

Impact of Automation on Service Efficiency and Guest Satisfaction in the Hospitality Industry in Kerala

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Abstract - Digitalization of hospitality services and automation is one of the fast-growing trends of the services sector, but only limited research has focused on finding the relationship between automation and service efficiency/customer satisfaction in culturally inclined tourism destinations like Kerala. The current study examines the impact of automation on service efficiency and customer satisfaction in Budget, Mid-scale, and Luxury hotels in Kerala. A descriptive, quantitative research design has been employed, and the primary data were collected from 384 hotel guests through a structured questionnaire using a 5-point Likert scale, and data were analysed with the aid of SPSS 26 through linear regression, Pearson correlation, and one-way ANOVA. The regression results demonstrated that service efficiency is significant in explaining variation in customer satisfaction ($R = 0.672$, $R^2 = 0.452$, $F = 220.423$, $p < 0.001$), and automation ($\beta = 0.672$) is a positively affecting variable. The Pearson correlation shows that customer satisfaction has a strong positive association with automation experience ($r = 0.614$, $p < 0.01$). One-way ANOVA suggests a significant difference in customer satisfaction across hotel categories ($F=29.842$, $p < 0.001$), with luxury hotels having the highest mean ($M=35.61$), mid-scale hotels next ($M=31.92$), and budget hotels last ($M=28.45$). Automation positively impacts service efficiency and guest satisfaction. Still, it has to be implemented at a rate that complements the human element of services, without losing Kerala's traditional service values.

Keywords: Automation, Hospitality Industry, Service Efficiency, Guest Satisfaction, Digital Transformation, Hotel Service Management, Statistical Analysis

I. INTRODUCTION

The last 10 years have also witnessed significant upheaval in the hospitality industry, driven by innovation and integration of automation, artificial intelligence (AI), and digital technologies. Automation has become a strategic tool for enhancing operational efficiency, reducing service time, minimizing human error, and ensuring consistent service delivery. Automated check-in systems, chatbots with AI capabilities, robots that control rooms, and robots to handle services are increasingly being embraced to meet the emerging demands of the new generation of travellers. As Limna, (2023) points out, automation is no longer a luxury but a competitive necessity for industries that demand speed,

precision, and standardized service. On the same note, the introduction of Robotics, AI, and Service Automation (RAISA) models has contributed to the reliability in operations and management of service provision in hotels (Yan et al., 2025). Joseph, (2025a) described hybrid entrepreneurship, leading to economic and employment growth, which could stimulate innovation and automation for improving service efficiency and guest satisfaction in the hospitality industry in Kerala.

Automation in place goes a long way on the operational level in promoting service efficiency by streamlining repetitive activities and minimizing manual operations, as well as upgrading workflow coordination. Research shows that AI can enhance productivity and enable company staff to participate in comprehensive and value-added activities (Sousa et al., 2024). Besides, the digital revolution entrenches back-end activities, including data management, inter-departmental collaboration, and resource allocation, which are vital for ensuring the service remains in high demand in tourism spots like Kerala.

Alongside its effect on efficiency, automation is important in developing the concept of guest satisfaction, as this is one of the major determinants of hotel success. The Application of AI-based personalization, real-time service provision, and digital interaction platforms contributes to customer comfort and improves their perception of service quality (Al-Hyari et al., 2023). Studies on the interaction between humans and robots also imply that service robots may positively affect the guest experience by being perceived as trustworthy, convenient, and non-emotional (Callarisa-Fiol et al., 2025). Nonetheless, researchers also urge that the overuse of automation can decrease the emotional involvement and diminish the human aspect of the hospitality experience, which is at the centre of the experiences (Çalışkan & Sevim, 2025; Yan et al., 2025). Joseph, (2025b) reported that sustainable management practices of SMEs lead to improved organizational performance, which could further stimulate the adoption of automation in the hospitality industry to render good customer service.

These issues are more prevalent in culturally diverse tourist destinations like Kerala, where personalized, warm, and hospitable service is more embedded in hospitality. Although automation is efficient and convenient, overuse can give the impression that services are impersonal. Moreover, the automation process demands considerable financial resources for infrastructure development, employee training, and equipment maintenance, which, in turn, may be difficult for small- and medium-sized hotels to afford (Limna, 2023; Altinay, 2010). Joseph et al., (2025a) stated the significant role of public-private partnerships in driving technological growth, which could improve automation of the hospitality sector. This has created a pressing need to learn how to incorporate automation successfully with traditional service ideals.

Although the existing body of literature on hospitality automation is also growing, a considerable gap in empirical studies on the region, specifically Kerala, remains. The current literature is mainly focused on technologically developed markets or luxury segments of hotels, creating a gap in the overall knowledge about the impact of automation on the efficiency of services and customer satisfaction in hotels with the variety of hotel types in this area (Ratnasari & Astuti, 2025). Joseph et al., (2025b) described the global importance of working relationships as support to innovation and modernizing operations in the service industry. Moreover, little literature has examined how increases in operational efficiency are reflected in guest satisfaction within the socio-cultural environment of the hospitality industry in Kerala.

To fill this gap, the current study will examine the effects of automation on service efficiency and guest satisfaction in the hotel industry in Kerala. To be more precise, the research questions that the study addresses are: (I) how automation affects service efficiency, (ii) how automation experience correlates with customer satisfaction, and (iii) how much guest satisfaction varies depending on the hotel type: Budget, Mid-scale, and Luxury. By combining these goals, the study can present a holistic picture of the two-fold effect of automation on operational performance and customer experience.

The research has added value to the existing literature by presenting empirical data on a regionally important tourism market and serving practical purposes for hotel managers and policymakers, enabling them to design balanced automation approaches. It also focuses on the need to maximize technological development while maintaining the human-feel aspect of hospitality that Kerala tourism is known for.

This study adds various dimensions to the available hospitality automation literature. First, it provides region-specific empirical data on the effects of automation on operational efficiency and customer satisfaction in the hospitality industry in Kerala, a famous tourist destination in a culturally sensitive region of the country where personalized service is expected to be a priority. Secondly, both operational efficiency and customer satisfaction

outcomes have been examined together using regression, correlation, and comparative statistical analysis, providing an integrated analysis of the effects of automation. Thirdly, analysis is being carried out on Budget, Mid-scale, and Luxury hotels, and findings are presented in a category-based study, providing practical insights into the automation strategy to be followed for each category.

