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Exploring the triad influence of service innovation, service quality and customer orientation between big data analytics and hotel performance

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Abstract

Purpose – In the Malaysian hospitality sector, this study assesses the tripartite mediating role of service innovation, service quality and customer orientation between big data analytics and hotel performance. The goal is to provide insights into the interactions among big data utilization, service innovation, service quality and customer orientation, thereby enhancing hotel performance within the Malaysian context.

Design/methodology/approach – A total of 324 responses were collected from hotel managers in Malaysia using a Google e-survey. This study employed the partial least squares structural equation modeling (PLS-SEM) to analyze the data.

Findings – The study revealed a positive and significant relationship between big data adoption and hotel performance. Furthermore, the current study identified the mediating roles of service innovation, service quality and customer orientation in the relationship between big data and hotel performance within Malaysia's tourism industry.

Practical implications – The findings of this study offer valuable insights for hotel managers regarding the strategic utilization of these characteristics to enhance customer satisfaction, loyalty and overall business performance within the Malaysian hospitality sector.

Originality/value – This research work illuminates the interrelated dynamics of service innovation, service quality, customer orientation, big data and hotel performance; this research contributes to the current body of knowledge.

Keywords Hotel performance, Service innovation, Service quality, Customer orientation, Big data analytics

Paper type Research paper

1. Introduction of the study

In many countries, hospitality and tourism are essential to economic development (Hina *et al.*, 2024). In Malaysia, the hospitality and tourism sector ranks as the second-largest contributor to gross domestic product (GDP), about 4.4%, including the hotel industry (Olayiwola *et al.*, 2024). In terms of employment, the overall hospitality and tourism sector, including the hotel industry, employed 23.6% of total Malaysian employment. However, the hotel industry employed almost 119,793 employees in 1,605 registered business in Malaysia (Suppiah and

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Selvaratnam, 2020). Moreover, according to the Malaysian Association of Hotels (MAH), 120 hotels have closed, and the industry lost RM 6.5 million. Further, the hotel industry also observed an approximately 10% fall in total employment (MIDA, 2024). However, following the conclusion of the endemic phase, the hotel industry in Malaysia has begun to recover; as of July 2022, tourist arrivals are estimated at 1.07 million.

However, the factors hindering growth in the hotel industry include a decline in GDP, a lack of customer orientation, inadequate service quality, and insufficient service innovation. Besides, the Government of Malaysia implements smart tourism 4.0 to utilize the industrial revolution technologies to tackle these challenges and boost the hotel industry (MIDA, 2024). In simple words, the absence of these critical elements has hindered the development of a roadmap intended to enhance the hotel's performance up to expectations. Concerning these crucial elements, one smart tourism 4.0 technology is the big data analytics which serves as a transformative resource that benefits businesses by providing insights into potential customers, enhancing transparency, meeting objectives, and establishing a competitive advantage (Naz *et al*., 2023). In the hotel industry, the use of big data analytics enables management of hotels to understand the guest preferences which can help them improve the service quality and hotel performance. However, the effective utilization of big data analytics can be useful in Malaysia, one of Asia's most attractive travel destinations (Sharma *et al*., 2023). Moreover, the effective adoption of big data analytics can offer various advantages, such as cost reduction and providing more specialized and innovative services to travelers (Amat-Lefort *et al*., 2023).

The hotel industry is particularly vulnerable to market fluctuations due to its service-oriented nature. While big data facilitates stakeholders, such as hotels, in innovating new products and services, it is equally imperative for these stakeholders to continuously adapt their organizational processes and structures. Moreover, hotel industry, especially in developing economies such as Malaysia, often exhibits uncertainty toward the implementation and acceptance of big data analytics, due to challenges such as insufficient attention from upper management, competitive pressures, neglect of clients' immediate needs, a lack of unique selling propositions, and ineffective marketing strategies (Abdelhalim, 2023). However, the role of big data analytics cannot be neglected in this digital era, but on the other hand, in respect of developing economies, this technology is still at the birth stage. Past studies investigating the relationship between performance-related characteristics and big data have predominantly focused on the manufacturing and information technology sectors, mostly in technologically advanced countries (Alsayat, 2023). However, there is a scarcity of research examining this relationship within the travel and tourism sector, especially in developing economies such as Malaysia (Srivastava *et al*., 2023). Thus, the present study aims to investigate the adoption of big data analytic in the context of developing countries and especially in the service sector such as the hotel industry (Junco *et al*., 2023).

Moreover, in Malaysia, the hotel industry is characterized by intense competition, emphasizing service innovation, service quality, customer orientation, and the application of big data to enhance performance. These factors significantly influence customer satisfaction and loyalty within the tourism hotel sector, leading to higher hotel performance (Baharuden *et al*., 2019). Specifically, service innovation is critical in enhancing organizational performance and competitiveness (Lee *et al*., 2019). Nevertheless, a substantial gap exists in the research concerning the practical application of big data analytics to improve the hotel operations. The literature examining the impact of big data analytics on hotel performance—particularly through the lenses of service innovation, service quality, and customer orientation in Malaysia—is limited (Loh and Teoh, 2021), thereby rendering the key elements underlying performance in hospitality businesses unclear.

To bridge this research gap, the current research investigates the impact of service innovation, service quality, and customer orientation on the performance of hotels, specifically using big data analytics. The hotel industry has been selected as the focus due to its growing reliance on data-informed approaches toward improving customers' experiences and

satisfaction (Dash *et al*., 2023). While previous studies have investigated the importance of big data in hospitality, more needs to be understood about how it interfaces with service dimensions that impact hotel performance. Through the use of big data analytics, hotels are able to develop better insights into customer tastes, patterns, and trends in the market, which can be strategically embedded in customer-focused strategies (Riaz and Ali, 2024). Nonetheless, few studies have explored whether big data analytics drives hotel performance by virtue of the mediating effects of customer orientation, service innovation, and service quality. Bridging the gap, this current study contributes to the existing literature by providing an empirical test of such relationships, shedding new light on how big data analytics affects the success of hotels. The research will elaborate on these dimensions further through a systematic methodology, including a literature review, research methodology, data analysis, findings, discussion, implications, limitations, and recommendations for future studies.

