

Digital transformation in hospitality: the role of AI in enhancing business through gastronomic offerings

Digitalna transformacija ugostiteljstva: uloga veštačke inteligencije u unapredjenju poslovanja kroz gastronomsku ponudu

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Abstract

The impact of AI on the hospitality industry is increasingly significant. This paper explores the influence of digital transformation on the hospitality sector, with a particular focus on the role of artificial intelligence (AI) in enhancing business operations through gastronomic offerings. Digital technology is transforming the way hospitality establishments operate, offering new opportunities for optimizing operations, personalizing customer experiences, and efficiently managing resources. By analyzing the application of AI technologies, such as predictive analytics, personalized marketing, and automated ordering systems, the paper addresses how hospitality businesses can improve their competitive position and guest satisfaction. The study employs both qualitative and quantitative research methods to present successful examples of AI integration into business models, highlighting the benefits, challenges, and prospects for future development. Managers from 64 restaurants across the Republic of Serbia participated in the research, and the findings demonstrate the clear potential of artificial intelligence to transform hospitality, creating sustainable and innovative business practices.

Keywords: hospitality, business, gastronomic offer, artificial intelligence, innovation

Sažetak

Uticaj veštačke inteligencije na poslovanje u ugostiteljstvu je sve veće. Ovaj rad istražuje uticaj digitalne transformacije na ugostiteljski sektor, s posebnim fokusom na ulogu veštačke inteligencije u unapredjenju poslovanja kroz gastronomsku ponudu. Digitalna tehnologija menja način na koji ugostiteljski objekti posluju, pružajući nove mogućnosti za optimizaciju operacija, personalizaciju korisničkog iskustva i efikasno upravljanje resursima. Kroz analizu primene veštačke tehnologije, kao što su prediktivna analitika, personalizovani marketing i automatizovani sistemi za naručivanje, rad se bavi načinima na koje ugostiteljski objekti mogu poboljšati svoju konkurentsku poziciju i zadovoljstvo gostiju. Studija koristi kvalitativne i kvantitativne metode istraživanja kako bi prikazala uspešne primere integracije veštačke inteligencije u poslovne modele, ističući koristi, izazove i perspektive za budući razvoj. U istraživanju su učestvovali menadžeri iz 64 restorana na teritoriji Republike Srbije a rezultati istraživanja pružaju nedvosmislen potencijal veštačke inteligencije za transformaciju ugostiteljstva, stvarajući održive i inovativne poslovne prakse.

Кljučне речи: ugostiteljstvo, poslovanje, gastronomska ponuda, veštačka inteligencija, inovacije

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1. Introduction

In the modern business environment, digitalization has become a key success factor in many sectors, including hospitality (Mambetova et al., 2021). Digital transformation entails the integration of digital technologies into all aspects of business operations, enabling hospitality establishments to improve operational efficiency, optimize processes, and enhance the customer experience (Zsarnoczky, 2018). The hospitality sector, which encompasses restaurants, hotels, and other establishments that provide food and accommodation services, is facing increasing pressure to adapt to technological innovations and consumer expectations. In this context, digital transformation is not only an opportunity for growth and market differentiation but also a necessity for maintaining a competitive edge (Leão & da Silva, 2021).

One of the critical elements of digital transformation in hospitality is the application of artificial intelligence (AI), which is increasingly influencing various aspects of operations, customer experience, and gastronomic offerings (Buhalis & Moldavska, 2022). AI represents an advancement in the ability of computer systems to perform tasks that typically require human intelligence, such as speech recognition, decision-making, learning from data, and language comprehension. In hospitality, AI is used to optimize kitchen operations, personalize guest experiences, manage inventory, forecast demand, and analyze customer feedback, enabling more efficient operations and the provision of highly tailored services (Bisoi et al., 2020; Milton, 2024).

The application of AI technologies in hospitality offers numerous benefits, particularly in enhancing gastronomic offerings. Through data analysis on guest preferences, seasonal trends, and historical sales data, AI can help hospitality workers better understand their market and adjust their menus to meet changing tastes and guest needs (Knani et al., 2022; Cherenkov et al., 2024). AI-based dish recommendation systems can personalize the menu for each guest based on their previous orders and dietary preferences, thereby increasing guest satisfaction and brand loyalty. Additionally, AI can contribute to reducing food waste by optimizing inventory and menu planning, which is crucial for sustainability in hospitality (Milton, 2024).

