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# The Synergistic Effect of Lean Practices and Technological Innovation Adoption on Hotel Service Performance: An Empirical Study in Vietnam

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## ABSTRACT

The growth of competition in the hospitality sector requires hotel managers to adopt effective management practices and invest in technological innovation to differentiate their services. This research simultaneously investigates the benefits of lean practices and technological innovation adoption of hotels operating in Vietnam market. The responses collected from 122 management representatives from hotels show that lean practices and technological innovation adoption have positive relationships with performance improvement, staff and customer satisfaction. The synergistic effects between lean practices and technological innovation adoption in hotel service were also confirmed. It is suggested that an effective combination between lean and technological innovation is necessary in driving the growth of firms in the hospitality sector.

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## 1. Introduction

The hospitality industry is a volatile environment in which changing patterns of travel, guest expectations, and competition are constant sources of operational challenges [1]. In contrast to many other industries with fixed workflows, hotels must deal with occupancy that can vary greatly, changing service needs at an incredibly fast pace, and efforts to constantly balance cost efficiency against an exceptional guest experience. This inherent unpredictability increases the likelihood of inefficiency in staffing, purchasing, and service delivery [1]. Lean practices have been proved to lower operational costs, positively enhance customer satisfaction and support sustainable performance in hospitality [2]. In addition, technological innovation adoption is also advised for hotel managers to improve their service performance. From the hotel staff's perspective, the use of technological innovations increases their knowledge and confidence, encourages more interaction, guarantees service quality

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and boosts role flexibility. From the customers' point of view, technological innovations adoption helps to differentiate a service provider from other competitors by providing customized service experience with less stress and higher satisfaction [3].

The effect of lean practices and technological innovation adoption were usually investigated separately in previous works [1], [4], [5]. The synergistic effect of lean practices and technological innovation adoption on hotel performance received little attention from researchers. Nevertheless, focusing solely on hotel performance provides an incomplete picture, as customer and staff satisfaction are equally vital indicators of sustainable success in the hospitality industry. Therefore, this paper will try to fill the gap by examining the impact of lean practices, technological innovation adoption and their synergistic impact on performance improvement of hotels, staff satisfaction and customer satisfaction.

This paper argues that lean practices are necessary for hotel service management because it helps to continuously improve service performance. The responses collected from 122 management representatives from hotels show that lean practices and technological innovation adoption have positive relationships with performance improvement, staff and customer satisfaction. Moreover, technological innovation applied upon lean-based management practices provide effective tools for hotel managers to achieve lean objectives by minimizing waste, improving customer values and enhancing efficiency.

## 2. Literature review

### 2.1 Lean practices in service

Lean is a management philosophy focusing on being flexible and agile, and lean practices cover management methods to eliminate waste - activities that do not generate value [6]. As a result of a continuous improvement process, the operation efficiency and quality are improved whereas production time and waste are reduced substantially [1]. Lean practices as a set of managerial actions aimed at improving the system's effectiveness and efficiency by removing waste [6]. Lean service is often regarded as the management philosophy and techniques that eliminates waste and variation in service processes to enhance user and employee experience, foster collaborative problem-solving, drive continuous improvement, and ultimately achieve operational excellence [7]. Although lean management was developed in the manufacturing sector, its principles could also be applied in service, including (1) elimination of waste, (2) zero defects, (3) pull instead of push, (4) multifunctional teams, (5) decentralized responsibilities, (6) vertical information systems, and (7) continuous improvement [8].

In hospitality service, several types of lean wastes such as defects, delay, overproduction, over processing, inventory, transportation and motion, have been identified in previous research [9], and the reduction of the aforementioned waste could improve the business performance. In particular, it was showed that Lean Six Sigma practice positively influences organizational and operational performance [5]. Consistently, lean practices contribute to efficiency, process standardization and service quality improvement [10].