The hospitality sector is undergoing rapid automation driven by increased guest demand, labor shortages, and the need to improve operational efficiency. Despite the effectiveness of automation technologies like AI-based check-in operators, service robots, smart rooms, and automated concierge operations that have been implemented in several global locations, the effect of these technologies will always be location-specific and have varying impacts based on the region of installation and hotel types (Ivanov, 2020). The application of automation poses special operational and experiential challenges in emerging tourism destinations such as Kerala, where guest expectations are deeply rooted in personalized, culturally entrenched service. The growing popularity of the digital transformation approach, however, has not helped many hotels in Kerala to find the right balance between efficiency improvements and maintaining the human-centric hospitality culture (Chourasia, 2025).

Although the current body of research highlights that automation has the potential to enhance productivity, minimise human error, and streamline workflow, the extent to which it has contributed to the efficiency of services in regional hotels has not been fully researched. Moreover, although international literature demonstrates the potential of automated systems to improve customer satisfaction by making services more convenient and smoother, there is also proof that digital interactions can decrease the level of emotional interaction and reduce the perception of warmth in services, especially in culturally sensitive hospitality markets (Çalışkan & Sevim, 2025). The degree of this tension leaves doubts that guests in Kerala appreciate automation as a desirable feature of the destination or that they view it as a replacement of human touch, an element that is entrenched in the tourism branding and service identity of the state.

Empirical studies that evaluate the integration of automation in the daily operations of the hotels in Kerala and the degree to which automation can enhance quantifiable parameters, including service speed, accuracy, responsiveness, resource optimisation, and similar aspects (Ratnasari & Astuti, 2025), are also missing. Simultaneously, the attitudes of guests towards automation in Kerala are under-researched, even though in other markets, technological familiarity, cultural expectations, and perceived usefulness are known to influence the attitudes of guests (Azhar et al., 2026). Joseph, (2025c) explained that an AI-driven adaptive system enhances personalization of services, applicable to hotels and resorts, with increased use of automation for an enhanced customer experience. In the absence of localised research, the hotel managers in Kerala are left in no man's land in terms of understanding the automation technologies that are most

effective and their effects on the outcome of guest satisfaction.

Additionally, the hospitality industry in Kerala is typified by a high number of small and mid-scale hotels, a good number of which do not have the resources and strategic orientation to successfully implement technological change. Such organizational limitations, along with unequal training of the

staff and their degree of digital preparedness, make the introduction of automation more complex (Altinay, 2010). This makes it a pressing need to know whether the potential advantages of automation exist in the hospitality industry in Kerala, i.e., efficiency, consistency, and convenience are really being maximized in the industry, and whether the advantages of automation are really benefiting consumer satisfaction.

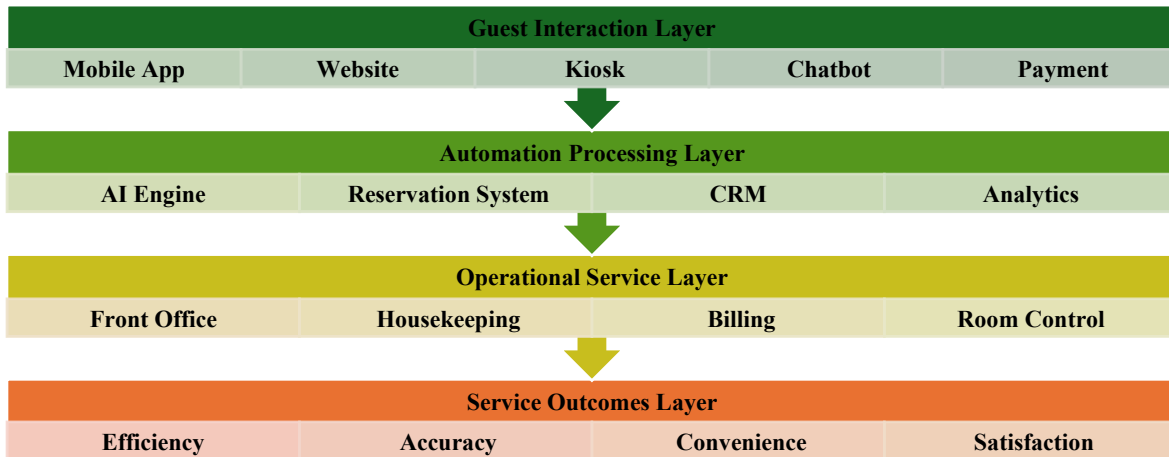


Fig. 1 Automation Ecosystem in Modern Hotel Service Delivery

The layered automation ecosystem in the contemporary hotels is illustrated in fig. 1. All guest interactions, like using mobile applications, online channels, kiosks, chatbots, and payment, are processed via AI, reservation systems, CRM, and analytics engines, and are supported by hotel key functions like front office, housekeeping, billing and room control for providing better service with high efficiency and accuracy in a convenient manner.

With these gaps in mind, the gap in the literature represents the main issue of the current research because there is little empirical data on the effect of automation on service efficiency and guest satisfaction within the narrow socio-cultural and operational background of the hotel sector in Kerala. In the absence of this evidence, strategic decision-making and policy formulation on the adoption of technology is still very sporadic and speculative. Thus, the research aims to measure, quantify, and determine the correlation between automation, efficiency, and satisfaction among the guests in Kerala to provide the insights that can help to implement the innovations effectively and introduce new ones in the industry.

The rest of the paper is structured as below. Section II is devoted for the literature review and the theoretical aspects, where in Section III, a description of the research gap, conceptual frame-work and objectives of the study are presented. Section IV deals with research methodology where data collection, measures of variables, analytical framework and model, mathematical equation of model, statistical techniques to be applied for analysis are described. The study outcomes and statistical results obtained using regression, correlation and ANOVA are presented in section V. Key findings, managerial implications, limitations of the

study and future research is dealt in section VI. In the last section, section VII summarizes the principal findings and applicability of the study.