Beyond improving gastronomic offerings, artificial intelligence significantly impacts the broader business models of hospitality establishments. The integration of AI technologies can aid in automating routine tasks, reducing operational costs, and increasing employee productivity (Buhalis et al., 2019; Cherenkov et al., 2024). For instance, chatbots and virtual assistants can automate the reservation process and respond to guest inquiries, while guest satisfaction monitoring systems can collect and analyze feedback in real-time, allowing management to respond quickly to market needs and expectations. These innovations not only improve operational efficiency but also enable hospitality establishments to

better adapt to market changes and enhance competitiveness (Cheah et al., 2018; Gajić et al., 2023).

This paper explores how digital transformation and the role of artificial intelligence influence the operations of hospitality establishments through the enhancement of gastronomic offerings. By analyzing successful examples of AI technology implementation in hospitality, the research demonstrates how these innovations can contribute to more efficient resource management, greater guest satisfaction, and improved business performance. Furthermore, it investigates the challenges and obstacles that hospitality establishments face during the digital transformation process, including implementation costs, the need for employee training, and changes in organizational culture. Finally, the authors provide recommendations for further research and the implementation of AI to improve business operations and achieve sustainable growth in hospitality.

2. Literature review

Digital transformation represents a key shift that encompasses all aspects of business, including the integration of new technologies into daily operations, improved communication with guests, and enhanced services (Busulwa et al., 2022). In the hospitality sector, this process is transforming business practices through the integration of modern technologies such as artificial intelligence (AI), automation, the Internet of Things (IoT), and big data analytics (Saini & Bhalla, 2022). These technologies enable hospitality establishments to achieve greater operational efficiency, optimize processes, and provide personalized services that meet the growing expectations of guests (Mercan et al., 2021).

Artificial intelligence (AI) plays an increasingly significant role in the digital transformation of hospitality establishments (Bisoi et al., 2020). Technologies such as machine learning, natural language processing, and recommendation systems are being increasingly used to optimize operational processes and improve the customer experience (Chiu et al., 2021). For example, machine learning enables detailed data analysis and demand trend prediction, aiding in better inventory management and reducing food waste (Miguéis et al., 2022). The use of natural language processing in the development of chatbots and virtual assistants automates guest communication, providing quick and relevant information. Simultaneously, recommendation systems that analyze previous interactions and guest preferences enable the creation of personalized offers, which can significantly enhance customer satisfaction (Sharma et al., 2021; Vukolić et al., 2023). Research emphasizes that personalization is key to creating an exceptional customer experience in hospitality. Through detailed analysis of guest preferences, order history, and feedback, it is possible to develop services and offers tailored to the specific needs and desires of clients (Rane et al., 2023). This approach not only increases guest loyalty but also strengthens brand image and competitiveness in the market.

Digital transformation also impacts the redefinition of business models in hospitality (Imtiaz & Kim, 2019). Changes in consumer habits and expectations, driven by technological advancements, require hospitality establishments to reassess their strategies and adapt to new trends (Buhalis et al., 2019). For instance, the rise in the popularity of online reservations and mobile apps has changed how guests interact with hospitality establishments, leading to the need for integrating various digital platforms into unified customer relationship management systems (Sigala, 2018). This enables tracking guest behavior across multiple channels and providing a consistent and personalized customer experience. Moreover, digital technologies contribute to better resource management and optimization of operational processes in hospitality (Iranmanesh et al., 2022). Automation of tasks such as order management, inventory control, and staff scheduling can significantly reduce operational costs and increase efficiency (Vaka, 2024). For example, using IoT technologies to monitor equipment and inventory status enables predictive maintenance and reduces the risk of downtime, resulting in time and cost savings (Lee et al., 2020).

Although the application of artificial intelligence and other digital technologies brings many benefits, challenges remain. The main challenges include the need to adapt organizational culture and train employees to work with new technologies (Borges et al., 2021). Hospitality establishments must invest in the training and development of their employees to ensure the successful implementation of digital solutions (Verevka, 2019; Vukolić et al., 2022). In addition, data security and privacy are becoming increasingly important issues as the use of digital platforms and the collection of guest data increase. Successful digital transformation in hospitality requires a holistic approach that encompasses technological innovations, adaptation of business models, and a focus on the customer experience (Ćurčić et al., 2019; Busulwa et al., 2022). Digital transformation is not merely technological progress but a strategic change that demands the integration of new technologies into the core of the business and continuous adaptation to market changes and guest needs (Gobble, 2018, Chernyshev et al., 2023).