### 2.2 Technological innovation adoption

Technological innovation adoption could be defined as the acceptance of a new product/service or element in service operation of organizations [11]. Giotis and Papadionysiou [12] indicated several technological innovations that could be applied in hospitality, namely Information Communication Technology (ICT), social media, Internet, smart phones and Industry 4.0 technologies. These technologies could assist hotel businesses in reaching customers via online promotion and booking platforms. Furthermore, the application of technological innovations in hotels also foster customer perception and satisfaction. Elshaer and Marzouk [4] concluded that the relationship between smart technologies and customer experience is mediated by hotel innovation. The adoption of new technologies leads to higher firm performance [13], quality in information, system and service [14], better staff performance and service outcomes [3].

### 2.3 The synergy between lean practices and technological innovation adoption

In organizational context, lean philosophy could be combined with other practices to create a synergistic effect, thus improving the business performance. Kumar and Rodrigues [15] illustrated that lean and green practices could be integrated to foster innovations in companies and supply chain. Onofrei et al. [16] documented a synergistic effect between lean practices and operational intellectual capital in enhancing operational performance of enterprises. In manufacturing context, the complementary effects between lean practices and technology adoption have

been explored in several articles with the conclusion that the implementation of technological innovation would improve the effectiveness of lean practices on firm performance [17], [18]. However, in hospitality industry, little research has been conducted to examine the synergy between lean practices and technological innovation adoption. The benefits of lean practices and technological innovation adoption is usually explored separately in hotel service context [4], [5], [10], [13]. The synergistic effect of lean practices and technological innovation adoption in the hospitality industry can be better understood through the complementary nature of their roles. Lean practices encourage operational performance by eliminating waste. When technological innovation is added to a lean foundation, it boosts the hotel's responsiveness to customer needs, service issues, and operational changes. Together, this synergy delivers stronger service performance than either approach alone.

## 2.4 Analytical framework and hypotheses establishment

According to the Resource-Based View, competitive advantages come from unique and valuable resources within a firm [19]. It is argued that the implementation of lean practices and technological innovation adoption mutually reinforces each other and form a unique configuration of internal resources, thus enhancing service outcomes of firms in hospitality. In hospitality, firms must constantly adapt to increasing customer expectations and technological advancements. While lean practices provide the operational foundation for service, technological innovation adoption acts as catalyst for responsiveness. Both factors are important in obtaining superior service outcomes.

In hotel service setting, the implementation of lean increases efficiency by reducing time, cost and resources, thus boosting operational performance. When unnecessary costs are reduced, the profitability and competitiveness of hotels are strengthened [5]. Based on the above, the following hypothesis is formulated:

*H1: Lean practices have a positive relationship with performance improvement in hotel service.*

The adoption of technological innovations has been proved to significantly increase hotel performance in previous research. According to Martínez-Caro et al. [20], the utilization of digital technologies allows firms to streamline process, facilitate communication and collaboration, therefore improving organizational performance. In hospitality, the application of Industry 4.0 technologies such as AI and Big Data not only allows hotel managers improve marketing performance but also creates automated processes which decrease human error in repetitive tasks. As a result, operational efficiency, higher productivity and lower cost are achieved [13], [21]. Meanwhile the usage of e-commerce and social commerce create a new booking channel to reach more potential customers and enhance brand visibility with minimal transaction costs [22]. Thus, the following hypothesis is proposed:

*H2: Technological innovation adoption has a positive relationship with performance improvement in hotel service.*

In manufacturing, the synergistic effect of lean practices and technological innovation adoption have been documented. Khanchanapong et al. [18] reported a positive interaction between manufacturing technologies and lean practices in performance improvement. Particularly, the combination of the two results in lower cost, shorter lead time, higher quality and flexibility. Rossini et al. [17] suggested that lean practices and Industry 4.0 technologies can be integrated into Lean Automation, which has positive relationship with operational performance. Instead of replacing lean management, the emergence of technological innovations offers new tools for managers to implement lean practices properly. In hotel operations, the adoption of technology could increase the effectiveness of lean practices, thus constitute a greater effect on performance. Smart monitoring system facilitates information sharing, allowing better collaboration among departments and reduce idle times. Robotic technology could be used to create human-robot interaction with high standardization. In general, by applying technological innovations, wastes in hotel services are reduced while efficiency and productivity are ensured, which are aligned with the principles of lean practices. Hence, the following hypothesis is formulated:

*H3: The synergy between lean practices and technological innovation adoption positively affects performance improvement.*

