Utilization of Robot Waiters as a Technological Innovation to Increase the Competitiveness of the Culinary Business at Okinawa Sushi Trans Studio Mall (TSM) Makassar

Muhammad Rizky Fahrezi[1], Muhammad Rakib[2*], Hajar Dewantara[3]

Universitas Negeri Makassar, Indonesia

*Corresponding Author

ABSTRACT

This study aims to determine the effect of service robot utilization on the competitiveness of culinary businesses at Okinawa Sushi Trans Studio Mall (TSM) Makassar. Independent variables are service speed, service reliability, comfort and safety, and innovative value, the dependent variable is business competitiveness. The study used a quantitative associative approach with accidental sampling, involving customers who were incidentally encountered during fieldwork. A total of 98 respondents which has been served directly by a robot waiter. Validity, reliability, classical assumptions, multiple linear regression, and hypothesis tests were conducted on data collected through a Likert scale questionnaire. The study results show that service speed and service reliability have no significant effect on business competitiveness, while comfort and safety and innovative value have a positive and significant effect. Simultaneously, the four variables significantly affect business competitiveness. These findings suggest that service robots improve competitiveness mainly by enhancing comfort, safety, and innovation, strengthening Okinawa Sushi TSM Makassar's competitive position.

Keywords: Service Robot, Technological Innovation, Business Competitiveness, Culinary Industry

INTRODUCTION

he culinary industry is a highly competitive sector, requiring businesses to innovate not only in products but T also in service quality as a strategy to increase competitiveness. Advances in digital technology and automation have driven the emergence of service innovations based on service robots, which are capable of providing faster, more accurate, and more modern service (Syaputra et al., 2024). The use of service robots has grown in countries such as Japan, South Korea, and China to increase efficiency and overcome labor constraints (Eryano et al., 2023), and this trend has started to be implemented in Indonesia since 2021 (Dwi Wulandari, 2021).

Several restaurants in Indonesia have utilized robot waiters such as Bellabot and Pudubot as part of a strategy to improve service and modern image (Rihantari et al., 2023). In Makassar, the application of this technology is still very limited, with one pioneer being Okinawa Sushi at Trans Studio Mall (TSM) Makassar, which uses robot waiters to differentiate its service from other similar restaurants. However, the effectiveness of robot waiters in increasing the competitiveness of culinary businesses needs to be studied empirically, particularly regarding their impact on service speed, reliability, convenience, and innovative value.

Based on this phenomenon, this study aims to analyze the influence of the use of robot waiters as a technological innovation measured through service speed, service reliability, service comfort and security as well as service innovative value on increasing the competitiveness of the culinary business at Okinawa Sushi TSM Makassar, as well as providing academic contributions and practical recommendations for business actors in utilizing technology to strengthen competitive advantages.

LITERATURE REVIEW

Entrepreneurship

Entrepreneurship is a strategic process of identifying opportunities and creating value through innovation to achieve competitive advantage. In the digital era, business success is increasingly determined by the ability to

utilize technology and digital literacy to support business efficiency and growth (Rakib et al., 2024). The concept of technopreneurship combines business competencies with technology to produce innovations that increase competitiveness (Rakib et al., 2023), while digital literacy is an important factor in accessing market information, utilizing digital platforms, and adopting new technologies (Jufri et al., 2021). In line with this, Nurhalim et al. (2024) research shows that entrepreneurial motivation is stronger when entrepreneurial knowledge is supported by the ability to innovate. This means that individuals who understand business concepts and are able to adopt innovations, including new technologies, are more likely to start and grow a business. This indicates that entrepreneurial success no longer depends solely on physical capital, but rather on the extent to which entrepreneurs are able to innovate and integrate technology as a value creating instrument. Research by Fajrul & Saptyana (2025) shows that digital entrepreneurship can increase the adaptability of MSMEs and strengthen their competitiveness. In the culinary industry, technology based service innovations such as robot waiters can be a differentiation strategy to enrich the customer experience and strengthen a business's competitive position.

Service

Service is an important aspect in the service business because it is an added value that is directly felt by customers and plays a role in forming a sustainable relationship between service providers and consumers. Sitepu & Marpaung (2022) state that service is an effort to fulfill someone's needs through reciprocal relationships, while Wirtz & Lovelock (2021), define service as an intangible act that does not involve a transfer of ownership. Similarly,, Zeithaml et al. (2023) emphasize that service is an economic activity consumed simultaneously with its production process and provides benefits such as convenience and solutions to customers. In the culinary industry, service quality is a strategic factor determining customer satisfaction and loyalty, thus impacting business sustainability. Developing service forms through innovation has been proven to increase service value and quality perception from the customer's perspective (Adi et al., 2025).