2. Literature review

This section has reviewed past studies to clarify the current research gaps. Furthermore, construct development has been discussed, and hypotheses have been proposed based on past studies. Moreover, theoretical support is also discussed in this section.

2.1 Review of past studies in ASEAN countries

In the context of ASEAN, the study by Fernando *et al*. (2018) found the significant impact of big data analytics on supply chain innovation and the performance of service firms in Malaysia. Another study revealed the positive and significant role of big data analytics in improvement of social and environmental performance of banking sector in Malaysia (Ali *et al*., 2021b). Besides, a study conducted in Indonesia found that, the big data analytics bringing positive changes in supply chain resilience (Sheng and Saide, 2021). Furthermore, Vachkova *et al*. (2023) that big data analytics positively contribute to implementing customer relationship management, warehouse and operations improvement in manufacturing and services micro, small and medium enterprises in Malaysia.

Moreover, Sawangwong and Chaopaisarn (2023) collected the 240 responses from Thailand's manufacturing SMEs, revealing the influential role of big data analytics in enhancing SMEs supply chain reliability and efficiency. One more study conducted in Indonesia expressed that big data analytics also improves innovative behavior and employee performance in mining industry (Wahyudhi *et al*., 2023). A study by Le *et al*. (2023) observed the significant contribution of big data analytics in enhancement of sustainable corporate performance directly and indirectly through sustainable supply chain management in SMEs in Vietnam. Besides, the study of Chong *et al*. (2024) researched that big data analytics had improved the competitive advantage and firm performance of manufacturing firms in Malaysia. Afifa and Nguyen (2024) study investigated the 419 responses of manufacturing companies of Vietnam and suggests the big data analytics positively contributed to control of environmental concerns and improving the manufacturing industry environmental performance.

Although, on the basis of the above studies, collectively, these studies reveal that big data analytics and its related technologies are important for higher performance of companies in the ASEAN countries context. Based on the above review, the ASEAN countries have no single piece of evidence to explore the influence of big data analytics on hotel industry performance with triple mediation effects of service innovation, service quality, and customer orientation under Service-Dominant Logic Theory (SDLT). Refer to Appendix 1.

2.2 Hotel performance

Hotel performance is a critical factor in the hospitality industry; it indicates the efficiency of hotel operations. Various factors influence the hotel's performance, including internal

management practices and external market dynamics (Yadegaridehkordi *et al*., 2020). The proximity of competitors also plays a significant role, as competition among hotels can affect each other's performance (Park *et al*., 2024). Besides, service packages, brand innovation and customer satisfaction are interconnected elements influencing the hotel industry's profitability (Kankam-Kwarteng *et al*., 2022). Moreover, the corporate branding, customer loyalty, and customer experience also contribute to the overall performance of international hotels (Hariandja and Vincent, 2022).

Additionally, market structures affected the behavior of non-star hotels and their overall business performance (Nababan and Sinuraya, 2022). Similarly, outer factors, like COVID-19, recorded a significant impact on the operational performance of the hotel industry (Zhang *et al*., 2022). Concisely, understanding the above-discussed factors are important; merely the main concern of this study is to consider the potential factors in this dynamic business environment. In short, only limited studies have investigated the role of big data analytics on hotel performance along with triple mediation of service innovation, service quality, and customer orientation in the Malaysian hotel industry.

2.3 Big data and hotel performance

Big data analytics is recognized as a strategic resource that organizations can effectively leverage to detect changes in the business environment. Sangaiah *et al*. (2023) noted that big data represents an interdisciplinary domain that incorporates mathematical models, data science, and computer science methodologies for the systematic collection and analysis of data. The capacity to collect, examine, and interpret substantial datasets in order to derive business insights and convert them into competitive advantages also characterizes big data (Al-Dmour *et al*., 2023). Mikalef *et al*. (2019) define big data as "a firm's ability to acquire and analyze data for the development of insight by successfully coordinating and deploying its data, technology, and personnel" (p. 274).

However, numerous industries, especially the service sector, are particularly concerned about the empirical relationship between big data and firm performance. Many commercial enterprises invest significantly in technology and data infrastructure, and endeavor to align big data initiatives with their strategic objectives to gain the conceivable advantages (Hassani and Silva, 2023). Several studies provide comprehensive understanding into how big data affects and enhances overall hotel performance. The adoption of big data is in early stages in Southeast countries, although some studies have raised the importance of big data analytics for higher hotel performance.

For example, the study by Tabora (2024) pointed out that big data analytics is reshaping the hotel industry, especially in Singapore and Vietnam, they are using big data analytics to analyze the large amount of data and uncover the hidden insights and trends to enhance the customer journey and market it more pleasantly. The studies of Naz *et al*. (2024) addressed that big data analytics application in Malaysia is better than in other Southeast countries and contributes positively to hotel performance through innovation and better decision-making capabilities. Yadegaridehkordi *et al*. (2020) identified a significant link between big data analytics and improvements in hotel performance. Considering the focus on big data's potential to enhance hotel performance, this study examines the relationship between big data utilization and hotel performance outcomes. Additionally, Aakash and Gupta Aggarwal (2022) analyzed the global influence of big data on hotel performance. The findings of this study provide actionable guidance to executives on how to effectively employ big data analytics to enhance hotel performance and attain a competitive advantage in the tourism sector. Consequently, based on the preceding discussion, the following hypothesis is proposed:

H1. There is a positive relationship between big data analytic and hotel performance.