Staff satisfaction refers to an internal emotional state of mind resulting from the assessment of staff for their job experience [23]. It is a critical component influencing employee engagement, retention, and service quality in the hospitality industry. Employees in lean organizations are encouraged to actively participate in process improvement. This participative

environment not only empowers employees but also fosters a sense of ownership and professional fulfilment. By implementing lean practices, hotel service providers can identify and remove unnecessary tasks and bottlenecks in their service process to create a smoother workflow for employees [9]. Consequently, such improvements in the working environment are expected to enhance job satisfaction and overall staff morale. Based on the above, the following hypothesis is formulated:

*H4: Lean practices have a positive relationship with staff satisfaction in hotel service.*

The adoption of information technologies offers many benefits for employees, such as quick access to information, more task completions and better communication. Consequently, employees tend to evaluate positively about their working environment, relationships with colleagues and their job characteristics, which turn into job satisfaction. In hotel service, technological innovations cannot replace employees as human touch and soft skills are necessary in customer experience. Rather than that, technologies put employees at ease and allow them to utilize their time and develop their skills in different areas [24]. Shin et al. [3] found that innovative technologies increase front desk staff's confidence and knowledge and offer more mobility and flexibility. Therefore, it is hypothesized that:

*H5: Technological innovation adoption has a positive relationship with staff satisfaction in hotel service.*

The combination of lean practices and technological innovation adoption can significantly amplify their effects on staff satisfaction. The application of digital technologies offers more autonomy, upskilling and feedback for employees, therefore leading to professional development and satisfaction. When smart technological innovations are implemented widely in organizations, there will be high level of automation and standardized process, which encourage employees to participate in high-skill activities [25]. Through continuous improvement in lean, staff satisfaction and motivation are fostered as they perceive opportunities for self-development during their employment. Accordingly, the following hypothesis is proposed:

*H6: The synergy between lean practices and technological innovation adoption positively affects staff satisfaction.*

Customer satisfaction is the evaluation of customers about the fulfillment level of services [26]. Theoretically, lean practices in services can influence customer satisfaction by process efficiency and service quality improvement. According to Sztorc [10], improving service quality and minimizing service time are among the most mentioned reasons of adopting lean practices in hotels. Lean practices allow hotel managers to eliminate wastes in service process, therefore providing a consistently high level of service quality. Faster response time and service delivery also ensure customer satisfaction. Additionally, lean practices are usually associated with simplifying and standardizing service process, which improve the ease of interaction between customers and service providers. Thus, the following hypothesis is proposed:

*H7: Lean practices have a positive relationship with customer satisfaction in hotel service.*

Technological innovation adoption plays an important role in creating customer satisfaction. The research of Chevers and Spencer [27] concluded that the adoption of in-room ICT and back-office ICT components are positively correlated with general customer satisfaction because these technologies directly assist customers in entertainment or communication during their stay. Industry 4.0 technologies could be utilized to enhance customer satisfaction by providing timely feedback. For example, Big Data and AI are used to analyze a great amount of data generated customers' feedback to improve service quality. Virtual Reality technology is able to provide a real-time visiting experience, which contributes to customer delight. Hence, the following hypothesis is formulated:

*H8: Technological innovation adoption has a positive relationship with customer satisfaction in hotel service.*

The integration of lean practices and technological innovations could create a synergistic effect on customer satisfaction. Lean practices focus on improving efficiency by streamlining service process while technological innovation adoptions offer automation and optimization. In hotel service, robots and self-service technologies can be used to replace employees in low-interacting and repetitive tasks. From a customer perspective, these technologies provide a unique experience and reduce waiting times [22]. Moreover, lean practices aim at error reduction through continuous improvement, while technological innovations provide not only error-free but also personalized services. Consequently, the following hypothesis is posited:

*H9: The synergy between lean practices and technological innovation adoption positively affects customer satisfaction.*

Figure 1 presents the proposed research model derived from the developed hypotheses.