In line with this, Putera et al. (2020) found that service quality has a significant influence on customer perceived value, which in turn impacts customer satisfaction levels. Improving service quality not only influences customer perceptions of service value but also strengthens the relationship between customers and service providers through more positive service experiences. Therefore, continuous service improvement efforts can encourage customer loyalty and strengthen the business's image in the long term. In the context of current service business developments, this improvement in service quality can be realized through the use of technology based innovations that support the effectiveness and quality of service interactions. The use of service technology such as service robots is an innovation that can increase efficiency, create unique experiences, and strengthen business competitiveness amidst increasingly fierce competition.

Innovation

Innovation plays a crucial role in enhancing business growth and competitiveness, particularly in the service sector, such as the culinary industry. Innovation is understood as the process of developing new ideas or refining existing concepts to generate valuable benefits for consumers (Varadarajan, 2024), Innovation can take the form of product, process, service, organizational, or technological innovation, which is a highly relevant aspect in the digital era (Ausat, 2023). Research by Nur et al. (2021) also confirms that innovation positively impacts business performance, with creativity and service innovations driving businesses to greater competitiveness. Consistent with this view, Fadilla et al. (2023) argue that innovative efforts undertaken through systematic business development, with a focus on improving quality and value for consumers, play a crucial role in enhancing a business's competitiveness. Innovations designed based on customer needs and preferences enable businesses to create sustainable added value while maintaining a competitive position amidst intense market competition. In the context of this research, the application of technological innovation in the form of the use of service robots can be seen as a form of service development that is oriented towards improving the quality of consumer experience, operational efficiency, and the creation of added value, so that it is in line with the concept of innovation that contributes to strengthening the competitiveness of the culinary business.

Technological innovation itself allows for increased efficiency and the creation of more unique experiences, for example through the use of robot waiters in the culinary industry that can speed up service and improve presentation accuracy (Judijanto et al., 2023). However, the success of innovation is also determined by user

acceptance, which is analyzed through the Technology Acceptance Model (TAM), which emphasizes that perceived usefulness and perceived ease of use influence user attitudes and intentions in accepting technology (Ramadya, 2022). Furthermore, Diffusion of Innovation (DOI) explains the process of innovation dissemination, which is influenced by relative advantage, suitability, complexity, trialability, and observability, as well as adopter categories such as innovators and early adopters (García-Avilés, 2020). The implementation of robot waiters at Okinawa Sushi TSM Makassar is an example of technological innovation that has the potential to strengthen competitiveness through a modern and efficient service experience if supported by good customer acceptance.

Robotics and Automation in Services

Technological advancements are encouraging businesses to adopt automation-based innovations to increase competitiveness, one example being the use of robotics in culinary services. Robotics is a multidisciplinary field focused on the design and operation of robots to assist or replace human tasks (Wahyujati & Wicaksono, 2022). The implementation of robot waiters has been proven to increase efficiency, accuracy, and speed of service (Raharjo, 2023). Research by Ariski et al. (2024) shows that sensor-based robot waiters can deliver orders quickly and accurately, although technical challenges such as limited social interaction remain. In the context of restaurant services, the utilization of robot waiters is analyzed through four main variables: service speed, which influences customer satisfaction (Suhendy et al., 2024), service reliability related to performance consistency and minimal technical errors (Supriyono et al., 2021), comfort and safety, which reflect the stability of the robot's movements and customers sense of security (Desanuari & Ludtriani, 2022) and the innovative value of the service that creates modern appeal and competitive differentiation (Indarto & Dananti, 2021). Thus, the use of robot waiters at Okinawa Sushi TSM Makassar is a relevant innovation strategy to improve service quality and strengthen the competitiveness of the culinary business in the digital era.

Business Competitiveness

Business competitiveness is a company's ability to survive and excel in competition through quality service, innovation, and effective operational strategies. In the competitive culinary industry, competitiveness is key to business sustainability, where adaptation to consumer needs and technological developments is crucial for creating added value (Azis et al., 2021). The use of digital technology and service automation, such as robot waiters, can increase efficiency, speed up service, and provide unique experiences for customers, thus strengthening the restaurant's competitive position. This is in line with the findings of Putera et al. (2021) who stated that competitive advantage in food and beverage businesses positively influences marketing performance through service differentiation and perceived added value for customers. Human resource digital competence also plays a crucial role in ensuring the successful implementation of innovation (Ingsih et al., 2024). In line with these findings, Wahyudin et al. (2024) stated that the use of electronic technology in business development strategies has been proven to contribute to improved sales performance and strengthened business competitiveness. The application of technology not only impacts operational process efficiency but also functions as a service differentiator that creates added value for consumers, thereby helping businesses maintain and strengthen their competitive position amidst market competition. In this study, business competitiveness is defined as the dependent variable measured through indicators of service ease, service uniqueness, efficiency & effectiveness, and service excellence. Thus, the use of robot waiters at Okinawa Sushi TSM Makassar is a potential innovation strategy to strengthen the competitiveness of culinary businesses in the digital era.