2.4 Intervening role of service innovation

In the hotel industry, service innovation is crucial for performance enhancement and competitiveness. Service innovation is defined as an "organization's ability to introduce new services that address the needs and preferences of its customers" (Wu *et al*., 2023). According to the SDLT theory, organizations develop service innovation through ongoing learning, experimentation, and adaptation. Companies that effectively leverage big data can utilize insights from data analytics to identify opportunities for service enhancement and differentiation, thereby facilitating continuous service innovation, leading to higher hotel performance (Zhu *et al*., 2022). More specifically, in the context of Southeast countries such as Singapore, Thailand, and Indonesia, few studies have revealed the direct positive significant role of service innovation in hotel performance improvement in Malaysia (Hilman and Kaliappen, 2015), Indonesia (Lemy *et al*., 2019) and Thailand (Pongsathornwiwat *et al*., 2019).

However, there is no single study to untap the mediating role of service innovation between big data analytics and hotel performance in the context of Southeast or Malaysia. Furthermore, Kankam-Kwarteng *et al*. (2022) explored the effects of new brand and service offerings on hotel performance, including the mediating roles of service innovation. The finding revealed that brand enhancements and service innovations shape visitors' perceptions to drive higher hotel performance. Furthermore, Khan *et al*. (2023) examined how open innovation and a focus on service innovation influenced the innovation capabilities of medium-sized and small private hospitals in India. This study offers valuable insights into comparable dynamics within the hotel sector by highlighting how open innovation strategies can play the intervening role between big data analytics and hotel performance. Malaysian hotels can improve their performance outcomes and competitiveness in the hospitality market by leveraging insights from big data to drive service innovation. Therefore, this study proposes the subsequent hypothesis:

H2. Service Innovation mediates the relationship between Big Data and Hotel Performance.

2.5 Intervening role of service quality

Service quality referred to the capacity of a company to deliver high-quality services that can meet client expectations (Rashid and Rasheed, 2024). According to the SDLT theory, organizations can cultivate service quality through ongoing monitoring, feedback, and improvement initiatives. Organizations utilize insights derived from big data analytics to identify strategies for enhancing service quality, optimizing service delivery processes, and addressing client complaints. According to Lin *et al*. (2024) research analyses online consumer reviews to explore the dimensions and characteristics of hotel service quality, underscoring the importance of understanding customer feedback to enhance service quality. Investigations such as those by Kumari *et al*. (2023) have revealed the hotel industry's often underestimated service quality, emphasizing the importance of addressing service gaps to improve guest experiences. Furthermore, Li *et al*. (2023) illustrate how user-generated images influence visitors' perceptions of service quality, emphasizing visual information's significant role in shaping visitors' expectations and experiences.

Basically, while big data analytics can boost hotel performance (Yadegaridehkordi *et al*., 2020), it's service quality that turns data-driven insights into memorable guest experiences. In simple words, consider big data as the engine of a car and service quality as the skilled driver steering it toward customer satisfaction and loyalty. In other words, hotel management can have the most powerful data engine, but without smooth, attentive service, they are just revving it without moving forward. Personalized check-ins and tailored recommendations may originate from algorithms, but it the warm smile at the front desk that truly makes the difference. Let's be real: Guests don't remember the data — they remember how the hotel made them feel. So, if hotels want to stay ahead, mastering both tech and touch is the winning combination.

As per past literature, big data analytics can improve the service quality to improve the customer experiences and operations of hotel businesses (Amat-Lefort *et al*., 2023). Furthermore, service quality significantly influences hotel performance in terms of improving customer loyalty and financial performance (Ali *et al*., 2021a). Hence, service quality likely plays an intervening role between big data analytics and hotel performance. Basically, the Malaysian hotels can maximize their performance outcomes in the tourism industry by utilizing the maximum potential of big data analytics to leverage the service quality. Therefore, based on this discussion, the following hypothesis is proposed:

H3. Service Quality mediates the relationship between Big Data and Hotel Performance.

2.6 Intervening role of customer orientation

Lastly, a customer-oriented organization focuses on comprehending and satisfying the wants and preferences of its clients (Rahaman *et al*., 2023). Customer orientation refers to a mindset and a system of organizational practices that facilitate ongoing learning about the preferences and behaviors of customers within the theoretical framework of SDLT. Client-focused businesses leverage insights from big data analytics to personalize their services according to each customer's unique needs, thereby enhancing customer satisfaction and loyalty, leading to better hotel performance (Zhao, 2022). In the hospitality sector, particularly in hotels, where success is contingent upon understanding and fulfilling patrons' demands, customer orientation is paramount. Research conducted by Liu *et al*. (2020) demonstrates the significance of prioritizing customer requirements for achieving corporate success, revealing a positive correlation between customer orientation and financial performance in hotels. This underscores the importance of placing customer satisfaction at the forefront and aligning business strategies with customer expectations.

Basically, in the hospitality world, big data analytics isn't just a buzzword; it's the secret sauce that helps hotels figure out what makes guests tick. By digging into booking patterns, past preferences, and even those feedback forms you fill out half-heartedly, hotels can fine-tune their services like a well-oiled machine. Imagine a hotel knowing you prefer extra pillows, late check-outs, and gluten-free pancakes without you saying a word. That's how big data turns guesswork into guest work. But it's not just about fancy perks; it's about crafting experiences that make customers feel understood. Using big data to adopt a customer-first approach benefits all parties involved. Guests leave happy (and well-fed), and hotels boost loyalty, online reviews, and let's be honest, and profits as well. It is proof that in hospitality, data-driven insights aren't just smart, their hospitality's new love language. In short, big data analytics not only improves customer orientation but alternatively improves overall hotel performance.