## 3. Methodology

A quantitative approach was chosen for this research as it allows researchers to validate relationships and measure impact of factors in the proposed research model. In particular, a survey was conducted to collect responses from management representatives of hotels in Da Nang, Vietnam. This is the area with the highest average income per capita (3.759 USD) in Central Vietnam and heavily driven by service sector which contributes roughly 67% in the economic structure [28]. The items used in the questionnaire were adapted from previous research [29]-[34]. The measurement of "lean practices" with 6 items was developed based on the research of Awad et al. [29]. The scale for "technological innovation adoption" including 7 items was developed from Ezzaouia and Bulchand-Gidumal [30], and Chege et al. [31]. The measurement of "performance improvement" was adapted from Chege et al. [31], and Dehisat and Awang [32]. The scale for "staff satisfaction" including 10 items was adapted from Pantouvakis and Bouranta [33], and Sohail and Jang [34]. The scale for "customer satisfaction" including 4 items was adapted from Pantouvakis and Bouranta [33], and Sohail and Jang [34]. All items are measured in 5-point Likert scale with 1 indicating strongly disagree and 5 indicating strongly agree. The questionnaire was reviewed by researchers in hospitality management as well as experienced hotel managers to ensure its relevance and clarity. Based on their feedback, several adjustments were made to better align the items with the operational context of Vietnamese hotels.

The number of valid answers was 122 which was then analyzed by hierarchical regression method in IBM SPSS 25.0 software. Hierarchical regression is a statistical technique for testing synergistic effects, as it allows researchers to assess the incremental explanatory power of interaction terms beyond the main effects of individual predictors. By entering variables in successive steps, this method enables the examination of whether the addition of an interaction term significantly improves model fit. The majority of surveyed hotels are privately owned (96.7%), with only a small proportion being state-owned. In terms of classification, the sample is dominated by 2-star (45.1%) and 3-star (36.9%) hotels, followed by 1-star and 4-star establishments. Most participating hotels are relatively young, with 63.9% operating for less than five years, indicating a dynamically expanding hospitality market in Da Nang. Table 1 depicts demographic characteristics of the respondents.