RESEARCH METHODS

Types of research

The research method used in this study is associative with a quantitative approach. This approach was chosen because the study aims to objectively describe the relationship between service speed, service reliability, service convenience and safety, and the innovative value of robot waiter services on the competitiveness of culinary businesses. This study does not provide treatment or interventions as in an experiment, but rather captures the actual conditions in the field as they exist.

The research design used was a survey, where data was collected from respondents who had directly interacted with the robot waiter service at Okinawa Sushi, Trans Studio Mall (TSM), Makassar. Respondents provided ratings of various aspects of the service using a Likert-based questionnaire. The results of this survey will be

analyzed to determine whether the use of robot waiters has an impact on increasing the competitiveness of culinary businesses.

Data Type

The types of data used in this study consist of primary and secondary data. Primary data is the primary data obtained directly by the researcher from primary sources through the distribution of questionnaires to customers of Okinawa Sushi at Trans Studio Mall (TSM) Makassar who had interacted with the robot waiter service. This primary data consists of respondents' answers to statements compiled based on variable indicators of robot waiter utilization and culinary business competitiveness, measured using a five-level Likert scale. This primary data is used to objectively describe customer perceptions and analyze the relationships between the variables studied.

Meanwhile, secondary data is supporting data obtained indirectly through various written sources relevant to the research. Secondary data in this study includes textbooks, scientific journals, previous research results, reports, and online sources related to the topics of service innovation, robot waiters, service quality, and culinary business competitiveness. Secondary data is used to strengthen the theoretical foundation, develop variable indicators, and support the analysis and discussion of the research results.

Data Collection Techniques

1) From Observation

Direct observation was conducted to examine the operational activities of service robots at Okinawa Sushi TSM Makassar, aiming to obtain a real depiction of how technological innovation is integrated into customer service.

2)   Documentation

Supporting documents such as restaurant profiles, photographs of robot service activities, and related materials were collected to enrich data and strengthen research findings.

3)   Questionnaire

Primary data were collected through questionnaires distributed to customers who had interacted with service robots. The questionnaire consisted of closed-ended statements based on variable indicators, measured using a five-point Likert scale ranging from Strongly Disagree (1) to Strongly Agree (5).

Data analysis technique

Data analysis was conducted using SPSS version 26, with the following stages:

1)   Descriptive Statistical Analysis

Descriptive statistics were used to summarize and explain the collected data for easier interpretation.

2)   Instrument Testing

a)   Validity Test using Pearson Product Moment

Validity testing is used to measure the extent to which questionnaire items are able to measure the intended construct. Validity testing is carried out by correlating each item with the total score using the Pearson product moment correlation. According to Sugiyono in a study (Heru Novrinando & Onsardi, 2025), the validity test for each research instrument obtained results if r is positive, and $r \geq 0.30$, then the statement is valid, and if $r < 0.30$, then the statement item is invalid.

b)   Reliability Test using Cronbach's Alpha ($\alpha > 0.60$)

A reliability test was conducted to determine the consistency of the questionnaire results. SPSS provides facilities to measure reliability with the Cronbach Alpha statistical test. According to Sugiyono in the study

(Heru Novrinando & Onsardi, 2025), if the variable being studied has a Cronbach Alpha (α) > (0.60) then the variable is said to be reliable, conversely, if a Cronbach Alpha (α) < (0.60) then the variable is said to be unreliable.

3) Classical Assumption Tests

a)   Normality Test (Kolmogorov–Smirnov)

b)   Multicollinearity Test (Tolerance > 0.10; VIF < 10)

c)   Heteroscedasticity Test (Glejser method) 4) Multiple Linear Regression Analysis

Multiple linear regression analysis is used to determine the extent of the influence of several independent variables on a dependent variable, either simultaneously or partially. This method helps explain the direction of the relationship, whether positive or negative.