II. REVIEW OF LITERATURE

Over the past five years, there has been a steep advancement in digital transformation in the hospitality industry due to the advancement of AI, IoT, robotics, and cloud systems (Jayawardena et al., 2023). Researchers report a shift from hotels where pilots have been tested to systematic approaches to adopting automation in front- and back-office tasks driven by cost pressure, labor shortfalls, and the growing need for faster, contact-free services for guests (Jonathan, 2025; Sharma, 2024). Surveys in the area point to the accelerating expansion of technologies such as property-management systems, chatbots, autonomous housekeeping robots, and predictive revenue management, and note that automation is transforming the business models and competitive strategies of hotels (Limna, 2023). Joseph, (2025d) concluded that the application of artificial intelligence on business eco systems enhances productivity and innovation, thus supporting automation within the hospitality industry.

A robust body of literature suggests that automation improves quantifiable operational outcomes. Empirical and review studies show that transaction speed (e.g., automated check-in), error reduction (automated billing and inventory), and resource optimization (predictive maintenance, staff rostering), all of which lead to better service efficiency, are achieved (Ratnasari & Astuti, 2025; Digital transformation studies, 2024). Hotels that have adopted robotics and AI report case and field studies with higher throughput on routine work and the release of human labor to complex and

value-added work, which is a redistribution that can increase the overall productivity in the case of appropriate management of integration and training of robotics and AI (Wu & Huo, 2023; reviews of robotics in hospitality research, 2024). Joseph & Nadig, (2025) stated that employee's psycho well-being and mindfulness contribute to improved service quality despite the trend towards automation in the hospitality industry.

The other theme of interest is the impact of automation on guests' experience. The literature on AI-based personalization (recommendation engines, customized in-room environments, chatbots) indicates that there are positive correlations with perceived convenience, trust in the reliability of the services, and loyalty intentions when they are accurate and do not invade the privacy of guests (Makivić et al., 2024; Al-Hyari et al., 2023). A study of service robots also shows that when robots are designed with perceived competence and warmth in mind, warmth can enhance guest satisfaction, especially among tech-savvy groups, by introducing novelty, speed, and consistent service (Wu & Huo, 2023; Rana et al., 2025). Nevertheless, the literature notes that the technological characteristics should be aligned with the guest's expectations: a poor implementation or privacy concerns may undermine satisfaction despite potential efficiency gains (Makivić et al., 2024).

Whereas most of the research focuses on operational advantages, there is a corpus of research examining the socio-psychological and cultural aspects of automation. Multiple authors caution that one should not expect automation to have a consistent positive impact on satisfaction; rather, they report the existence of efficiency-emotional or social warmth trade-offs in service (Çalışkan & Sevim, 2025; Callarisa-Fiol et al., 2025). The results indicate that the level of acceptance of automation by guests is contingent upon the perceived usefulness and the perceived emotional fit: the technologies that replace daily activities and save human interaction as moments of relations can be more successful than total automation of all contact points (Çalışkan & Sevim, 2025; Moriuchi & Murdy, 2024).

Local research on Indian and surrounding tourism markets offers varied preparedness and results. A study of online activities in Indian hotels singles out pilots in automated kitchens, online reservations, and contactless guest services; all of which have increased efficiency but have also demonstrated the limits of capacity in small and medium-sized businesses (Bathla et al., 2025; Times of India coverage, 2025). In the context of tourism, particularly along the coast, more intensive empirical research indicates that AI-enhanced features have a positive impact on customer satisfaction and loyalty in tourism destinations, though local cultural preferences influence acceptance (Chotisarn & Phuthong, 2025; Chen et al., 2026).

The number of peer-reviewed articles that directly investigate automation in the hospitality industry in Kerala is very small. A recent specific study on AI-powered marketing applications in five-star hotels in Kerala shows that AI tools

have positive associations with customer satisfaction, but in the luxury market and marketing processes. This shows one of the significant gaps: there is little regional evidence on small- to mid-scale hotels, operations (housekeeping, F&B automation), and the interplay between automation and culturally ingrained service norms in Kerala. As a result, local hotel managers lack a detailed, empirical guide to the automation investments that can achieve the optimal balance between service efficiency and guest satisfaction across different types of hotels (Yarlagadda, 2025; Altinay, 2010).

Altogether, the literature demonstrates that automation offers specific opportunities to increase operational efficiency and can improve guest satisfaction when implemented with consideration for personalization, privacy, and cultural fit (Makivić et al., 2024; Wu & Huo, 2023). Nevertheless, the socio-cultural trade-offs and implementation issues, particularly in contexts where high expectations of human warmth are high, such as in Kerala, are under-researched. It is thus urgent to conduct empirical, context-sensitive research that quantifies the objective improvements in efficiency (speed, accuracy, resource consumption) and subjective outcomes (satisfaction, perceived warmth, loyalty) across a sample of hotels in Kerala. The proposed research seeks to address that gap by thoroughly investigating the impact of automation on service efficiency and guest satisfaction within the Kerala hospitality sector. Engaging in this activity will help determine which moderators should be considered, including the hotel category, guest demographics, and staff digital preparedness.

The latest literature on hospitality automation shows a clear shift from exploratory use to the strategic implementation of advanced solutions, including AI, robotics, and IoT. Although earlier analyses focused mainly on the technological opportunity, recent studies have been keen to present the critical assessments of the operation and experience effects of automation. Indicatively, note that both front-office and back-end hotel operations have become more automated due to labor shortages and the need to provide contactless destinations. Nevertheless, most of these studies are macro-based on industry trends and provide few empirical results on service-level outcomes.

A significant body of literature consistently supports the claim that automation is more efficient in-service delivery. Research by Wu & Huo, (2023) shows that automated systems enable faster transaction processing, fewer operational errors, and more efficient use of available resources. Likewise, digital transformation studies (2024) note the increase in productivity and workflow consistency that can be measured. Although such findings yield strong agreement on the benefits of efficiency, they often fail to account for contextual differences, including hotel size, regional infrastructure, and workforce responsiveness. Specifically, Gretzel & Cai, (2023) have argued that small and medium-sized hotels may be limited in their ability to embrace automation due to reduced digital preparedness,

thereby undermining the reliability of this efficiency gain across the board.