Gastronomic offerings play a significant role in defining the guest experience in hospitality, and digital transformation greatly influences how these offerings are created, adapted, and managed (Busulwa et al., 2022; Adekuajo et al., 2023). Research highlights that technological innovations, including artificial intelligence (AI), allow hospitality establishments to better understand guest preferences and create personalized gastronomic offerings that meet their tastes and expectations (Hussein Al-shami et al., 2022; Milton, 2024). One of the most important aspects of the digitalization of gastronomic offerings is the use of AI for analyzing guest data and adapting menus (Hjalager, 2022). AI algorithms analyze historical order data, guest feedback, seasonal trends, and specific dietary preferences to suggest dishes that are most likely to appeal to guests (Cherenkov et al., 2024, Milton, 2024). This level of personalization not only improves

guest satisfaction but can also increase sales, as guests are more likely to order dishes tailored to their preferences. In addition to personalization, digital technologies enable more efficient management of gastronomic offerings through inventory optimization and food waste reduction (Principato et al., 2023). By using predictive analytics, hospitality establishments can more accurately forecast demand for certain ingredients and dishes, allowing for better inventory planning and ordering the exact quantity of necessary ingredients. This approach not only reduces operational costs but also contributes to sustainability by reducing waste (Swink et al., 2022).

Digital transformation can also introduce innovations in the menu creation process. For example, AI can analyze reviews on social media and restaurant rating platforms to identify popular dishes and ingredients, allowing kitchen staff and managers to adjust offerings based on real guest preferences (Perić et al., 2018; Martín-Martín et al., 2022). These insights can help hospitality staff quickly respond to changing trends and maintain the relevance of their offerings. Furthermore, AI enables hospitality businesses to experiment more easily with new dishes and concepts. Virtual kitchens and simulations, for instance, allow the testing of new recipes and menus without the need for physical preparation, reducing costs and risks associated with innovation (Huang et al., 2022). This flexible approach to menu development promotes creativity and the ability to quickly respond to shifts in demand. Innovations generally indicate that digital transformation, through the application of AI and other technologies, can significantly enhance gastronomic offerings and the overall guest experience in hospitality (Naumov, 2019). Research shows that hospitality establishments that successfully integrate digital tools into their operations can achieve greater efficiency, guest satisfaction, and a competitive advantage in the market (Mercan et al., 2021; Kitsios et al., 2021). Therefore, understanding and implementing these technologies is becoming increasingly important for success in the modern hospitality sector (Ruel & Njoku, 2021; Gajić et al., 2024).

3. Data and methodology

The data collection was conducted through a combination of methods, including surveys of managers from 64 hospitality establishments located in the urban centers of Serbia (Belgrade, Novi Sad, and Kragujevac), analysis of guest data and their preferences, as well as case studies of successful AI technology implementations in various hospitality settings. This approach provides a comprehensive understanding of how digital technologies influence operational processes, guest satisfaction, and business efficiency. These research sites were selected based on the assumption that larger hospitality establishments in urban areas have adopted some form of AI. Additionally, hospitality establishments with the highest ratings on Google reviews were also monitored. In Belgrade, 25 managers from 25 restaurants were surveyed, in Novi Sad 24 managers from 24 restaurants, and 15 managers from 15 restaurants in Kragujevac.

The research methodology includes a quantitative analysis of the collected data to identify trends and patterns in the use of artificial intelligence to enhance gastronomic offerings.

Based on the collected data and conducted analyses, three research questions were formulated to guide further discussion and interpretation of the results:

1. How does the application of artificial intelligence impact the personalization of gastronomic offerings in hospitality establishments?
2. What are the main challenges that hospitality establishments face when implementing digital technologies in their operations?
3. How does digital transformation contribute to improving operational efficiency and guest satisfaction in the hospitality sector?

Based on the reviewed literature and the formulated research questions, the authors propose the following three hypotheses:

H₁: The implementation of artificial intelligence (AI) in the hospitality industry positively impacts the operational efficiency of restaurants.

H₂: The use of artificial intelligence in the personalization of gastronomic offerings increases guest satisfaction.

H₃: Various challenges and obstacles arise during the digital transformation of restaurants, affecting the ultimate application of digital technology.