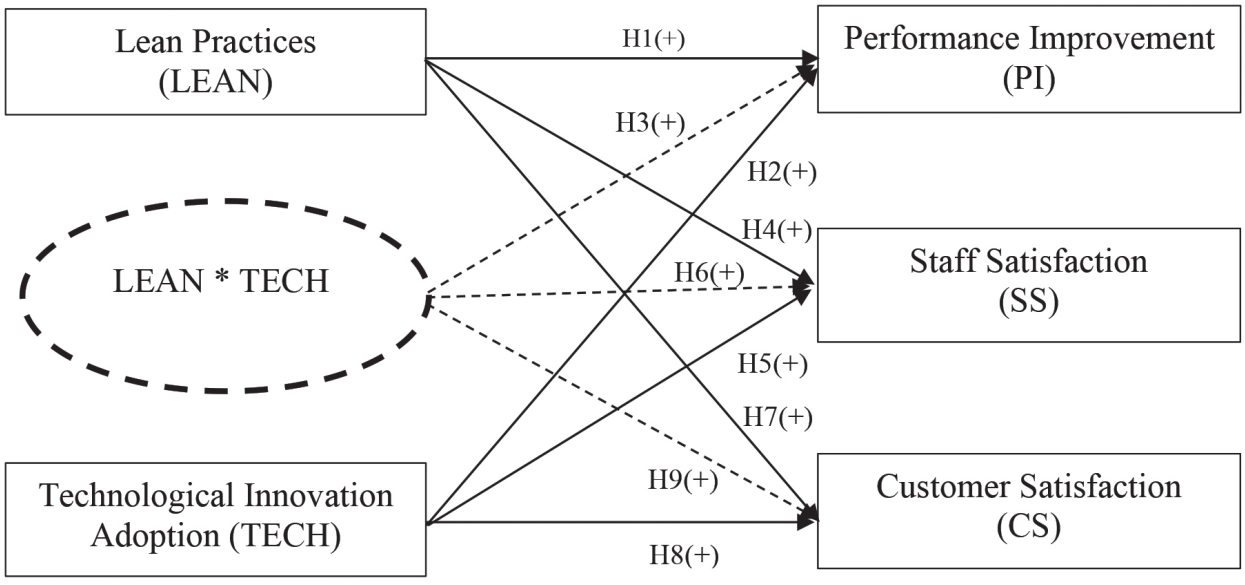


**Figure 1.** Research model. Source: Authors own work

**Table 1.** Demography of survey sample

| Category | Response | Frequency | Percentage |
|---|---|---|---|
| Ownership | State-owned | 4 | 3.3% |
| | Private | 118 | 96.7% |
| Star rating | 1-star | 9 | 7.4% |
| | 2-star | 55 | 45.1% |
| | 3-star | 45 | 36.9% |
| | 4-star | 13 | 10.6% |
| Years of operation | Less than 5 years | 78 | 63.9% |
| | 5-10 years | 33 | 27.1% |
| | More than 10 years | 11 | 9.1% |

*Source: Authors own work*

# 4. Analytical results

## 4.1 Measurement test

As presented in Table 2, Cronbach's alpha values of all variables are within the acceptable range of 0.7 – 0.95 [35]. Exploratory Factor Analysis was conducted to examine whether the items within the measurement scale collectively represent the same underlying construct. The Kaiser-Meyer-Olkin measure of sampling adequacy was 0.940, indicating that the data were suitable for factor analysis. Bartlett's test of sphericity was significant, confirming the appropriateness of the factor model. The analysis revealed that all items were loaded onto five distinct factors, explaining a cumulative variance of 71.726%.

The descriptive analysis indicates that the overall adoption of lean practices among hotels in Da Nang is moderately high, with an average score of 3.766 on a 5-point Likert scale (SD = 0.784). This mean value suggests that hotels generally agree that lean practices are being implemented, though the level of adoption is not yet strongly entrenched. The minimum and maximum scores (1.0 to 5.0) show considerable variation across respondents, implying that while some hotels have fully integrated lean practices into their operations, others are still at a very early or even non-adoption stage. Overall, these results reflect a positive but uneven implementation landscape and many hotels are progressing toward lean-based operational improvements.

As presented in Table 3, across all statements, the distribution of responses demonstrates a fairly positive level of lean adoption in hotel in Vietnam. A substantial share of respondents selected ratings of 4 and 5 indicating that lean practices are implemented proactively across most operational areas. Conversely, ratings in the 1–2 range appear only sparsely, suggesting that only a very small proportion of hotels report limited or absent lean adoption. Among the examined dimensions, process optimization and energy-saving initiatives exhibit the highest mean values (both 3.84), reflecting the particular emphasis hotels place on reducing waste in routine operations and improving the efficiency of resource utilization.

## 4.2 Correlation analysis

According to Table 4, Lean Practices, Technological Innovation Adoption and their synergy show positive associations with Performance Improvement, Staff Satisfaction and Customer Satisfaction. These associations are statistically significant at the 0.05 level.

**Table 2.** Descriptive analysis

| Variables | Cronbach's Alpha | Factor loadings | Min | Max | Mean | Standard deviation |
|---|---|---|---|---|---|---|
| Lean Practices | 0.948 | 0.684 - 0.775 | 1.0 | 5.0 | 3.766 | 0.784 |
| Technological Innovation Adoption | 0.920 | 0.596 - 0.738 | 1.0 | 5.0 | 3.730 | 0.683 |
| Performance Improvement | 0.927 | 0.645 - 0.782 | 1.14 | 5.0 | 3.337 | 0.850 |
| Staff Satisfaction | 0.931 | 0.643 - 0.822 | 1.50 | 5.0 | 3.639 | 0.626 |
| Customer Satisfaction | 0.921 | 0.520 - 0.637 | 1.50 | 5.0 | 3.539 | 0.800 |