By contrast, studies of guest satisfaction have more subtle and even contradictory results. On the one hand, AI-assisted personalization research points to the positive impact of automation on guest satisfaction (increasing convenience, responsiveness, and service reliability) (Al-Hyari et al., 2023; Makivica et al., 2024). Callarisa-Fiol et al., (2025), on the other hand, note that the correlation between automation and satisfaction is not linear because excessive automation can lead to a decrease in perceived emotional warmth and human connection. This means that the level of efficiency and experiential quality cannot be traded off critically, and that in automation, success should be determined by how closely it matches customer expectations and cultural context.

An additional comparison of the literature on human-technology interaction indicates that the acceptability of automation to guests depends on the spectrum of usefulness, ease of use, and compatibility with emotion. The impact of the technology acceptance factors, Rana et al., (2025) demonstrate that technology-aware customers (younger) demonstrate greater acceptance of service robots than older customers. Nevertheless, these are mostly carried out in developed or urban tourism markets, which raises questions about their generalisability to culturally sensitive tourism destinations like Kerala, where traditional values of hospitality remain influential.

In India and other tourism markets in the region, regional studies offer partial yet dispersed insights. For example, Times of India, (2025) reported increased efficiency through automated services such as digital booking and smart kitchens. However, they are mostly descriptive and may not be statistically validated. On the same note, International Publishers, (2025) also targets AI-based marketing in luxury hotels in Kerala, but not on the operational efficiency or other types of hotels, as it sees positive outcomes in terms of customer satisfaction. This shows a gap in the body of integrated studies that simultaneously investigate efficiency and satisfaction outcomes across hotel segments.

A major shortcoming in the current literature is the inability to compare across hotel categories. Although luxury hotels have a reputation as pioneers in automation, there is no evidence of how budget and mid-tier hotels utilize and benefit from automation technologies. Among these segments, the effects of automation should differ considerably due to the differences in the sets of resources and the expectations and models of services offered to customers. The literature usually lacks the consideration of this heterogeneity, thus hindering the practical implementation of the studies.

The literature, in general, indicates that although automation can increase the efficiency of the services provided and the satisfaction of guests, it seems to be very context-specific. Empirical research that incorporates operational and experience aspects and addresses regional and cultural aspects is obviously required, as well as the comparison of

the results between various categories of hotels. To fill these gaps, the following research paper will offer a detailed discussion on the topic of automation in the hospitality industry of Kerala by looking at the effect of automation on the efficiency of the provided services, the correlation between automation and customer satisfaction, and whether there are differences in satisfaction between hotels.

III. RESEARCH GAP AND CONCEPTUAL FRAMEWORK

Despite the extensive published literature on the positive effects of automation, AI, and robotics in reducing the workload of hotel organizations and enhancing the experiences of the guests, there is a massive evidence gap regarding the region-specific cases, especially in the hospitality sector of Kerala. The current literature is based on technologically advanced nations or large metropolitan tourist centres at the expense of smaller tourism-reliant regions. Although there is evidence of research done in India on the efficacy and contactless nature of automation, such studies tend to consider specific functions of digital bookings, online marketing, or AI chatbots, and not the overall ecosystem of hotel operations. In addition, the few Kerala-based studies done focus primarily on the luxury hotel segments with no reference to the mid-scale and low-cost hotels, which form the bulk of the hospitality industry in the state. Notably, no study has been able to measure and compare both service efficacy and guest satisfaction as the outcomes of automation that are interactive in the culturally rich service setting of Kerala, where human touch is highly valued. It is also quite interesting to note that the studies on the perception of automated services by guests in Kerala are extremely scarce, and it remains unclear how comfortable they can be with less human touch, as well as how automation can address their cultural views on hospitality. In addition, the organisational preparedness, staffing training demands, and automation integration concerns in Kerala hotels are yet to be analysed. The current gaps underscore the importance of a systematic, empirical study that will evaluate the effects of automation on service efficiency and customer satisfaction within the various types of hotels in Kerala and thus offer evidence-based policy, strategy, and technology embracement.

Objectives of the Study

Objective 1 – Regression

To examine the **impact of automation on service efficiency** among hotel customers in Kerala using linear regression analysis.

Objective 2 – Correlation

To determine the **relationship between automation experience and guest satisfaction** in the hospitality industry in Kerala.

Objective 3 – ANOVA

To compare **guest satisfaction levels across three categories of hotels** (Budget, Mid-scale, Luxury) using one-way ANOVA.

IV. RESEARCH METHODOLOGY

4.1 Research Design and Sampling

The current research takes a descriptive, analytical, and quantitative research design to analyse the effect of automation on guest satisfaction and efficiency of services in the hospitality business in Kerala. First-hand data were also gathered through a survey-based method wherein hotel guests with experience in automated services (digital check-in, AI-powered concierge, automated room control, or service robot) will be interviewed. The given design suits the purpose of this research since it will enable the researcher to quantify the relationships between variables by applying statistical methods (regression, correlation, and ANOVA). The study population is the guests of the hotels located in Kerala who have stayed at the Budget, Mid-scale, and Luxury hotels that have encountered any type of hotel automation. Kerala has a perfect environment as its tourism industry is expanding at a quick pace, and the level of automation is also on the rise. The results of the Cochran formula were used to establish a sample size of 384 respondents with sufficient representation and statistical power. The stratified random sampling method was used, where the hotels were divided into three strata depending on category (Budget, Mid-scale, Luxury). Respondents were chosen at random in every stratum in proportion to hotel distribution in Kerala. This makes the sample reliable and representative. The total sample size consisted of 384 respondents with equal distribution across the three hotel types (budget hotels-128 respondents, mid-scale hotels-128 respondents, luxury hotels-128 respondents).

4.2 Data Collection and Respondent Profile

The questionnaire employed to collect data was divided into four parts, which included demographic information, experiences with automation, service efficiency scale and guests satisfaction scale. The scale applied throughout the questionnaire was 5-point Likert scale with 1 indicating 'Strongly Disagree' and 5 'Strongly Agree'. The data was collected in a variety of forms for increased reach and accuracy. Forms included Google Form used for online questionnaires, personally distributed to the hotels (selected hotels), and mailed questionnaires to guests via their email addresses.

The demographic characteristics of the respondents in the study are presented in table I. There were 384 respondents in the survey, among which 52.3% of them were male, and 47.7% were female. More respondents were in the age range of 25-35 years (42.7%), and then those 36-50 years (25.0%). Among them, 61.5% were frequent travellers, so that most of them had an in-depth acquaintance with automated hotel

services. The demographic variability of the respondents provided good representation for the various consumer groups in Kerala's hospitality industry.

