balance between efficiency and personalized visitor experiences satisfying a range of consumer preferences.
- Enhance Data Privacy and Security Measures: - Creating stronger cybersecurity standards and regulations by the government and different national and international level hospitality bodies and transparent AI data collecting guidelines to overcome the challenge of ethical worries and provide consumers with a trusted and safe experience.
- Create Culturally Adaptive AI Solutions: - Creating tailor-made AI services as per the service preferences and cultural expectations of various Indian demographic groups.
- Promote Industry Collaboration and Innovation: - To promote AI research, innovation, and responsible use in the industry, the Indian hospitality sector can cultivate bodies and formulate connections with the tech companies, hospitality enterprises, and academic institutions to simply and strengthen the incorporation of Ai, robotics, and service automation in the Indian hospitality sector.

IV.LIMITATIONS AND FUTURE SUGGESTIONS

Following are the limitations for this research the the scope and future suggestions for research papers working on bridging the gap between

the incorporation and use and ethical concerns over Ai, robotics, and service automation: -

Limitations: -

- The study primarily focuses on the Indian hospitality sector, limiting its applicability to other regions with different market dynamics.
- The research provides a short-term analysis, lacking longitudinal data to assess long-term AI adoption trends and impacts.
- The study does not extensively cover the financial implications of AI adoption for small and mid-sized hospitality businesses.
- The scope of ethical concerns is broad, requiring deeper exploration of specific AI-related ethical dilemmas within the sector.

Future suggestions for research

- Comparative analysis across different regions and cultures can be done to provide better feedback on the acceptance and adoption of AI by the diverse Indian population.
- Extended research can be conducted over time to provide a better understanding of AI's long-term influence on workforce sustainability and customer experience.
- Further research can work on the economic aspect of the incorporation of AI, robotics and service automation in the sector to check for the economic sustainability.

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