4. Research results

The research was conducted during 2024, from January to June. Table 1 presents the demographic characteristics of the respondents. Table 1, which outlines the demographic characteristics of the respondents, provides insights into the profile of restaurant managers who participated in this study. The sample consists of 64 managers, and the analysis includes their age, years of experience in the hospitality industry, and education level. Most respondents fall within the age groups of 30 to 49, making up 81.24% of the sample. Specifically, 34.37% of respondents are between 30 and 39 years old, while 46.87% are between 40 and 49. A smaller portion, 18.76%, is over 50 years old. This age distribution indicates that restaurant managers are generally in their middle years, often associated with significant industry experience and maturity in decision-making. Regarding their work experience in hospitality, nearly half of the respondents (48.44%) have more than 10 years of experience, indicating a high level of expertise and familiarity with the industry. Additionally, 39.06% of managers have between 5 and 10 years of experience, while only 12.5% have less than 5 years of experience in the sector. These data suggest that more experienced managers are prevalent, contributing to a better understanding of the challenges and innovations in hospitality, including digital transformation. In terms of educational qualifications, the majority of respondents have higher education. Exactly 54.68% of managers hold a bachelor's degree, while an additional 37.5% have a master's degree or higher. Only 7.82% of respondents have completed secondary education. This educational

structure indicates a high level of qualification among restaurant managers, which is significant for implementing complex technologies such as artificial intelligence and successfully managing restaurants in the modern business environment.

Table 1. Demographic structure of respondents

	Frequency (N = 64)	
	N	%
<i>Age</i>		
30-39	22	34.37
40-49	30	46.87
50+	12	18.76
<i>Number of years of work in the hospitality industry</i>		
Less than 5	8	12.5
5-10	25	39.06
10+	31	48.44
<i>Level of education</i>		
Secondary school	5	7.82
Faculty	35	54.68
Master's degree or higher	24	37.5

Source: Author's calculation based on SPSS 26.00

The authors carefully designed a questionnaire aimed at collecting relevant data on the perceptions of hospitality managers regarding the role of artificial intelligence (AI) in optimizing operations and enhancing gastronomic offerings. The questionnaire was structured to cover various aspects of digital transformation, including operational, economic, and customer dimensions, based on previous similar studies by Martin Martin et al. (2022) and Mariani & Borghi (2024). Special attention was paid to the formulation of the questions to ensure they were clearly defined, precise, and easily understandable to restaurant managers. The questions were meticulously crafted to address all relevant areas of the research, such as the implementation of AI technologies, the challenges managers face, and the impact of these technologies on customer experience and operational efficiency. The functionality of the questionnaire was further ensured through consultations with experts in the hospitality and digital technologies sectors. Prior to conducting the main research, a pilot study was conducted on a sample of 20 restaurant managers. The goal of the pilot study was to identify and resolve any ambiguities or misunderstandings in the questionnaire, as well as to assess its applicability and reliability in real conditions. Based on the feedback received during the pilot study, necessary modifications and improvements were made to the questionnaire to ensure its optimal functionality and relevance to hospitality managers. The reliability of the questionnaire was tested using statistical methods, including an internal consistency analysis with Cronbach's alpha coefficient. The results of this analysis indicated high reliability of the questionnaire, showing that the questions were consistent and adequately measured the managers' perceptions of the impact of AI technologies on operations and gastronomic offerings. In this case, Cronbach's Alpha was 0.845, indicating a high level of reliability. All questions in the questionnaire were closed-ended, allowing for the standardization of responses and facilitating the quantitative analysis of data. A five-point Likert scale was used, where respondents rated statements on a scale from 1 ("strongly disagree") to 5 ("strongly agree"). This type

of scale was chosen for its ability to accurately measure latent constructs such as satisfaction, attitudes, and perceptions, which are crucial for the validity of the research. The Likert scale is often highly reliable and valid, particularly when a large number of items are used, as was the case in this study, enabling more precise measurement of the constructs being investigated.