*Source: Authors own work*

**Table 3.** Level of lean practices implemented in Vietnamese hotels

| Statements | Min | Max | Mean | Frequency of response | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | 1 | 2 | 3 | 4 | 5 |
| The hotel actively reviews job functions, job descriptions, and work assignments to streamline its organizational structure and human resources. | 1.00 | 5.00 | 3.59 | 3 | 1 | 59 | 39 | 20 |
| The hotel actively optimizes management and operational processes to reduce waste across all business activities. | 1.00 | 5.00 | 3.84 | 3 | 1 | 33 | 60 | 25 |
| The hotel strictly controls service quality to eliminate waste caused by poor service performance. | 1.00 | 5.00 | 3.79 | 3 | 1 | 40 | 53 | 25 |
| The hotel optimizes purchasing and input supply activities to eliminate waste in inventory and storage. | 1.00 | 5.00 | 3.79 | 3 | 1 | 41 | 51 | 26 |
| The hotel implements energy-saving practices to reduce waste in the use of energy, fuel, and materials. | 1.00 | 5.00 | 3.84 | 3 | 1 | 39 | 48 | 31 |
| The hotel actively minimizes waste in investment and business expansion activities. | 1.00 | 5.00 | 3.75 | 4 | 0 | 48 | 41 | 29 |

*Source: Authors own work*

**Table 4.** Correlation analysis results

| | | PI | SS | CS |
|---|---|---|---|---|
| LEAN | Pearson Correlation | .692 | .591 | .774 |
| | Sig. (2-tailed) | .000 | .000 | .000 |
| | N | 122 | 122 | 122 |
| TECH | Pearson Correlation | .757 | .542 | .737 |
| | Sig. (2-tailed) | .000 | .000 | .000 |
| | N | 122 | 122 | 122 |
| LEAN * TECH | Pearson Correlation | .789 | .625 | .817 |
| | Sig. (2-tailed) | .000 | .000 | .000 |
| | N | 122 | 122 | 122 |

*Source: Authors own work*

## 4.3 Hierarchical regression

Hierarchical regression allows researchers to examine the effects of Lean Practices, Technological Innovation Adoption and their synergy separately. At first, Lean Practices (LEAN) were put into model 1, and then Technological Innovation Adoption (TECH) was added into model 2. After that, the interaction between Lean Practices and Technological Innovation Adoption (LEAN * TECH - synergistic effect) was put into model 3 to validate its strength and significance.

As shown in Table 5, Lean Practices and Technological Innovation Adoption have significant positive impact on Performance Improvement, Staff Satisfaction and Customer Satisfaction. Additionally, their synergy also shows significant positive effect on the aforementioned dependent variables. These results demonstrate that both Lean Practices and Technological Innovation Adoption independently contribute to better organizational outcomes, and when combined, their impact becomes even stronger. This synergy suggests that lean and technology adoption reinforce each other, creating more efficient operations, more satisfied employees, and improved customer satisfaction. Ultimately, the findings prove that integrating lean with technological innovation is a powerful strategy for enhancing overall performance.

**Table 5.** Hierarchical regression results

| *Hierarchical regression on performance improvement* | | | | | |
|---|---|---|---|---|---|
| Model | Variable | Adjusted $R^2$ | F-statistic | Standardized β | Hypothesis testing result |
| 1 | LEAN | 0.475 | 110.335* | 0.692* | H1 accepted |
| 2 | TECH | 0.606 | 94.053* | 0.540* | H2 accepted |
| 3 | LEAN * TECH | 0.624 | 67.868* | 0.840* | H3 accepted |
| *Hierarchical regression on staff satisfaction* | | | | | |
| Model | Variable | Adjusted $R^2$ | F-statistic | Standardized β | Hypothesis testing result |
| 1 | LEAN | 0.344 | 64.402* | 0.591* | H4 accepted |
| 2 | TECH | 0.364 | 35.605* | 0.234* | H5 accepted |
| 3 | LEAN * TECH | 0.381 | 25.792* | 0.862* | H6 accepted |
| *Hierarchical regression on customer satisfaction* | | | | | |
| Model | Variable | Adjusted $R^2$ | F-statistic | Standardized β | Change in adjusted $R^2$ |
| 1 | LEAN | 0.596 | 179.223* | 0.774* | H7 accepted |
| 2 | TECH | 0.654 | 115.365* | 0.364* | H8 accepted |
| 3 | LEAN * TECH | 0.663 | 80.211* | 0.621* | H9 accepted |