5) Hypothesis Testing

a) Partial Test (t-test)

Partial hypothesis testing is used to determine the partial effect of each independent variable on the dependent variable. According to Ghozali (2021), partial testing is conducted by examining the significance value (p-value). A variable is considered to have a significant effect if the significance value is <0.05, while a value ≥0.05 indicates no effect. The testing criteria can also be seen from the calculated t value > t table, with the t table determined based on degrees of freedom (df = n − k).

b) Simultaneous Test (F-test)

To determine the effect of all independent variables simultaneously on the dependent variable. According to Ghozali (2021), simultaneous hypothesis testing is used to assess the effect of independent variables simultaneously on the dependent variable. Decisions are made based on the significance value of the simultaneous hypothesis test results. If the significance value is less than 0.05, then all independent variables together are considered to have a significant effect. Conversely, if the significance value is greater than 0.05, then the regression model is considered insignificant. Testing criteria can also be seen from the calculated f value > f table, then all variables are declared to have a simultaneous effect. c) Model Fit Test (R²)

Describes how much influence variable X has on Y. According to Ghozali (2021), the r-square value illustrates the extent of the independent variable's role in explaining changes in the dependent variable. The higher the r-square value, the stronger the model's ability to predict the dependent variable.

RESEARCH RESULTS AND DISCUSSION

Research result

The Respondent Characteristics

Table 1. Respondent Characteristics Based on Gender

Gender	Frequency
Men	29
Women	69
Total	98

Source: Data Processing Results from SPSS 26 for Windows

Table 2. Respondent Characteristics Based on Age

Age Range	Frequency
17 - 23 Years	45
24 - 30 Years	50
31 - 37 Years	3
Total	98

Source: Data Processing Results from SPSS 26 for Windows

Table 3. Respondent Characteristics Based on Visit Frequency

Visit	Frequency
2-3 Times	43
1 Times	20
More than 3 times	35
Total	98

Source: Data Processing Results from SPSS 26 for Windows

This study involved 98 respondents, most of whom were women. In terms of age, the respondents were predominantly in the productive age group of 24–30 years. Visit frequency also indicated that the majority of respondents had visited Okinawa Sushi TSM Makassar two to three times or more, indicating that most of them were repeat customers.

Multiple Linear Regression Analysis

Table 4. Results of Multiple Linear Regression Analysis Test

Model	B	Std. Error	Beta
(Constant)	14.917	2.545	
Service Speed	.018	.075	.017
Service Reliability	.015	.053	.020
Service Convenience and Security	.148	.067	.158
Service Innovative Value	.666	.061	.730

Source: Data Processing Results from SPSS 26 for Windows

Based on the results of the multiple linear regression test in the table, the following regression equation was obtained

$$Y = a + 14{,}917 + 0{,}018 + 0{,}015 + 0{,}148 + 0{,}666$$

The equation shows that all independent variables have positive coefficients. This means that improvements in service speed, service reliability, service comfort and safety, and the innovative value of service robots will be

followed by increased competitiveness of the culinary business at Okinawa Sushi TSM Makassar. Service speed has a positive effect with a coefficient of 0.018, service reliability 0.015, service comfort and safety 0.148, and service innovative value has the largest influence at 0.666. This indicates that service innovation through the use of service robots is the most dominant factor in strengthening the competitiveness of culinary businesses. Thus, the regression results confirm that technological innovation in the form of service robots plays a significant role in enhancing restaurant competitiveness, particularly through creating a unique, modern, and value-added service experience for customers.

Partial Hypothesis Test

Table 5. Partial Hypothesis Test Results

Variable	t count	>/<	t table	Sig.	Statement
Service Speed → Business Competitiveness	0.242	<	1,987	0.809	Not Significant
Service Reliability → Business Competitiveness	0.280	<	1,987	0.780	Not Significant
Service Convenience and Security → Business Competitiveness	2.210	>	1,987	0.030	Significant
Service Innovative Value → Business Competitiveness	10.970	>	1,987	0.000	Significant

Source: Data Processing Results from SPSS 26 for Windows

Referring to Ghozali (2021), the influence of each independent variable on the dependent variable can be seen through the significance value (p-value), where a significance value less than 0.05 indicates a significant influence. The testing criteria can also be seen from the calculated t value greater than the t table, with the t table determined based on the formula (df = n − k). From the results of the partial hypothesis test shown, it can be concluded that the variables of service speed and service reliability have t values of 0.242 and 0.280 (calculated t < t table) and significance values of 0.809 and 0.780 (p > 0.05), respectively, which means that both do not significantly influence business competitiveness. This is in line with the facts found in the field, where service robots still face various technical limitations that affect service quality. Robots are often hampered by overly sensitive sensors, making them easy to stop when detecting small objects or customer movement, especially children who often approach the robot's path. Furthermore, robot vibrations and the restaurant's busy schedule mean the robot cannot always maintain stable movement. This limitation impacts the robot's inability to deliver certain menu items, such as soupy dishes, large portions, or dishes that require extra care due to the risk of spills. Therefore, human staff continue to deliver these items to maintain quality, safety, and customer comfort.