After verifying the reliability of the measurement instruments used and presenting the sample distribution, the analysis proceeded with a review of the descriptive indicators of the measures used in the study to gain insight into the distribution of variables and their basic distribution characteristics. Table 2 presents descriptive statistics for the measures used in the study, including: mean (M), standard deviation (SD), Cronbach's reliability coefficient (α), as well as skewness (Sk) and kurtosis (Ku) measures. The data analysis from Table 2 reveals moderate attitudes of respondents regarding digital transformation and the application of artificial intelligence (AI) in restaurant operations. The mean values of responses range from 2.72 to 3.12, suggesting that respondents predominantly hold neutral views with a

slight tendency towards positive evaluations. The lowest mean value was recorded for the statement that the restaurant has digitalized its operations over the past three years, indicating a limited degree of digitalization. On the other hand, the highest value is associated with the perception that AI technologies can contribute to a better understanding of guest preferences and the personalization of gastronomic offerings, which implies a more positive attitude towards the potential use of AI technologies in this context. The standard deviation ranges from 1.32 to 1.59, indicating a relatively high degree of variability in the responses. This is expected, as the questions pertain to complex topics such as digital transformation and AI, and the varying levels of technology implementation among respondents may contribute to a greater divergence in opinions. Despite this variability, Cronbach's alpha for all items ranges between 0.814 and 0.827, indicating high reliability and internal consistency of the questionnaire. This high reliability confirms the validity of the measurements and ensures that the questionnaire adequately captures respondents' attitudes towards digital transformation and AI technologies.

Table 2. Descriptive statistics for the measures

	M	SD	α	Sk	Ku
Our restaurant has digitalized its operations over the past three years.	2.72	1.37	0.814	-0.354	-0.026
Digital transformation is essential for the future success of our restaurant.	3.11	1.59	0.821	-0.811	-0.851
We have adequate resources for implementing new digital technologies in our restaurant.	3.06	1.47	0.827	-0.742	-0.988
Our organization invests in training employees to use new technologies in restaurant management.	3.05	1.37	0.827	-0.911	0.075
I believe that digital transformation is a complex process that requires significant changes in the organization of the restaurant.	2.8	1.42	0.827	-0.057	-0.402
Artificial intelligence (AI) can significantly improve the operational efficiency of our restaurant.	3.06	1.41	0.819	0.476	-0.826
AI technologies can contribute to a better understanding of our guests' preferences and the personalization of our gastronomic offerings.	3.12	1.32	0.821	0.048	-0.718
The implementation of AI in our organization could reduce the operational costs of the restaurant.	3.09	1.44	0.824	-0.911	-0.066
Our organization is ready to implement AI technologies in its operations, particularly in menu creation and inventory management.	2.81	1.46	0.815	-0.121	-0.058
Artificial intelligence can help personalize the gastronomic offerings according to guest preferences.	3.09	1.47	0.817	-0.901	0.929
The implementation of new technologies in our restaurant is met with resistance from employees.	2.81	1.37	0.823	-0.876	0.952
The costs of implementing new digital technologies in restaurants are too high for our organization.	2.92	1.48	0.818	-0.827	-0.446
The lack of expertise in AI technologies is a significant barrier for our restaurant.	3.08	1.47	0.816	-0.266	-0.267
Our organization lacks sufficient data on guest preferences to effectively use AI technologies.	2.94	1.36	0.819	-0.728	-0.834
Digital transformation has improved the customer experience and the quality of our gastronomic offerings.	3.05	1.43	0.816	-0.304	0.151
The use of AI has reduced food waste and improved menu planning in our restaurant.	2.97	1.46	0.816	-0.914	0.895
I believe that investment in digital technologies will bring long-term benefits to our organization, particularly in optimizing gastronomic offerings.	2.94	1.48	0.815	-0.585	-0.700
The use of AI technologies enables our restaurant to respond more quickly to changes in guest preferences.	2.97	1.49	0.817	-0.229	-0.200
AI helps better manage inventory and reduce food costs in our restaurant.	3.05	1.51	0.819	-0.897	-0.484
Our restaurant uses digital tools to analyze guest feedback to improve the gastronomic menu.	2.92	1.4	0.820	-0.778	-0.253

Source: Author's calculation based on SPSS 26.00

The skewness values show that the responses are mostly slightly negatively skewed, meaning that respondents tend to give more neutral or negative evaluations, although this deviation is not significant. The only exception is the

statement regarding artificial intelligence in the personalization of gastronomic offerings, where skewness indicates a more positive attitude. On the other hand, kurtosis values indicate relatively flat distributions of

results, meaning that responses are not concentrated at the extremes but are mostly around the mean. This is particularly evident in statements related to the personalization of offerings and employee resistance to implementing new technologies. Overall, these data suggest that respondents recognize the importance of digital transformation and AI technologies, albeit with moderate enthusiasm and caution regarding their implementation. While there is awareness of the potential of these technologies, the variability in responses reflects differing levels of readiness and experience among the respondents. For further analysis, it is recommended to use regression analyses or variance analyses to identify factors influencing these attitudes and provide deeper insights into perceptions of digital transformation and the application of AI technologies in the hospitality sector.