TABLE I DEMOGRAPHIC PROFILE OF RESPONDENTS (N = 384)

Variable	Category	Frequency	Percentage (%)
Gender	Male	201	52.3
	Female	183	47.7
Age	Below 25 years	68	17.7
	25–35 years	164	42.7
	36–50 years	96	25.0
	Above 50 years	56	14.6
Education	Undergraduate	142	37.0
	Postgraduate	186	48.4
	Others	56	14.6
Occupation	Business	102	26.6
	Private Employee	148	38.5
	Government Employee	76	19.8
	Others	58	15.1
Hotel Stay Frequency	Occasional Traveller	148	38.5
	Frequent Traveller	236	61.5

4.3 Questionnaire Design and Variable Measurement

TABLE II QUESTIONNAIRE STRUCTURE AND MEASUREMENT CONSTRUCTS

Section	Construct	Number of Items	Measurement Scale
Part A	Demographic Information	5	Categorical Scale
Part B	Automation Experience	6	5-point Likert Scale
Part C	Service Efficiency	6	5-point Likert Scale
Part D	Guest Satisfaction	7	5-point Likert Scale

Table II presents the structure of the questionnaire used for primary data collection in this study. The instrument was divided into four sections comprising demographic information (5 items), automation experience (6 items), service efficiency (6 items), and guest satisfaction (7 items). Demographic variables were measured using a categorical scale, while all perception-based constructs were assessed using a 5-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). This structured design ensured systematic measurement of respondent characteristics and key research variables related to automation, service efficiency, and guest satisfaction in Kerala's hospitality industry.

Key variables used in this study were clearly defined operationally. Automation experience can be defined as respondents' belief about engaging with automated hotel technologies such as self-check-in systems, AI-driven concierge service, automated room control systems, chatbots, self-service technology, etc. Service efficiency can be defined as how successfully the service is being performed,

considering speed, accuracy, responsiveness, no waiting, and consistency through automation of hotel operations. Guest satisfaction can be defined as the total satisfaction perceived by a customer regarding his/her stay at a hotel with regard to convenience, comfort, and overall service quality/experience. All construct items were measured on a five-point Likert scale from 1 (Strongly Disagree) to 5 (Strongly Agree), where a higher value indicates a higher perception of constructs.

4.4 Ethical Considerations and Data Validity

This research uses a number of existing validated and adjusted scale instruments to investigate the constructs required. These instruments were previously developed by a number of researchers: the Automation Experience Scale was based upon studies of artificial intelligence (AI) and service automation; the Service Efficiency Scale was based upon operational efficiency models, and the Guest Satisfaction Scale was based upon the satisfaction models in hospitality and related industries. The instruments were pilot tested prior to final data collection in order to verify clarity, validity, and reliability. Statistical Package for the Social Sciences Version 26 (SPSS) was used to analyse the data by performing descriptive statistics, Cronbach's Alpha reliability, correlation, linear regression, one-way ANOVA and Tukey Post Hoc. AMOS (Analysis of Moment Structures) was used to estimate and quantify program and policy impacts via path analysis, mediation analysis, structural equation modelling (SEM), and model fit indices. Microsoft Excel was also used for data cleaning, coding, tabulation, and displaying graphical analysis of data.

All the ethical issues had been carefully noted throughout the data collection process. Prior to their involvement, the purpose of the study, the purely academic and non-commercial nature of the research, and the voluntary nature of their involvement were explained to all respondents. Each participant gave their consent before completing the questionnaire. All participants were reassured about their privacy; that the respondents' identity was protected and anonymity maintained. Information gathered would only be used for research purposes. Participation in the survey can be ceased at any point with no requirement. To ensure the validity of the data, each question item in the questionnaire was adapted from validated existing studies conducted in the hospitality and automation fields, and tested through a pilot study before final data collection. All constructs were checked for internal reliability using Cronbach's Alpha. All the constructs' value was found above the minimum required reliability of 0.70.

4.5 Proposed Analytical Model

A comprehensive analytical model was developed for the analysis of the relationship between automation experience, service efficiency, and guest satisfaction by setting automation experience as the independent variable, service efficiency as the dependent variable, and guest satisfaction as the outcome variable. The categories of hotel (Budget,

Mid-scale, and Luxury) were considered as the grouping factor and compared for their level of automation experience, efficiency and guest satisfaction. In view of assessing the effect of automation in the service industry, this proposed analytical model contains predictive, relational, and comparative statistical elements.

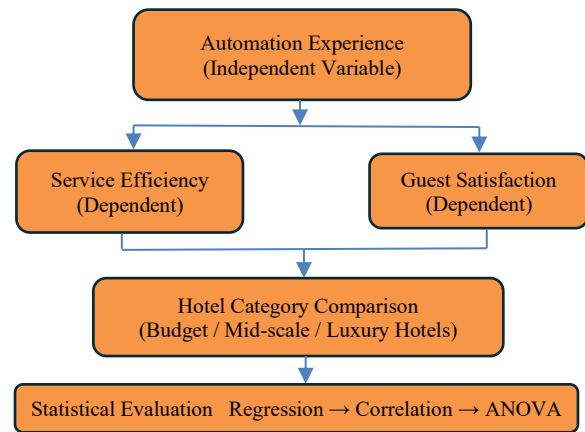


Fig. 2 Proposed Analytical Framework for Automation Impact Assessment
The analytical framework is presented in fig. 2, which was designed to assess the effects of automation experience on efficiency and guests' satisfaction in the hospitality sector in Kerala. The effects are then contrasted among Budget, Mid-scale, and Luxury hotels and finally analyzed with statistical techniques such as linear regression, Pearson correlation, and one-way ANOVA to investigate the prediction, relation, and differences among groups.