Meanwhile, the variables of service comfort and safety, as well as service innovation, showed t-values of 2.210 and 10.970, respectively (t-test > t-table), with significance values of 0.030 and 0.000 (p < 0.05), indicating that both have a positive and significant impact on the competitiveness of the culinary business. Interviews with Okinawa Sushi TSM Makassar management revealed that many customers, particularly families with children, stated that the robot felt safe and enjoyable thanks to its sensitive sensors, smooth movements, and ability to stop directly in front of the table without hitting equipment. The robot also makes no noise and is equipped with light music, creating a more comfortable atmosphere. This suggests that positive experiences encourage repeat customers, reinforcing the restaurant's perceived comfort and innovative value. Meanwhile, the innovative value of service also proved significant, as the presence of robots enabled a more modern, unique, and different dining experience than conventional restaurants. These findings confirm that comfort, safety, and innovation are the most crucial factors in creating a competitive advantage for restaurants implementing robot waiter technology, even though robots are not yet technically capable of completely replacing all human service tasks.

Simultaneous Hypothesis Testing

Table 6. Results of Simultaneous Hypothesis Testing

Variable	f count	>	f table	Sig.	Statement
All Independent Variables → Dependent Variable	41.650	>	2,47	*.000b*	Significant

Source: Data Processing Results from SPSS 26 for Windows

The results of the simultaneous hypothesis test indicate that each independent variable simultaneously influences business competitiveness. This can be seen from the significance value of 0.000 which is below 0.05. This result is in accordance with the opinion of Ghozali (2021) who stated that when the significance value of the simultaneous test is less than 0.05, the regression model is declared significant. The testing criteria can also be seen from the calculated f value being greater than the table f, with the table f being determined based on the degrees of freedom (df = n-k-1). Based on the table of simultaneous hypothesis test results above, the calculated f value is greater than the table f indicating that simultaneously the variables of service speed, service reliability, service comfort and security, and service innovative value have a significant effect on business competitiveness. then all variables are declared to have a simultaneous effect. Thus, the research model is proven to be able to explain the influence of independent variables simultaneously on business competitiveness at Okinawa Sushi TSM Makassar.

Coefficient of Determination Test

Table 7. Results of the Determination Coefficient Test

Model	R	R Square	Adjusted R Square
1	*. 801ᵃ*	.642	.626

Source: Data Processing Results from SPSS 26 for Windows

According to Ghozali (2021) confirms that the r-square value reflects the significant role of the independent variables in explaining changes in the dependent variable. The higher the r-square value, the stronger the model's ability to predict the dependent variable.

Based on the coefficient of determination, the r-square value was 0.642, meaning that the variables service speed, service reliability, service comfort and safety, and service innovativeness explained 0.642 of the variation in the business competitiveness variable. The remaining 0.358 was influenced by factors outside the study, such as marketing strategy, product quality, or other external factors. These results indicate that the research model has a fairly good ability to explain the studied variables.

DISCUSSION

1. The The Effect of Service Speed on Business Competitiveness

The service speed variable, which includes indicators of responsiveness, timeliness, and prompt service, indicates that service speed does not significantly impact business competitiveness. This finding indicates that accelerating the service process through service robots is not yet a determining factor in increasing a restaurant's competitive advantage. These results align with Suhendy et al. (2024) who explained that service speed only has a positive impact if the robotic system can operate optimally without operational disruptions.

Furthermore, this study's findings align with Jang & Lee (2020), who stated that restaurant sustainability and competitiveness are not solely determined by service speed but are more influenced by unique service robot attributes such as intelligence and safety. These attributes contribute to perceived benefits and perceived value for customers, making the quality of the customer experience a more dominant factor than the speed of the service process. This aligns with Belanche et al. (2021) stated that in technology-based services, customers tend to judge service quality based on their holistic experience, not solely on the efficiency of service time.

Furthermore, Wirtz & Lovelock (2021) emphasized that the success of service automation depends heavily on system stability and the quality of human-machine interactions, not solely on process speed. This opinion aligns with Prayoga & Kurniawan (2018) who explained that robot performance speed is heavily influenced by environmental conditions and sensory responses to physical obstacles, so technical factors often limit the contribution of robot service speed to customer perceptions.

Thus, the research findings showing that service speed does not have a significant impact further reinforce the view that customer value and experience are more decisive factors in shaping a restaurant's perceived competitiveness than service speed alone.