Theoretically, Zhang and Song (2022) big data analytics significantly impacts customer orientation. In turn, customer orientation positively influences hotels' financial performance (Dah *et al*., 2023). Therefore, customer orientation could mediate between big data analytics and hotel performance in Malaysia. Furthermore, the study of Karatepe and Douri (2012) that found the mediating role of customer orientation between job resourcefulness and employee outcomes in Iranian hotels. This study lays the groundwork to understand the mediating role of customer orientation bring the full potential of big data analytics toward higher hotel performance. Malaysian hotels can enhance their performance by leveraging big data analytic insights to drive customer-centric initiatives. Therefore, this study proposes the following hypothesis:

H4. Customer Orientation Mediates the relationship between Big Data and Hotel Performance.

2.7 Service-dominant logic theory

Service logic dominant theory (SLDT) was proposed by Vargo and Lusch (2004). They explained that value is created through service and collaboration between companies and their

customers rather than just selling physical products. In other words, companies provide value by offering services and solutions, and customers play an active role in co-creating value (Lusch *et al*., 2008). However, this makes companies more focused on customers and makes them more competitive (Doherty, 2015). Basically, the main purpose of SLDT is to create value co-creation; in simple words, co-creation is created by the company and customer together, rather than standing alone.

However, in respect to big data analytics, it produced bulk customer data, which helps organizations to improve their personalized experience with customers and create value (Sharma *et al*., 2023). Big data analytics act like operant resources which enable hotels to increase the service innovation, service quality and customer orientation through data-driven insights (Lusch *et al*., 2008). This framework shifts the focus from tangible goods to services (Gannage, 2014), as goods dominant logic viewed the service innovation as output of the products, but the service dominant logic view sees the service innovation as continuous process which bring by customer interaction and learning (Mele *et al*., 2014). The service innovation involves customers proposing their ideas; later, companies can incorporate these customized ideas and create value (Magnusson, 2003).

Besides, service quality also brings co-creation to enhance the quality of services with involvement or feedback from customers, which obviously helps companies to create co-creations, as we know it helps to increase the company's performance overall (Bell, 2019). Moreover, customer orientation brings the customer priorities and involves them in the value co-creation process, which ultimately brings higher hotel performance (Kuzgun *et al*., 2022). However, based on a co-creative approach, the advice that hotels should measure beyond the financial outcome, here customers' engagement is key for success. In short, research framework with incorporating with SDLT create value in the hotel sector. In simple words, service innovation, service quality, customer orientation, and big data analytics are key value co-creation enablers, and as value co-creation brings higher hotel performance in return (see Figure 1).

3. Methodology

The selection of hotels in Malaysia serves as a suitable context for this research due to well international recognize destination. The current study utilized a sampling frame of 1,120, derived from the website of the Malaysian Association of Hotels (PHM, 2024). According to the table provided by Krejcie and Morgan (1970), a sample size of 324 was determined for this

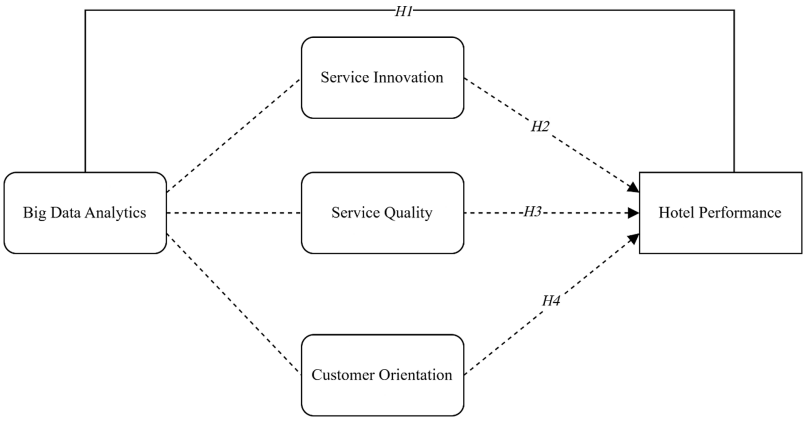


Figure 1. Research framework. Source: Authors' own work

study. The unit of analysis is positioned at the organizational level. Approximately 500 questionnaires were distributed among the managers of the target hotels in accordance with the sampling frame.

As the data collected, most of the hotels situated in major cities, such as 80 hotels targeted at Kuala Lumpur, 49 hotels approached from Penang, 33, 21, 19, 34, 30, and 58 hotels contacted from Johor Bahru, Alor Setar, Sungai Patani, Malacca, Ipoh, and Langkawi respectively. Furthermore, 9, 35, 106, 110 and 64 categories as 1-, 2-, 3-, 4- and 5-star hotels respectively. The study encompassed a range of hotels, from budget (1 star to 2 star) to luxury 3-, 4-, and five-star hotels. The category and area of distribution of hotels can be seen in Appendix 2. Respondents were approached through online surveys. Additionally, this study took approximately one year and one month to achieve the required sample size, with a recorded response rate of 64.80% relative to the total sample size for data analysis. The current study response rate is higher than the recent study response rate of 63.33% (Naz *et al*., 2023), which is enough to reduce the response biases.

In respect to demographics chrematistics of this study recorded as 49% male and 51% female. Along with gender, the age reported to be between 20–30, 44%, 35–45, 45%, 11% reported were over 45 years. Among the participants, 44% hold managerial positions, 21% serve as assistant managers, and 35% work as supervisors. In terms of educational attainment, 17% completed matriculation, 37% achieved an intermediate level of education, and 46% possess a bachelor's degree or higher.

Furthermore, to address worries about mistakes from people not replying, this study examined whether there were differences between early and late responses on key variables of the study like big data analytics, service innovation, service quality, customer orientation, and hotel performance, using the methods outlined by Wagner and Kemmerling (2010). The analysis of non-response indicated no significant differences among the five paired groups (p-values >0.05), which further suggests that non-response bias is not a concern for this study, as detailed provided in Appendix 3.