4.6 Mathematical Formulation

To investigate the correlation between automation experience and service efficiency, a linear regression equation (1) has been formulated as:

$$SE_i = \beta_0 + \beta_1 AE_i + \varepsilon_i \tag{1}$$

Where, SE_i = service efficiency of an i-th subject, AE_i = automation experience of an i-th subject, β_0 = intercept and β_1 = regression coefficient, ε_i = random error term. To measure the relationship between automation experience and guest satisfaction, the Pearson coefficient was used, as described in equation (2):

$$r = \frac{\sum(AE_i - \underline{AE})(GS_i - \underline{GS})}{\sqrt{\sum(AE_i - \underline{AE})^2 \sum(GS_i - \underline{GS})^2}} \tag{2}$$

Where r = the correlation coefficient, GS_i = guest satisfaction of an i-th subject, \underline{AE} = mean guest satisfaction of automation experience and \underline{GS} = mean value of guest satisfaction. In order to investigate whether there is a significant difference in guest satisfaction across hotel categories, one-way ANOVA has been conducted using the following equation (3):

$$F = \frac{MS_{between}}{MS_{within}} \tag{3}$$

Where, $MS_{between}$ = Mean Square Between the groups and MS_{within} = Mean Square within the group.

The relationship between automation and operating efficiency is investigated through the predictive model of regression as given by equation (1). Automation experience and guest satisfaction are assessed based on their level of correlation with the help of equation (2), and by the help of the F-test given in equation (3) for the difference in guest satisfaction across various categories of hotels.

4.7 Algorithmic Implementation

Algorithm 1: Automation Impact Assessment Framework

Input: Survey responses from N = 384 hotel guests
 Output: Statistical relationship between automation, efficiency, and satisfaction

- Step 1: Import questionnaire responses into SPSS
 - Step 2: Perform data cleaning and remove incomplete responses
 - Step 3: Encode Likert-scale responses numerically
 - Step 4: Compute construct scores for automation experience
 - Step 5: Compute construct scores for service efficiency
 - Step 6: Compute construct scores for guest satisfaction
 - Step 7: Apply linear regression to evaluate equation (1)
 - Step 8: Compute Pearson correlation using equation (2)
 - Step 9: Perform one-way ANOVA using equation (3)
 - Step 10: Conduct Tukey post-hoc comparison
 - Step 11: Interpret statistical significance at $p < 0.05$
 - Step 12: Report findings and managerial implications
- End

Algorithm 1 outlines the logical process of assessing the impact of automation on service efficiency and guest satisfaction in Kerala's hospitality industry. Initially, questionnaire data were gathered from 384 participants, and later, the data were pre-processed, coded, and the construct variables (automation experience, service efficiency, and guest satisfaction) were aggregated. The analysis of the resultant data was performed with a linear regression, Pearson correlation, and one-way ANOVA as indicated in equations (1)-(3) in order to study prediction, association, and the differences between hotel types, respectively.

4.8 Statistical Analysis Framework

In all the statistical analysis the level of significance was set at 5% ($p < 0.05$) confidence interval at 95%. When $p < 0.05$, it was interpreted as statistically significant, $p < 0.01$ as highly significant, and $p < 0.001$ as very highly significant. These cut-off for significance was used for the regression, correlation, ANOVA, and post hoc analysis, which were carried out by SPSS Version 26.

The strategy chosen for this analysis focused on understanding how automation influenced important service-related outcomes within Kerala's service sector of hotels. It uses a linear regression analysis to assess the predictive capacity of automation on the service outcome efficiency and to understand how much of the variation in performance it accounts for. The Pearson correlation analysis was employed to understand the strength and the direction of the relation between experience with automation and guest satisfaction. Furthermore, in order to explore the variation in guest satisfaction between Budget, Mid-scale, and Luxury hotels and identify any statistically significant differences among the hotels, one-way ANOVA and Tukey post hoc were used.

The data for this study were collected over a period of four months (January 2025 to April 2025) to capture diverse guest experiences across different tourism periods in Kerala. Further, respondent demographic information was collected to enhance analytical depth. The sample included participants across gender, age groups (Below 25, 25–35, 36–50, above 50), education levels, occupation, and frequency of hotel stay. The majority of respondents belonged to the 25–35 age group and were frequent travellers, indicating a relatively high familiarity with automated hotel services.

V. RESULTS AND ANALYSIS

5.1 Linear Regression Analysis

TABLE III MODEL SUMMARY FOR REGRESSION ANALYSIS

Model	R	R Square	Adjusted R-Square	Std. Error of the Estimate
1	.672	.452	.450	3.215

Table III summarises the goodness of fit of the regression model. It was found that the R value was .672 indicating a positive correlation between automation and the dependent variable. R-squared of .452 revealed that 45.2% of the variance in the dependent variable is explained by automation, while the adjusted R-squared was .450, meaning that the model is good to predict dependent variable with reasonable prediction errors (standard error of the estimate was 3.215).

TABLE IV ANOVA FOR THE REGRESSION MODEL

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	2280.142	1	2280.142	220.423	.000
Residual	2760.918	382	7.226		
Total	5041.060	383			

Table IV analyses ANOVA to test the significance of the regression model. An F-value was computed to be 220.423, with a p-value .000. The significance of the regression model indicates that the automation affects the dependent variable to a significant extent. Therefore, the regression model is suitable to predict the dependent variable.

TABLE V REGRESSION COEFFICIENTS OF THE MODEL

Model	Unstandardized B	Std. Error	Standardized Beta	t	Sig.
(Constant)	12.482	.662	—	18.86	.000
Automation	.684	.046	.672	14.85	.000

Table V indicates the regression coefficients representing the impact of automation on the dependent variable. As calculated, the value of the coefficient for automation (B) was .684 meaning that for any increase in automation dependent variable increases, and this effect is statistically significant (indicated by a significant value of t-statistic = 14.85, $p = .000$, $Beta = .672$)