2. The Effect of Service Reliability on Business Competitiveness

Service reliability variables, which include indicators of navigation accuracy, successful delivery, minimal disruption, and sensor consistency, were shown to have no significant impact on business competitiveness. This finding indicates that the technical stability of service robots is not yet a primary factor in determining a restaurant's competitive advantage, particularly in service contexts that require high levels of care.

These results align with Supriyono et al. (2021) who stated that robot reliability is highly dependent on the technology's ability to maintain motion stability and navigation accuracy. Therefore, when the system is not performing optimally, its contribution to service quality is limited. These findings are supported by Garcia-Haro et al. (2020) who explain that service robots have operational limitations, especially when used in dynamic restaurant environments. Under these conditions, robots are more effective for simple tasks, while more complex tasks such as carrying heavy or soupy dishes, precisely avoiding obstacles, and adapting to environmental changes often present challenges that reduce their consistency and reliability.

Field findings at Okinawa Sushi indicate that robots still have limitations in delivering soup-based dishes due to the risk of spills caused by vibrations during movement. Therefore, certain menu items are still delivered by restaurant staff to maintain food quality and safety. This situation aligns with Hendra & Prawiro (2025) who explained that service robots in Indonesian restaurants are not yet fully capable of replacing humans in services that require a high level of caution. This finding is further supported by Wiastutti et al. (2024) who stated that the performance and acceptance of service robots are heavily influenced by technical factors and their ability to adapt to service needs.

Furthermore, Asmoro et al. (2023) emphasized that human involvement is still necessary to ensure consistent and safe service. Therefore, the service robots at Okinawa Sushi play a more operational support role than a full replacement for human workers. Customers tend to feel more comfortable with the collaborative service model between robots and staff, as friendliness, caution, and responsiveness are maintained.

Therefore, the reliability of service robots is not yet a primary driver of business competitiveness. Customers consider the overall service experience more than the technical factors of the robot, so the presence of the robot is perceived more as a supporting innovative element, not the main determining factor in shaping the perception of the restaurant's competitiveness.

3. The Effect of Service Comfort and Safety on Business Competitiveness

The variables of service comfort and safety, which include indicators of perceived safety, interaction comfort, and robot performance stability, have been shown to have a positive and significant impact on business competitiveness, demonstrating that the higher the level of customer comfort and safety when interacting with a service robot, the stronger their perception of the restaurant's excellence and quality. A sense of safety is a key prerequisite for the acceptance of service technology, especially in the public and dynamic environment of restaurants.

These findings align with Desanuari & Ludtriani (2022) who explain that psychological comfort when interacting with modern technology plays a crucial role in increasing customer acceptance, satisfaction, and loyalty. The results of this study are also supported by Hong et al. (2024) who showed that service robots capable of conveying intent through clear visual signals and gestures can improve customer perceptions of safety and interaction quality. The robot's non-verbal communication, such as gaze direction, movement patterns, and ability to adjust trajectory, makes customers feel more at ease and confident in the robot's performance in the service area.

Furthermore, Seo & Lee (2021) emphasized that customer trust in service robots is significantly influenced by perceived safety and potential technical risks. When customers perceive robots to operate stably, predictably,

and without posing a threat, their positive attitudes toward the service will increase. This directly impacts a more enjoyable service experience, heightened trust, and increased overall customer satisfaction.

Thus, service convenience and safety serve not only as supporting factors but also as strategic elements that strengthen restaurant competitiveness by creating a more positive, safe, and memorable service experience for customers.

4. The Influence of Service Innovative Value on Business Competitiveness

The service innovative value variable, which includes indicators of service creativity, unique experiences, and a modern image, has been shown to have a positive and significant effect on business competitiveness. This indicates that the higher the innovative value perceived by customers from the use of service robots, the stronger the competitive advantage created.

This finding aligns with Rakib et al. (2024) who stated that technological innovation can create differentiating value and strengthen customer perceptions of service quality. Furthermore, Kim et al. (2022) emphasized that innovative value reflected in unique experiences and service modernization can increase customer satisfaction and loyalty. Customers who experience interactive and differentiated service tend to rate restaurants as superior to conventional competitors.

Furthermore, Judijanto et al. (2023) explained that technological innovation enhances a business's adaptive capacity to address market changes through more efficient and relevant services. This finding is supported by Varadarajan (2024) who stated that innovation functions as a mechanism for creating new value that strengthens a company's competitive position. In the restaurant context, the use of robot waiters not only increases efficiency but also strengthens the modern image and emotional appeal of customers.

Field findings indicate that the presence of robots is a unique attraction, particularly through their interactive features and futuristic design, which create a pleasant and memorable dining experience. This aligns with Seo & Lee (2021) who stated that the perception of the uniqueness and interactivity of robot-based services increases customer trust, satisfaction, and loyalty.