*Note: *Significant at 0.05; Source: Authors own work*

## 5. Discussion and implications

While the effects of lean practices and technological innovations on firm performance were investigated separately and recorded in previous literature, this research suggests that their combination could generate a synergistic effect that brings a greater impact on firm performance. Lean practices and technologies represent resources of a firm, and they complement each other if used effectively. The ineffective adoption of technological innovation creates waste as it increases the business costs, which go against the core principle of lean and undermine firm performance. On the other hand, a success in technological innovation adoption facilitates data-driven service process, reduces waiting time and operational costs which is well aligned with lean philosophy, as a result, hotel performance improvement is obtained. In addition, staff satisfaction is improved in a lean and technology-driven work environment which is consistent with the findings of Leyer et al. [23], and Shin et al. [3]. By applying lean practices, service firms in general in hotels in particular can simplify service process which reduces workload for employees. Meanwhile, technologies can be used to assist employees in lowering errors in repetitive tasks, increasing the confidence of when serving customers and task achievements. Last but not least, higher customer satisfaction is achieved by adopting lean practices and technological innovations. By standardizing service process, lean practices provide consistency in service delivery. Based on technological innovation, hotels can minimize waiting time, reduce error incidents and provide personalized customer experience. Combining lean practices with technological innovation brings a resonant effect on customer satisfaction as they not only improve service process efficiency but also improve quality outcomes.

Regarding theoretical implications, this research extends the current knowledge of the complementary effect between lean and technological innovation adoption. Previous research of Khanchanapong et al. [18] found a synergistic relationship of lean and technological innovation in the manufacturing sector. Meanwhile, this research reported that the same synergy can be found in service sector. Additionally, it not only enhances performance but also leads to higher staff and customer satisfaction. Moreover, it is suggested through this research that lean practices and technological innovation adoption are not independent approaches. By nature, lean is a process-oriented approach focusing on waste reduction, whereas technological innovation adoption requires extra investment and effort. However, adopting new technologies can improve the effectiveness of lean practices by offering advanced tools for analysis, process streamlining, and performance monitoring, which aims at the ultimate goal of lean – waste reduction and continuous improvement [20].

Several practical implications could be drawn from this research. In the wake of the Industrial Revolution 4.0, many new technologies have been introduced to the market with their potentials to enhance performance of organizations. This might lead

to technological myopia in which organizations overrely on technologies and neglect the compatibility between adopted technologies and management philosophy. Additionally, considering resource constraints of firms in Vietnam's hospitality sector, technology investment in isolation could bring limited values and risk wasting organization's resources. Instead, technological innovation should be strategically aligned with lean management principles. In particular, lean practices should be adopted first as the foundation of management for hospitality firms as it boosts service performance, employee and customer satisfaction. After that, suitable technological solutions should be gradually integrated generate maximized benefits. However, it is noteworthy that hotel service managers need to manage the adoption process closely to ensure its success. Otherwise, new technologies will become burdens that increase operational costs and management complexity. Some potential technological innovations should be considered by hotel managers to improve the effectiveness of lean practices. First, automated technologies such as housekeeping tracking and self-check-in system could be applied in hotels to reduce workload and enhance flexibility for employees. To create excellent customer experience, continuous improvement based on customer reviews should not be neglected. Digital survey and AI analysis are useful tools for hotel managers to evaluate customer satisfaction. Finally, the integration of hotel management system can support hotel managers to control service quality, identify bottlenecks and remove them from service operations.

## 6. Conclusion

This is the first research to examine the synergy between lean practices and technological innovation adoption in hospitality sector. This study enriches service management literature by moving beyond the isolated examination of lean practices or technological innovation. It introduces a novel integrative perspective that highlights how these two approaches interact to generate superior service outcomes. The research suggests that lean practices should not be seen as an endpoint but as a foundational layer that must be augmented by technology to realize full operational potential. From a practical standpoint, this highlights the need for a dual investment strategy, namely fostering a culture of continuous improvement while simultaneously adopting technologies that enhance responsiveness and customer experience. The study also advances the theoretical understanding of how operational management philosophies and technological capabilities jointly shape service excellence in modern hospitality contexts. This moves the discussion away from framing lean and technology as separate approaches, toward a more integrated perspective of "lean enabled by technology" providing a new conceptual lens for future research.