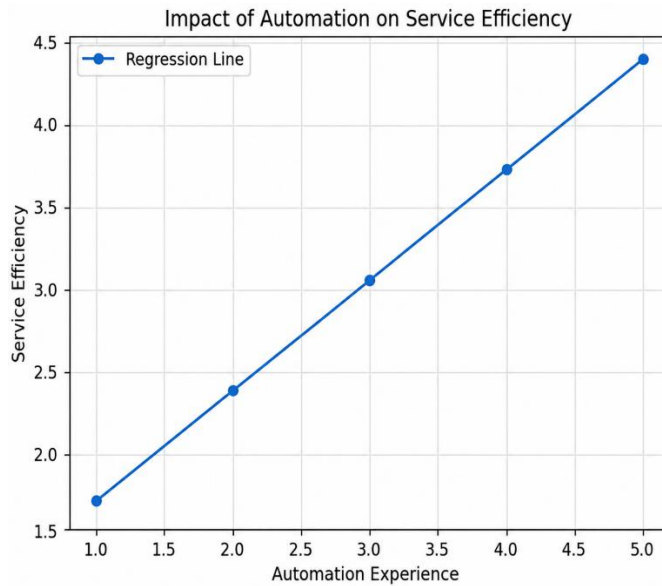


Fig. 3 Automation Performance in Services

Fig. 3 represents the relationship between the experience of automation service and efficiency in services for hospitality. As you can see, by the regression line, the adoption of automation technology is positively correlated with the operating performance; it shows that automation is a significant factor and positively influences operating performance as statistical analysis does ($R = 0.672$; $R^2 = 0.452$; $p < 0.001$).

5.2 Correlation Analysis

TABLE VI CORRELATIONS TABLE

Variables	Automation Experience	Guest Satisfaction
Automation Experience	1	.614**
Guest Satisfaction	.614**	1

The correlation analysis in table VI investigated how automation experience relates to the overall satisfaction of the guests. The outcomes showed that there was a strong, positive, and significant correlation ($r = .614$, $p < .01$), which proved that the higher the automation experience, the greater the level of guest satisfaction. This implies that those guests who were exposed to efficient, easy-to-use, automated systems, including automated check-in kiosks, AI-enabled room controls, chatbots or digital concierge services, were more likely to report positive experiences at the time of stay. The quality of the correlation also shows that automation is

not just a tool of functions but the power that impacts the perception and emotional responses of the customers. This is consistent with the earlier studies, which have established that guest satisfaction is more likely to grow when automation is smooth, user-friendly, and augments the convenience of the service. Therefore, the correlation analysis makes a good testament to the fact that hotel automation can play a significant role in enhancing the level of guest satisfaction in the hospitality industry of Kerala.

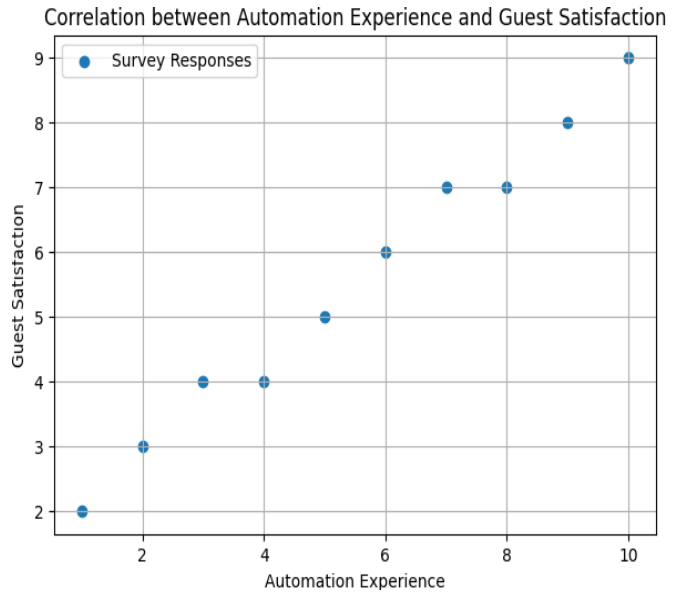


Fig. 4 The Relation Between Experiences and Guests' Satisfaction

Fig. 4 depicts the relationship between experiences of automation service and the guests' satisfaction with hotels. The data seems to be strongly positively related because most guests chose satisfied or strongly satisfied, which shows that the automation performance will have a high positive impact on the guests' satisfaction with a good interface ($r = 0.614$, $p < 0.01$).

5.3 One-Way ANOVA Analysis

TABLE VII DESCRIPTIVE STATISTICS FOR CATEGORIES OF HOTELS

Hotel Category	N	Mean	Std. Deviation
Budget	128	28.45	6.24
Mid-scale	128	31.92	5.87
Luxury	128	35.61	5.11
Total	384	32.00	6.24

Table VII displays the descriptive statistics for the hotel categories used. As can be observed in the statistics above, luxury hotels have the highest mean (35.61), whereas mid-scale hotels have a mean of (31.92) and budget hotels a mean of (28.45). All categories had an equal sample size ($N = 128$), and the standard deviation means that the variation among the groups is moderate. The general mean of all participants was 32.00.

TABLE VIII ANOVA RESULTS FOR HOTEL CATEGORIES DIFFERENCE

Source	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2048.312	2	1024.156	29.842	.000
Within Groups	13095.688	381	34.353		
Total	15144.000	383			

Table VIII presents the result of the ANOVA used to detect differences between hotel categories. An F-value of 29.842 and a p-value of .000 show a statistically significant difference between the hotel category means. It can therefore be concluded that the hotel category influences the studied variable.

TABLE IX POST HOC ANALYSIS USING THE TUKEY HSD TEST

Hotel Category Comparison	Mean Difference	Sig.
Budget vs Mid-scale	-3.47	.003
Budget vs Luxury	-7.16	.000
Mid-scale vs Luxury	-3.69	.002

The results of the Tukey HSD post hoc analysis, shown in table IX, determine which specific groups of the hotel categories differ significantly. All groups differed from each other as shown in table IX, from budget to mid-scale to luxury hotel, as all p-values are below .05. The largest mean differences were identified between the luxury hotels and the other categories.