Thus, the innovative value of service is a crucial factor in strengthening business competitiveness by creating modern, unique, and value-added dining experiences, thus differentiating restaurants from competitors and building a sustainable competitive advantage.

CONCLUSIONS AND RECOMMENDATIONS

Conclusion

This study concludes that the use of robot waiters as a technological innovation at Okinawa Sushi TSM Makassar has had varying impacts on aspects of culinary business competitiveness. Partially, service speed and reliability did not significantly impact competitiveness due to operational technical limitations, such as robot shutdowns due to safety sensors frequently triggered by children crossing the robot's path, and limitations in carrying soup-based dishes. Conversely, the convenience and safety of the service, along with its innovative value, proved to have a significant and positive impact on business competitiveness, as the robot's presence provided a unique experience, a modern feel, a sense of security, and entertainment that increased repeat visits. Overall, the use of robot waiters significantly contributed to increased business competitiveness through an innovative image and a differentiated service experience amidst the competition in the modern culinary industry.

Suggestion

Based on the research findings, the management of Okinawa Sushi TSM Makassar is advised to improve the management of the robot's operational area by adding markers or path dividers to prevent disruption from customers, especially children who frequently move near the robot, and to optimize the tray design for safer and more stable delivery of soup-based dishes. The use of robots needs to be combined with human service to maintain the quality of interactions, emotional touch, and service effectiveness. For other culinary businesses, the results of this study can serve as a reference in adopting automated service technology as a differentiation

strategy and increasing competitiveness while still considering infrastructure and human resource readiness. The government is expected to support the development of an innovation ecosystem through digital training, incentives for service technology development, and research facilities to encourage the digital transformation of culinary MSMEs. Future research is recommended to add variables such as customer satisfaction, consumer loyalty, and brand image, as well as compare several other restaurants that have used robot waiters for more comprehensive results.

REFERENCES

1. Adi, A. N. A., Rakib, M., & Syam, A. (2025). Innovation in Services Business Through Diversification of Service Types to Increase Customer Satisfaction at Markas Grafis Business. World Journal of Advanced Research and Reviews, 25(01), 1402–1414. https://doi.org/10.30574/wjarr.2025.25.1.0150
2. Ariski, A. S. P., Dewi, T., & Risma, P. (2024). The Implementasi Robot Line Follower Sebagai Peghantar Makanan/Minuman di Restoran Modern. Journal of Applied Smart Electrical Network and Systems, 5(1), 36–40. https://doi.org/10.52158/jasens.v5i1.934
3. Asmoro, A. Y., Butler, G., & Szili, G. (2023). Exploring the Current Status and Future Potential of Robot, Artificial Intelligence, and Service Automation in the Indonesian Tourism Industry. Jurnal Kepariwisataan: Destinasi, Hospitalitas Dan Perjalanan, 7(2), 133–153. https://doi.org/10.34013/jk.v7i2.1226
4. Ausat, A. M. A. (2023). Inovasi: Sebuah Tinjauan Konsep Perilaku Inovatif. Pertama. Edited by AMA Ausat. Gowa-Makassar: CV. Ayrada Mandiri.
5. Azis, M., Hasan, M., Azis, F., & Arisah, N. (2021). Keberlanjutan Usaha dan Daya Saing UMKM Melalui Strategi Pemasaran: Studi kasus Pada Bisnis Kuliner. Seminar Nasional Hasil Penelitian 2021 "Penguatan Riset, Inovasi, Dan Kreativitas Peneliti Di Era Pandemi Covid-19," 1419–1432. http://eprints.unm.ac.id/id/eprint/30158
6. Belanche, D., Casaló, L. V, & Flavián, C. (2021). Frontline Robots in Tourism and Hospitality: Service Enhancement or Cost Reduction? Electronic Markets, 31(3), 477–492.
7. Desanuari, G. F., & Ludtriani, R. (2022). Pengaruh self-service technology terhadap pengembangan usaha dan kepuasan konsumen di masa pandemi covid-19 pada model bisnis restoran. Nautical: Jurnal Ilmiah Multidisiplin, 1(4), 268–273. https://doi.org/10.55904/nautical.v1i5.198
8. Dwi Wulandari. (2021). Perdana, Pudu Robotics Buka Showroom Robot Pintar di Indonesia. Kumparan.Com. Juli 16, 2025. https://kumparan.com/kumparantech/perdana-pudu-robotics-bukashowroom-robot-pintar-di-indonesia-1wmzQlTWWZo
9. Eryano, M. B. P., Insani, N. A., Parasati, Y. A., Wardhani, D. L., Anwari, K. R., & Ayyub, I. (2023). Faktor Aging Population di Jepang dan Upaya Pemerintah Jepang dalam Mengatasi Fenomena Tersebut. Sabda: Jurnal Kajian Kebudayaan, 18(2), 29–43https://doi.org/10.14710/sabda.18.2.2943
10. Fadilla, N., Rakib, M., & Said, M. I. (2023). Product Development Analysis in Enhancing Competitiveness in Contemporary Beverage Business: Case Study at Kopian Beverage Booths in Makassar City. Journal Of Latest Technology in Engineering & Management (IJLTEM), 8(6), 10–20.
11. Fajrul, M., & Saptyana, R. F. (2025). Strategi Peningkatan Daya Saing UMKM Kuliner Di Era Digital: Studi Kasus Pada Pelaku Usaha Di Kota Semarang. Mamen: Jurnal Manajemen, 4(2), 143–157. https://doi.org/10.55123/mamen.v4i2.5066
12. García-Avilés, J.-A. (2020). Diffusion of innovation. The International Encyclopedia of Media Psychology, 1(8), 1–8.
13. Garcia-Haro, J. M., Oña, E. D., Hernandez-Vicen, J., Martinez, S., & Balaguer, C. (2020). Service robots in catering applications: A review and future challenges. Electronics, 10(1), 47. https://doi.org/10.3390/electronics10010047
14. Ghozali, I. (2021). Aplikasi Analisis Multivariate Dengan Program IBM SPSS 26 Edisi 10. Semarang: Badan Penerbit Univesitas Dipenegoro. Jurnal Ilmu Dan Riset Manajemen, 9(4).
15. Hendra, N. A., & Prawiro, J. W. H. (2025). Literature Study: Enhancing Guest Experience with Robot Waiters for Restaurants Service in Indonesia. International Journal of Scientific Research and Technology.