Some limitations are acknowledged in the research. First, the scope of findings in this research is limited in the hospitality sector, therefore, future research can expand to other service sectors to validate our findings. Secondly, the sample size consists of hotels in Da Nang City might not be representative for Vietnam market. Finally, other factors such as human resource quality and financial capital could be considered as they might have impact on the effective adoption of lean practices and technological innovation. In addition, future studies should investigate potential moderators - such as organizational culture, leadership style, or employee digital readiness - to better understand the mechanisms and conditions under which lean practices and technological innovation jointly enhance service outcomes. Besides, adopting longitudinal research designs would allow scholars to capture how the integration of lean and technology evolves over time and to identify long-term performance effects that cross-sectional studies cannot reveal. Finally, cross-country comparisons offer another valuable direction, as differences in national culture, regulatory environments, and technological maturity may influence the extent to which "lean enabled by technology" can drive service excellence.

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## Appendix A - Question items of all variables

| Code | Statements |
|---|---|
| *Lean Practices (LEAN)* | |
| LEAN1 | The hotel actively reviews job functions, job descriptions, and work assignments to streamline its organizational structure and human resources. |
| LEAN2 | The hotel actively optimizes management and operational processes to reduce waste across all business activities. |
| LEAN3 | The hotel strictly controls service quality to eliminate waste caused by poor service performance. |
| LEAN4 | The hotel optimizes purchasing and input supply activities to eliminate waste in inventory and storage. |
| LEAN5 | The hotel implements energy-saving practices to reduce waste in the use of energy, fuel, and materials. |
| LEAN6 | The hotel actively minimizes waste in investment and business expansion activities. |
| *Technological Innovation Adoption (TECH)* | |
| TECH1 | The hotel actively seeks new technologies to apply in business operations to better serve customers. |
| TECH2 | The hotel uses a Customer Relationship Management (CRM) system to enhance service quality. |
| TECH3 | The hotel's website provides multiple functions (e.g., room booking, online payment, service information) to support customer service. |
| TECH4 | The hotel maintains an active presence on major online booking platforms (e.g., TripAdvisor, Agoda, Hotels.com, Booking.com). |
| TECH5 | The hotel's Wi-Fi and internal LAN systems operate reliably and are regularly upgraded. |
| TECH6 | The hotel stores and analyzes customer information to understand customer behavior and forecast customer demand. |
| TECH7 | The hotel is moving toward a "Hotel 4.0" model (e.g., automation, Internet of Things, smart hotel technologies). |
| *Performance Improvement (PI)* | |
| PI1 | The hotel's labor productivity has continuously increased over recent financial years. |
| PI2 | The hotel's average revenue per employee has increased significantly. |
| PI3 | The hotel's average profit per employee has increased significantly. |
| PI4 | The hotel's market share has expanded significantly. |
| PI5 | The hotel's competitive capability has improved significantly. |
| PI6 | The hotel has significantly reduced waste in investment capital usage. |
| PI7 | The hotel's efficiency in using input materials has increased significantly |
| *Staff Satisfaction (SS)* | |
| SS1 | Employees are satisfied with their job at the hotel. |
| SS2 | Employees are satisfied with the salary and allowances provided by the hotel |
| SS3 | Employees are satisfied with the hotel's salary-increase policy. |
| SS4 | Employees are satisfied with the hotel's incentive bonus policy. |
| SS5 | Employees are satisfied with the hotel's welfare programs. |
| SS6 | Employees are satisfied with the hotel's promotion opportunities. |
| SS7 | Employees are satisfied with their relationship with hotel leadership. |
| SS8 | Employees are satisfied with their relationship with colleagues |
| SS9 | Employee job satisfaction has increased year by year. |
| SS10 | Employee turnover does not negatively affect the hotel's business operations. |
| *Customer Satisfaction (CS)* | |
| CS1 | Customers are satisfied with the hotel's products and services. |
| CS2 | The hotel's customer complaint rate has decreased significantly in recent years. |
| CS3 | The proportion of customers giving positive feedback has increased significantly in recent years. |
| CS4 | The rate of returning customers for the hotel's services has increased in recent years. |