Within the data analysis for this study, the Kaiser-Meyer-Olkin (KMO) test of sample adequacy was applied, yielding a value of 0.811. This value indicates very good correlations between the variables and suggests that the sample is adequate for further factor analysis. According to conventions, KMO values above 0.8 are considered very good, implying that the variables are sufficiently related for conducting analysis in this study.

Additionally, Bartlett's test of sphericity was conducted, revealing significant differences among the variables ($\chi^2 = 16588.082$, $df = 2009$, $p < 0.001$). These results suggest that the null hypothesis of equal correlation coefficients is rejected, meaning that significant correlations exist between the variables in the model. The high χ^2 value and significance ($p < 0.001$) confirm that the data contains sufficient information for factor analysis and that the

variables are interrelated to a degree that allows successful interpretation of the extracted factors.

The analysis of total explained variance presented in the Table 3 shows that the four factors identified in the study collectively explain a significant portion of the variance in the data. The first factor, "Digital Transformation in Restaurant Operations," has an eigenvalue (IE) of 5.989 and explains 15.716% of the total variance. After rotation, its total variance remains consistent, explaining 15.716%, indicating its importance in explaining the differences among variables. The total explained variance after rotation for this factor is 4.151, which highlights its impact after load adjustment. The second factor, "Resources and Readiness for Implementing New Technologies," has an initial eigenvalue of 2.996 and explains 7.885% of the variance, with its cumulative variance reaching 23.599%. This suggests that this factor is also important for the analysis. After rotation, its total explained variance rises to 4.243, indicating an increased significance of this factor after additional adjustment. The third factor, "Advantages of Implementing Artificial Intelligence (AI)," has an initial eigenvalue of 2.880 and explains 7.579% of the total variance, with cumulative variance reaching 31.178%. Its value after rotation is 3.761, which also underscores the significance of this factor in the overall analysis. The fourth factor, "Challenges and Barriers in Technology Implementation," with an eigenvalue of 2.308, explains 6.073% of the variance, with a cumulative percentage of 37.252%. After rotation, its total explained variance is 3.025, indicating that this factor also has a significant impact on the analysis after load adjustment. These four factors together explain 37.252% of the total variance in the data before rotation and 43.24% after rotation.

Table 3. Factor analysis

Factor	IE			SS _E			SS
	Total	Variance %	Cumulative %	Total	Variance %	Cumulative %	Total
F1: Digital transformation in restaurant operations	5.989	15.716	15.716	5.971	15.714	15.714	4.151
F2: Resources and readiness for implementing new technologies	2.996	7.885	23.599	2.996	7.885	23.599	4.243
F3: Advantages of implementing artificial intelligence (AI)	2.88	7.579	31.178	2.88	7.579	31.178	3.761
F4: Challenges and barriers in technology implementation	2.308	6.073	37.252	2.308	6.073	37.252	3.025
Total Explained Variance							

Note: IE – Initial Eigenvalues; SS – Sum of Squared Loadings after Rotation; SSE – Sum of Squared Loadings after Extraction.
Source: Author's calculation based on SPSS 26.00

The table displays VIF values for the four factors, which are used to assess multicollinearity, or the degree of linear dependence between independent variables. VIF values below 3.3 indicate acceptable multicollinearity, meaning the variables are not excessively correlated and independently contribute to the explanation of variance. All factors in the table have VIF values below the recommended threshold, indicating that there is no significant multicollinearity in the model. This ensures the stability of the model and facilitates the interpretation of the results.