Additionally, this study also has covered the common method bias (CMB) concerns. In this regard, the current study has run the Harman's one-factor test on the collected data as per the guidelines of Podsakoff *et al*. (2012). This test treated all items as a single factor and yielded the results presented by (Fuller *et al*., 2016). The findings from this test indicated a common variance percentage of 35.71%, which is below the 50% threshold, thereby suggesting that CMB is not an issue in this study. The results are available in Appendix 4.

3.1 Scale of the study

The scale for hotel performance with total eight items, is derived from the study conducted by Chand (2010). Additionally, the scale of big data, consisting of four items, is based on the research by Yadegaridehkordi *et al*. (2020). Furthermore, the scales for service innovation, service quality, and customer orientation are sourced from the studies of Hu *et al*. (2009), Chand (2010), and Grissemann *et al*. (2013), respectively.

4. Data analysis and findings

This study has utilized partial least-squares structural equation modeling (PLS-SEM) to analyze the data and derive the results. The PLS-SEM technique is more reliable for complex models such as in current study case. Thus, this study has employed the SmartPLS 4 to execute the PLS-SEM analysis. The analysis was run in two stages, first the measurement model evaluated the data reliability and validity; second, the structural model was tested the hypotheses to draw the study conclusions.

4.1 Reliability and convergent validity of the constructs

According to Table 1, the Cronbach's alpha and composite reliability were employed to assess the reliability of the constructs. Reliability refers to the accuracy and consistency of the study's

Table 1. Reliability and convergent validity of the constructs

Constructs	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
Big data adoption	0.886	0.890	0.921	0.746
Customer orientation	0.832	0.839	0.889	0.666
Hotel performance	0.900	0.902	0.920	0.589
Service innovation	0.903	0.905	0.919	0.510
Service quality	0.891	0.893	0.911	0.506

Source(s): Authors' own work

measurements. Christmann and Van Aelst (2006) assert that the values of Cronbach's alpha and composite reliability should exceed 0.70; this criterion has been met, as indicated in Table 1.

Additionally, with regard to convergent validity, the average variance extracted (AVE) for the constructs should be greater than 0.50 (Hair *et al.*, 2019). The AVE criterion serves as a benchmark to evaluate whether the indicators of a latent variable converge sufficiently to represent the underlying construct. Consequently, the AVE values for all constructs exceeded 0.50, as demonstrated in the results presented in Table 1 and Figure 2.

4.2 Discriminant validity of the constructs

The HTMT criterion was employed to verify the validity of the constructs. Discriminant validity ensures that the measurements utilized in this study accurately capture distinct constructs rather than yielding similar results due to inherent similarities. Ab Hamid *et al.* (2017) indicate that HTMT values should be less than 1, suggesting that all constructs are

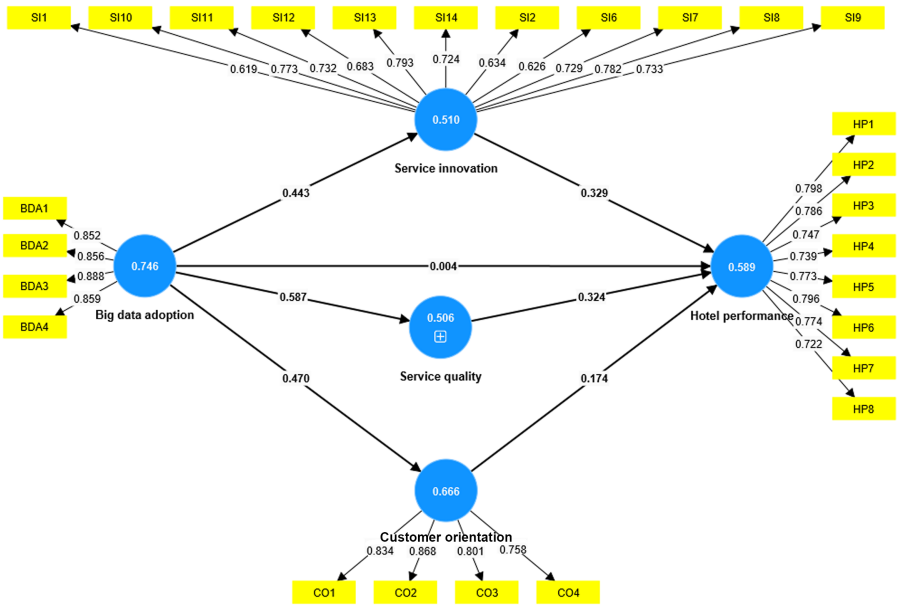


Figure 2. Measurement model. Source: Authors' own work

sufficiently differentiated, thus confirming the validity of the constructs. Consequently, Table 2 demonstrates that the recorded values are all less than 1.

4.3 Model fitness

This study assessed the model fitness using standardized root mean square residual (SRMR) and the normed fit index (NFI) criteria. The value of SRMR and NFI should be less than 0.08 and 0 to 1, respectively (Hu and Bentler, 1998). The results presented in Table 3 indicate that the SRMR value is 0.063, which is below the threshold of 0.08, and the NFI value is approximately 0.77, which is also relatively close to 1. Therefore, these findings suggest that the model is suitable for the research framework.

The result can be seen in Table 3.

4.4 Structural model

The present study examined the structural model utilizing a bootstrapping method with a subsample size of 5,000, applying a t-statistic threshold of 1.96 and a significance level of 0.05. The analysis revealed a positively significant direct relationship between big data and hotel performance. These results are detailed in Table 4 and Figure 3.

Furthermore, the mediating roles of service innovation, service quality, and customer orientation between big data analytics and hotel performance have been examined, with all hypotheses supported. The results are presented in Table 5.