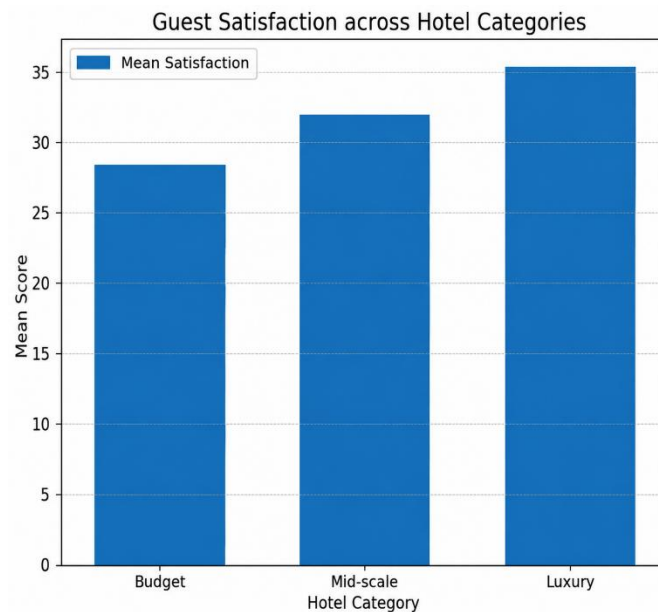


Fig. 5 Guest Satisfaction in Different Kinds of Hotels

Fig. 5 presents a comparison of mean guest satisfaction in different kinds of hotels, including Budget, Mid-scale, and Luxury hotels. It appears that the guest satisfaction is highest in Luxury hotels and followed by Mid-scale hotels and Budget hotels, suggesting there is a significant difference in hotel performance and service quality across different kinds of hotels (F=29.842, p<0.001).

VI. DISCUSSION

As this research suggests, automation is undoubtedly a key factor in increasing service efficiency and guest satisfaction in Kerala’s hospitality industry. The regression analysis proves there is a strong and highly significant positive association between automation and service efficiency (R=0.672; R=0.452; F=220.423; p<0.001), and hence 45.2% of the variation in service efficiency can be attributed to the use of automation. A highly significant positive regression coefficient (B=0.684; =0.672; p<0.001) shows how increased automation use enhances speed, accuracy, and consistency of services. These results concur with previous research conducted by Wu (2023), highlighting digital automation as a crucial tool for enhancing service efficiency and reducing workflow and human errors. However, this study specifically shows empirical evidence from Kerala, where hospitality continues to be an interaction-heavy service.

Furthermore, a positive correlation was established between experience in using automation and guest satisfaction (r=0.614; p<0.01). Guests who have experienced more automation at hotels report greater satisfaction with services received. This confirms results from Al-Hyari et al., (2023) and Makivic et al., (2024), who identify convenience, speed, and reliability of service as important attributes contributing to satisfaction when a technologically supported service environment is involved. Nevertheless, a significant positive association means the impact of automation on guest satisfaction is high, but it does not imply complete determination. At culturally sensitive tourism destinations such as Kerala, personal service is imperative for guest satisfaction, and thus automation cannot totally compensate for human interaction.

While the current study offers useful empirical evidence on how automation has impacted the service efficiency and guest satisfaction within Kerala's hospitality industry, limitations exist. Firstly, limited to the data from the responses of 384 customers from the selected Budget, Mid-scale, and Luxury hotels in Kerala, the generalisability of the result might be restricted to a specific location and market. Secondly, the cross-sectional quantitative study captures a snapshot of guests' experiences, hence did not explore the variation over time in the use of technology and customers' behavior towards them. Thirdly, questionnaire surveys were based on guests' self-reports which may be distorted by subject's bias and their individual interpretation. Finally, the focus of this research was limited to automation experience, service efficiency and guest satisfaction while omitting variables such as employees readiness and technology acceptance, service quality, and digital maturity of the organization etc.

One-way ANOVA analysis indicates that guest satisfaction varied significantly across the three categories of hotels (F=29.842; p<0.001). Satisfaction was the highest among luxury hotels (M=35.61), followed by mid-scale (M=31.92) and budget hotels (M=28.45), Tukey post hoc test indicated a statistically significant difference between all three

categories. This shows that effective utilization of automation differs with resource availability and the technological infrastructure available at the hotel. Whereas luxury hotels are likely to benefit the most, financial and operational constraints may prove difficult for budget and mid-scale hotels.

On a managerial level, automation adoption must be increased in areas such as digital check-in/check-out, AI-integrated customer support and information, automated payment process, and smart rooms and other in-room applications. Technology used must be simple and guest-friendly, and also aligned with guest expectations of the service at the specific hotel category. Since a warm and personal welcome is considered the essence of Kerala hospitality, a hybrid service approach is best suited for enhancing service experience at Kerala's hotels. Therefore, along with increased automation, training the staff is equally important to support and provide customer service efficiently.

The research was based on 384 questionnaires filled out by respondents of various selected hotels in Kerala. Thus, generalizing the results across all hotels in the region might be difficult. The present research used a cross-sectional design; hence, guest perceptions reflect a point in time, and subjective responses can have biases. Factors like the level of employee readiness to use technology, adoption of technology, service quality, and organizational digital maturity were not explored.

Future research may investigate across regions or across countries using comparative studies and also utilize a longitudinal design with additional constructs such as TAM, UTAUT, SERVQUAL, and perceived trust. More advanced statistical tools like Structural Equation Modelling (SEM) might also be used to highlight mediating and moderating effect in automation within hospitality services.

VII. CONCLUSION

The hotel sector of Kerala is under a process of change, and hotel automation systems have started getting implemented at hotels to enhance their operational efficiencies and guest experience. However, the impact of automation has been studied in very few region-specific hospitality sectors of Kerala. This research aims to examine the impact of hotel automation systems on service efficiency and guest satisfaction among Budget, Mid-scale, and Luxury hotels in Kerala with a quantitative research approach. This study has used primary data from 384 hotel guests through the tool, a structured questionnaire developed based on a 5-point Likert scale, and it has been analysed using SPSS version 26. The test of hypotheses had involved the use of linear regression, Pearson correlation, and one-way ANOVA. The analysis confirmed that automation had a significant positive relationship with service efficiency, with $R = 0.672$; $R^2=0.452$, $F = 220.423$, and a sig value of <0.001 , meaning 45.2% variance in the service efficiency is explained by automation. It has also been revealed through Pearson

correlation analysis that automation had a strong and positive relationship with guest satisfaction, with $r=0.614$ and p -value <0.01 . Moreover, a significant difference existed in the guest satisfaction among hotel categories by one-way ANOVA with F value = 29.842 and significance of $p <0.001$, where guest satisfaction is higher among luxury hotels (Mean = 35.61) and mid-scale hotels (Mean = 31.92) than the budget hotels (Mean = 28.45). Automation adds significant value to operational efficiency and customer satisfaction in hotels and it is essential to strike a balance between technological changes and personalized hotel service quality.

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