Table 4. Variance Inflation Factor (VIF) for assessing multicollinearity between factors

Factor	Variance Inflation Factor (VIF < 3.3)
F1: Digital transformation in restaurant operations	1.664
F2: Resources and readiness for implementing new technologies	1.912
F3: Advantages of implementing artificial intelligence (AI)	1.613
F4: Challenges and barriers in technology implementation	1.607

Source: Author's calculation based on SPSS 26.00

The analysis of the relationships between the factors presented in the table indicates strong positive impacts of various aspects of digital transformation and technological innovation on customer satisfaction and engagement (F3). The first factor, improvement of gastronomic offerings through digital transformation (F1), has a coefficient of 0.711, indicating a significant impact on F3, with a p-value of 0.001 and a t-statistic of 2.166. This result highlights a strong positive relationship between digital transformation and customer satisfaction. The second factor, resource management efficiency through new technologies (F2), also shows a significant impact on F3, with a coefficient of 0.651 and a p-value of 0.000. The high t-statistic of 4.714 suggests that this relationship is statistically very significant, confirming

that better resource management directly contributes to improved customer satisfaction. The third factor, operational efficiency improvement through the application of artificial intelligence (F4), has a coefficient of 0.701, with a p-value of 0.000 and a t-statistic of 5.125. This result demonstrates a strong influence of AI technologies on customer satisfaction, indicating that the application of AI in restaurant operations significantly enhances the customer experience. All relationships mentioned are statistically significant, with p-values below 0.05, suggesting that digital transformation, efficient resource management, and the application of AI technologies have a substantial and positive effect on increasing customer satisfaction in restaurant operations.

Table 5. Structural Equation Modeling - SEM

Path	Impact	M	SD	T statistic (O/STDEV)	p
Digital transformation in restaurant operations → Advantages of implementing artificial intelligence (AI)	0.711	0.112	0.057	2.166	0.001
Resources and readiness for implementing new technologies → Advantages of implementing artificial intelligence (AI)	0.651	0.358	0.074	4.714	0.000
Challenges and barriers in technology implementation → Advantages of implementing artificial intelligence (AI)	0.701	0.301	0.051	5.125	0.000

Note: M - mean values of regression coefficients obtained from the sample; SD – standard deviation; T Statistics (|O/STDEV|): t-statistic, obtained as the ratio of the original coefficient to its standard deviation; p - values indicating the statistical significance of the regression coefficients.

Source: Author's calculation

5. Discussion

The demographic profile of respondents in this study suggests that restaurant managers, who generally have significant experience and high educational qualifications, are in their middle years. These factors may play a crucial role in their ability to understand and implement innovative technologies, such as those related to digital transformation and artificial intelligence (AI) in the hospitality sector. The results of this study show that digital transformation and the application of new technologies play a key role in improving customer satisfaction in restaurant operations. The analysis of relationships between various factors indicates significant impacts in all examined aspects.

The findings suggest that digital transformation of gastronomic offerings is strongly associated with customer satisfaction, implying that modernization through digital tools directly influences guest perceptions and enhances their dining experience, consistent with the findings of Saad Andaleeb & Conway (2006). Efficiency in resource management through new technologies also shows a significant impact on customer satisfaction. This finding supports the argument that the optimization of resources and processes through modern technologies contributes to more efficient restaurant operations, which in turn improves the guest experience. This result aligns with previous studies that have demonstrated that technological innovations can reduce costs, improve efficiency, and positively influence customer perceptions (Jeon et al., 2020; Furtado et al., 2020). The application of AI in improving operational efficiency also shows a

strong impact on customer satisfaction. This finding suggests that AI technologies, such as personalized recommendations, inventory management, and menu optimization, play an important role in enhancing the customer experience. The use of AI can not only increase the efficiency of restaurant operations but also improve customer interaction and engagement, which is crucial for long-term success in hospitality. These findings are consistent with previous research that emphasizes the importance of technological innovation in improving operational efficiency and customer satisfaction in the hospitality sector (Martin et al., 2022; Mariani & Borghi, 2024).

The results indicate that the introduction of digital and AI technologies in restaurants can be a key factor in enhancing the guest experience, leading to greater loyalty, recommendations through electronic communication, and long-term success for restaurants, in line with the findings of Naumov (2019) and Buhalis & Moldavska (2022). Based on the work reviewed, the theoretical contribution of this study lies in its ability to bridge the gap between existing research on digital transformation and artificial intelligence (AI) in hospitality and the practical implications for gastronomic offerings. Unlike Martín-Martín et al. (2022), who focused on determinants of digital transformation, or Mariani & Borghi (2024), who examined resilient service operations through AI, this paper specifically highlights the role of AI in personalizing gastronomic experiences and enhancing operational efficiency, thus extending theoretical frameworks by integrating AI's impact on customer satisfaction and sustainable practices in hospitality.