Table 2. HTMT criterion

Constructs	Big data adoption	Customer orientation	Hotel performance	Service innovation	Service quality
Big data adoption					
Customer orientation	0.542				
Hotel performance	0.470	0.653			
Service innovation	0.491	0.626	0.689		
Service quality	0.657	0.778	0.717	0.682	

Source(s): Authors' own work

Table 3. Model fitness

Criteria	Saturated model
SRMR	0.063
NFI	0.770

Source(s): Authors' own work

Table 4. Direct relationship

Hypothesis	Beta	Standard deviation	*T* statistics	*p* values	Decision
H1: Big data adoption → Hotel performance	0.423	0.045	9.474	0.000	Supported

Source(s): Authors' own work

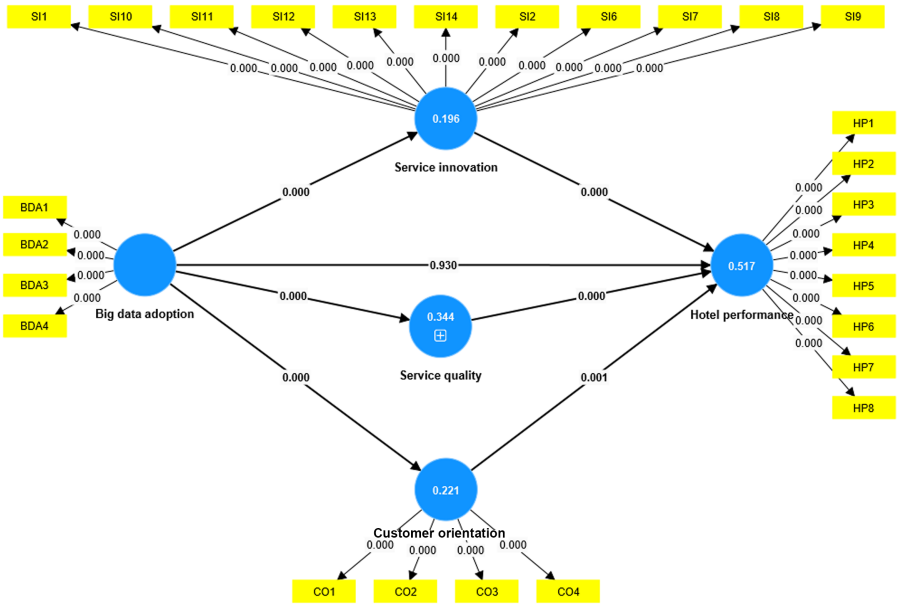


Figure 3. Structural model. Source: Authors' own work

Table 5. Mediation results

Hypothesis	Beta	Standard deviation	*T* statistics	*p* values	Decision
H2: Big data adoption → Service innovation → Hotel performance	0.149	0.029	4.974	0.000	Supported
H3: Big data adoption → Service quality → Hotel performance	0.194	0.040	4.725	0.000	Supported
H4: Big data adoption → Customer orientation → Hotel performance	0.081	0.027	3.083	0.002	Supported

Source(s): Authors' own work

Furthermore, this study employed the criteria established by Zhao *et al*. (2010) to identify the types of mediation. As illustrated in Figure 3, the findings indicate that all three mediation relationships exhibited complementary mediation. In simple words, big data analytics has an indirect relationship with hotel performance through service innovation, service quality and customer orientation, means data driven services, quality of service and meeting the customers' needs brings higher hotel performance in Malaysia. Furthermore, complementary mediation has happened in this study because when two and more mediating variables such as service innovation, service quality and customer orientation work to reinforce or strengthen the relationship between independent and dependent variables such as big data analytics and hotel performance.

5. Discussion and conclusion

5.1 Conclusion

The main objective of the study is to investigate whether big data analytics drives hotel performance by virtue of the mediating effects of customer orientation, service innovation, and

service quality. Bridging the gap, this current study contributes to the existing literature by providing empirically tested such relationships, shedding new light on how big data analytics affect the success of hotels. In this view, the research framework has developed using service-dominant logic theory (SDLT), and several hypotheses were tested. 324 responses have been collected from hotel managers and found a positive and significant relationship between big data analytics and hotel performance; thus, hypothesis H1 is accepted. This finding is consistent with the studies conducted by Aakash and Gupta Aggarwal (2022). In simpler terms, big data is regarded as a crucial resource for enhancing hotel performance, particularly in an intensely competitive environment.

Big data gives businesses key advantages, including cost savings, improved risk management, increased revenue, and enhanced decision-making capabilities. Without recognizing these benefits, organizations would lack a clear incentive to implement big data. Furthermore, our research supports a positive relationship between the adoption of big data and firm performance. Globally, companies increasingly rely on big data analytics to enhance their performance (Nam *et al*., 2015). The effective utilization of big data can significantly improve a company's performance (McAfee *et al*., 2012). According to Verma (2017), big data enhances marketing outcomes and improves data management and results in substantial cost savings. Ultimately, the application of big data can secure a competitive advantage for firms, leading to improved performance.

Additionally, the current study reveals the positive and significant mediating roles of service innovation, service quality, and customer orientation between big data and hotel performance in Malaysia. Thus, hypotheses 2, 3, and 4 are supported. The current study posits that big data analytics influences hotel performance directly and indirectly through service innovation, service quality, and customer orientation within Malaysia's tourism industry. In other words, leveraging big data can enhance service innovation by providing insights into customer preferences, thereby improving hotel services and, consequently, hotel performance. This suggests that the capacity of hotels to innovate their services by utilizing insights derived from big data is a key factor in enhancing performance. By utilizing big data, hotels can identify emerging trends, personalize guest experiences, and develop new service offerings that address the evolving needs of their customers. This aligns with the broader understanding that innovation, driven by data insights, is crucial for maintaining competitiveness in the hospitality industry.

Moreover, regarding service quality, big data facilitates understanding customer behavior and feedback concerning their expectations. Addressing this information can lead to improvements in service quality, ultimately enhancing hotel performance. Furthermore, big data analytics enable hotels to adopt a customer-centric approach, thereby improving customer satisfaction and loyalty, which in turn boosts hotel performance. The utilization of big data allows hotels to continuously monitor and enhance the quality of their services. For example, by analyzing customer feedback and operational data, hotels can identify areas for improvement, streamline processes, and ensure that the quality of service meets or exceeds customer expectations. High service quality is essential in the hospitality industry, where customer satisfaction directly impacts a hotel's reputation and performance.

Furthermore, big data enables hotels to gain a deeper understanding of their customers' preferences, behaviors, and needs. This customer-centric approach allows hotels to tailor their services and marketing strategies to better meet the demands of their clientele, resulting in higher levels of customer satisfaction and loyalty. In an industry where customer experience is paramount, this focus on customer orientation, supported by big data, serves as a critical driver of improved performance.

5.2 Theoretical implications of the study

In terms of academic contributions, this study empirically examined the triadic influence of service innovation, service quality, and customer orientation on the relationship between big

data analytics and hotel performance within the context of hotel industry of Malaysia under the theoretical support of Service-Dominant Logic Theory (SDLT), which is currently underexplored. Although research on big data analytics is still in its early stages concerning theoretical development, the SDLT offers a comprehensive understanding of the interactions involved in the adoption of big data analytics as it pertains to service innovation, service quality, customer orientation, and hotel performance.

However, this study provides valuable theoretical insights aligned with SDLT. The findings establish that big data adoption significantly enhances hotel performance, illustrating the importance of operant resources like data-driven insights in achieving strategic advantages. Additionally, the mediating roles of service innovation, service quality, and customer orientation reflect the SDLT principle of value co-creation, emphasizing collaboration between businesses and customers. These mediators demonstrate the integration of resources and the relational dynamics central to SDLT, where innovation and customer engagement play vital roles in generating value. The study contributes to SDLT by showcasing how big data supports resource integration and co-creation processes, particularly within the Malaysian tourism and hospitality industry. Furthermore, the study is based on a substantial sample size, comprising 324 responses from the hotel industry at the firm level. Consequently, this research enhances both the theoretical and operational understanding of the interplay among big data analytics, service innovation, service quality, customer orientation, and hotel performance. Additionally, the study offers distinct perspectives on the relative importance of these constructs, providing valuable insights that can assist hotel managers in effectively adopting big data analytics, service innovation, service quality, and customer orientation to improve hotel performance.

5.3 Practical implications of the study

This study contributed to providing the implications for the management of hotel owners and managers in Malaysia. The findings emphasize the need for Malaysian hotel management to recruit highly skilled employees with IT-based capabilities, such as big data analytics awareness, especially in line with Malaysia's digital transformation goals under initiatives like the Malaysia Digital Economy Blueprint (MyDIGITAL). This study provides strong findings regarding understanding service innovation, service quality, and customer orientation, which are critical for Malaysia's hospitality sector to attract both domestic and international tourists. Spending on thorough training and development programs will make hotel services richer, enhancing travel experiences by implementing activities such as mobile check-in, artificial intelligence concierge services, and smart room technology. These online advancements will help place Malaysian hotels as technologically driven service entities with a competitive advantage over their regional rivals Thailand and Singapore. Furthermore, management of hotels can maintain their service consistency and delivery as per customers' expectations and on time, such as clean services and friendly staff. In addition, the research results invite Malaysian hotel managers to focus on customer needs and wants through immediate customer feedback, anticipatory service solutions, and customized experiences, which are particularly important in tourist areas such as Langkawi, Penang, and Kuala Lumpur.

Hotel managers encourage the big data analytics capabilities to provide the innovative and quality-oriented services travelers want, as well as turn into customer-focused quality services and understand the customers' needs and provide them with innovative solutions to maintain the hotels' sustainable competitive advantage. In short, owners/managers of the hotel industry are encouraged to put their effort in the right direction, such as 1. changing their style of work from traditional operations to digitalization, 2. building IT-based capabilities, specifically big data analytics understanding at individual and organizational levels, and 3. Introducing value-added services to maintain the hotel's performance for a long time. Consequently, it is strongly recommended that senior management within the hotel sector and policymakers in Malaysia's tourism industry should not ignore the consideration of the effective implementation of big

data analytics in conjunction with service innovation, service quality, and customer orientation to enhance industry performance.

5.4 Limitations and future recommendations

Despite its contributions, this study has several limitations. First, the cross-sectional design restricts causal inference, as data was collected at a single point in time. Future research should adopt a longitudinal approach to track changes over time and validate the relationships between big data utilization, service innovation, service quality, customer orientation, and hotel performance. Second, the use of self-reported information from hotel managers has the potential for biases, including social desirability and subjective opinions. Using multiple sources of data, including financial reports, customer complaints, and third-party ratings, would increase measurement validity and reduce common method bias. Third, the generalizability of the study is constrained because it is conducted within the Malaysian hotel sector. Future studies may apply the framework to other industries and service sectors, including manufacturing, to test if similar associations exist. The study also collected data mainly from urban regions in West Malaysia and may not represent regional differences fully. Future studies should sample rural regions and East Malaysia to gain a more holistic view. Extending the research to other nations would further enhance the generalizability of the results across various economic and cultural contexts. In addition, although the mediating functions of service innovation, service quality, and customer orientation were studied in this study, potential moderators were not examined. The potential moderators, such as government assistance, management support, and policy regulations, can be useful for future studies to extend the current study's research work.