According to the above, all three proposed hypotheses have been confirmed, and the answers to the research questions are as follows:

1. The application of artificial intelligence significantly contributes to the personalization of gastronomic offerings, enabling a better understanding of guest preferences and the adjustment of offerings based on individual needs. This process directly increases customer satisfaction, which is confirmed by the strong positive impact of AI technologies on the customer experience.
2. The main challenges that hospitality establishments face when implementing digital technologies include a lack of resources, expertise, and employee resistance. These obstacles slow down the process of digital transformation and require strategic investments in training and technological infrastructure.
3. Digital transformation significantly contributes to improving operational efficiency in restaurant operations by reducing costs and optimizing work processes. At the same time, digitalization enhances guest satisfaction through personalized services and quicker adaptation to their needs.

5.1. Theoretical and practical implications

This research contributes to the theoretical framework of understanding the role of artificial intelligence and digital transformation in the hospitality sector. From a theoretical standpoint, the study confirms the significance of new technologies in improving operational efficiency and customer satisfaction. The results suggest that digital transformation is not merely a technological innovation but a key factor for the development and sustainability of modern hospitality. The study expands existing theoretical knowledge on how AI technologies can influence the personalization of gastronomic offerings, allowing restaurants to gain deeper insights into customer preferences and tailor their services on an individual level. Additionally, the research strengthens the theoretical assumption that technologies play a mediating role in enhancing efficiency by optimizing processes and reducing operational costs. This research also sheds light on the challenges that hospitality establishments face during digital transformation, broadening the discourse on barriers to the implementation of new technologies in hospitality and related industries.

The practical implications of this research are of great significance for managers and owners of hospitality establishments. The results suggest that the application of artificial intelligence and digital tools is crucial for enhancing business efficiency and improving the guest experience. Managers should invest in the technological infrastructure that enables the application of AI technologies for the personalization of offerings, inventory optimization, workforce management, and the improvement of operational processes. It is particularly important to invest in employee training so they can effectively use new technologies, thus overcoming one of the most common challenges—lack of expertise. The practical contribution of the research also involves

identifying obstacles that slow down digital transformation, such as employee resistance and the high costs of implementation. Hospitality establishments must develop strategies to mitigate these obstacles, including providing clear benefits to employees from the application of new technologies and ensuring adequate financial resources for successful digital transformation. In the long term, the application of these recommendations can lead to greater guest satisfaction, loyalty, and recommendations through electronic word-of-mouth (eWOM), which will positively impact the success and sustainability of hospitality businesses.

6. Conclusion

The results of this research emphasize the critical role of artificial intelligence (AI) and digital transformation in enhancing operational efficiency, customer satisfaction, and overall competitiveness within the hospitality industry. The findings demonstrate that digitalization, particularly through the implementation of AI technologies, allows hospitality establishments to personalize gastronomic offerings, gain deeper insights into guest preferences, and optimize work processes. These advancements have a direct and positive impact on guest satisfaction, fostering increased loyalty and repeat business. Furthermore, the study highlights that digital transformation is not merely a strategic advantage but a fundamental necessity for the long-term success of hospitality businesses, especially in the context of the growing demands and expectations of modern consumers. By providing tools to streamline operations and improve service quality, AI technologies can help businesses navigate the increasingly competitive market landscape while addressing sustainability concerns. In addition to identifying the benefits of digital transformation, the research sheds light on the significant challenges faced by hospitality establishments during the adoption of new technologies. These challenges include limited resources, employee resistance, and the need for adequate training and infrastructure development. Addressing these obstacles requires strategic investments in human capital and a focused effort to raise awareness about the tangible benefits of digitalization and AI for business operations. The implications of this research extend beyond theoretical insights, offering practical guidance for industry stakeholders. By prioritizing sustainable practices, such as reducing food waste through AI-driven inventory management and creating innovative, guest-centric solutions, hospitality businesses can enhance their resilience and adaptability. These findings underscore the importance of aligning digital transformation strategies with the principles of sustainability and innovation, which are increasingly pivotal for the industry's evolution. Overall, this research contributes to the growing body of knowledge on digital transformation in the hospitality sector, providing a framework for achieving both operational excellence and sustainable growth. Hospitality businesses that proactively adopt AI and digital tools, while investing in employee development and addressing implementation challenges, are better positioned to meet the needs of contemporary consumers and secure their place in a rapidly changing market. In the

future, embracing these technologies will not only drive competitiveness but also promote a more sustainable and innovative approach to hospitality management.

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