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Appendix 1

Table A1. Review of past studies in ASEAN countries

Citation	Sample size	Independent variables (IV)	Dependent variables (DV)	Mediating/Moderating variables	Findings	Country
Fernando *et al*. (2018)	145	Big Data Analytics, Data Security	Service Supply Chain Performance	Service Supply Chain Innovation Capabilities	Big data analytics positively impacts service supply chain innovation and performance	Malaysia
Ali *et al*. (2021)	407	Big Data Predictive Analytics (BDPA)	Social and Environmental Performance	Organizational Culture	BDPA improves social and environmental performance in Islamic banks	Malaysia
Sheng and Saide (2021)	207	Big Data, Knowledge Ambidexterity	Supply Chain Survivability	Virtual Enterprise	Virtual enterprises mediate the relationship, enhancing supply chain resilience in Indonesia	Indonesia
Vachkova *et al*. (2023)	202	Big Data Predictive Analytics (BDPA)	Operational and Innovation Performance	Firm Size	BDPA enhances CRM and warehouse operations but faces barriers in adoption among Malaysian MSMEs	Malaysia
Sawangwong and Chaopaisarn (2023)	240	Industry 4.0 Technological Pillars	Supply Chain Performance	None	Real-time data and automation significantly enhance Thai SMEs' supply chain reliability and efficiency	Thailand
Wahyudhi *et al*. (2023)	119	Big Data Analytics, Innovative Work Behavior	Employee Performance	None	BDA and innovative behavior improve employee performance in Indonesian mining contractors	Indonesia
Le *et al*. (2023)	495	Big Data-Driven Supply Chain Management (BDSCM)	Sustainable Corporate Performance (SCP)	Circular Economy Thinking Application (CETA)	BDSCM enhances SCP directly and indirectly via SSCM, moderated by CETA	Vietnam
Chong *et al*. (2024)	191	Big Data Analytics Capability (BDAC)	Competitive Advantage, Firm Performance	None	BDAC improves competitive advantage and firm performance in Malaysian manufacturing firms	Malaysia
Naz *et al*. (2024)	260	Big Data Analytics Capability (BDAC), AI Capability	Hotel Performance	Environmental Dynamism	BDAC and AI improve hotel performance, moderated by environmental dynamism	Malaysia
Afifa and Nguyen (2024)	419	Big Data Analytics (BDA)	Environmental Performance	Environmental Strategy, Digital Learning Orientation	BDA improves ENP, mediated by environmental process integration and moderated by strategy/orientation	Vietnam

Appendix 2

Table A2. Sample description

Area	1 star	2 star	3 star	4 star	5 star	Total
Kuala Lumpur	1	4	20	24	31	80
Penang	1	5	22	13	8	49
Johor Bahru		2	13	15	3	33
Alor Setar	2	4	8	5	2	21
Sungai Patani	1	2	9	5	2	19
Malacca	1	4	13	13	3	34
Ipoh	1	2	10	13	4	30
Langkawi	2	12	11	22	11	58
Grand Total	9	35	106	110	64	324

Appendix 3

Table A3. Paired samples test

		Paired differences							
		Mean	Std. deviation	Std. error mean	95% confidence interval of the difference Lower	Upper	t	df	Sig. (2-tailed)
Pair 1	Hotel_Performance_E – Hotel_Performance_L	1.79250	5.98886	0.84695	0.09048	3.49452	1.116	49	0.059
Pair 2	Service_Innovation_E – Service_Innovation_L	1.71866	11.01544	1.57363	−1.44535	4.88266	1.092	48	0.280
Pair 3	Service_Quality_E – Service_Quality_L	2.18353	10.69506	1.51251	−0.85597	5.22303	1.444	49	0.155
Pair 4	Customer_Orientation_E – Customer_Orientation_L	−0.18500	2.52579	0.35720	−0.90282	0.53282	−0.518	49	0.607
Pair 5	Big_Data_E – Big_Data_L	0.49000	2.62638	0.37143	−0.25641	1.23641	1.319	49	0.193

Appendix 4

Table A4. Total variance explained

Component	Initial eigenvalues			Extraction sums of squared loadings		
	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %
1	16.784	35.711	35.711	16.784	35.711	35.711
2	2.788	5.933	41.644			
3	2.411	5.129	46.774			
4	2.093	4.452	51.226			
5	1.787	3.803	55.029			
6	1.706	3.629	58.658			
7	1.284	2.732	61.390			
8	1.099	2.338	63.728			
9	1.034	2.200	65.928			
10	0.928	1.973	67.901			
11	0.820	1.744	69.645			
12	0.791	1.684	71.329			
13	0.750	1.595	72.924			
14	0.711	1.514	74.437			
15	0.664	1.413	75.850			
16	0.637	1.356	77.207			
17	0.616	1.310	78.517			
18	0.601	1.279	79.796			
19	0.560	1.192	80.988			
20	0.533	1.134	82.122			
21	0.505	1.073	83.195			
22	0.499	1.062	84.257			
23	0.478	1.018	85.275			
24	0.447	0.950	86.225			
25	0.437	0.930	87.156			
26	0.410	0.872	88.027			
27	0.394	0.839	88.866			
28	0.387	0.824	89.690			
29	0.373	0.793	90.483			
30	0.346	0.737	91.220			
31	0.340	0.723	91.943			
32	0.339	0.721	92.664			
33	0.328	0.699	93.363			
34	0.316	0.672	94.035			
35	0.300	0.639	94.674			
36	0.289	0.615	95.289			
37	0.256	0.545	95.833			
38	0.252	0.536	96.369			
39	0.237	0.504	96.873			
40	0.229	0.488	97.360			
41	0.214	0.455	97.815			
42	0.205	0.436	98.251			
43	0.195	0.416	98.666			
44	0.179	0.380	99.046			
45	0.170	0.361	99.407			
46	0.153	0.325	99.732			
47	0.126	0.268	100.000			

Note(s): Extraction Method: Principal Component Analysis