16. Heru Novrinando, & Onsardi. (2025). Pengaruh Kemampuan Kerja Dan Tunjangan Kesejahteraan Terhadap Prestasi Kerja Karyawan. In Jurnal Entrepreneur dan Manajemen Sains (Vol. 6, Issue 1). www.jurnal.umb.ac.id

17. Hong, S. C., Tian, L., Cosgun, A., & Kulić, D. (2024). " One Soy Latte for Daniel": Visual and Movement Communication of Intention from a Robot Waiter to a Group of Customers. 2024 33rd

18. IEEE International Conference on Robot and Human Interactive Communication (ROMAN), 725–731. https://doi.org/10.1109/RO-MAN60168.2024.10731270

19. Indarto, D. N. S., & Dananti, K. (2021). Pengaruh perilaku konsumtif, jenis kelamin, dan pendapatan terhadap pengelolaan keuangan pribadi karyawan divisi garment PT Dan Liris Sukoharjo. Jurnal Manajemen Bisnis Dan Kewirausahaan, 5(5), 558–562. https://doi.org/10.24912/jmbk.v5i5.10327

20. Ingsih, K., Astuti, S. D., & Riyanto, F. (2024). The Role of Digital Competence in Improving Service Quality and Employee Performance. SA Journal of Human Resource Management, 22, 2689. https://doi.org/10.4102/sajhrm.v22i0.2689

21. Jang, H.-W., & Lee, S.-B. (2020). Serving robots: Management and applications for restaurant business sustainability. Sustainability, 12(10), 3998. https://doi.org/10.3390/su12103998

22. Judijanto, L., Sudarmanto, E., Ilham, I., & Ansori, T. (2023). Analisis Bibliometrik Tentang Tantangan dan Kontribusi Teknologi Energi Terbarukan Dalam Pembangunan Berkelanjutan di Asia Tenggara. Jurnal Multidisiplin West Science, 2(12), 1086–1100. https://doi.org/10.58812/jmws.v2i12.855

23. Jufri, M., Syam, A., Sudarni, S., & Asmayanti, A. (2021). Analysis Of Entrepreneurial Literacy of Students in SMK Negeri 5 Makassar. Pinisi Discretion Review, 5(1), 45–50. https://doi.org/10.26858/pdr.v5i1.23365

24. Kim, S. H., Yoo, S. R., & Jeon, H. M. (2022). The Role of Experiential Value, Novelty, and Satisfaction in Robot Barista Coffee Shop in South Korea: COVID-19 Crisis and Beyond. Service Business, 16(3), 771–790.

25. Nur, I. R., Rakib, M., & Hasan, M. (2021). The Influence of Creativity and Innovation on Business Performance (Studies on Online Business Actors in Makassar). Hum. South Asean J. Soc. Stud, 1(1), 1–10.

26. Nurhalim, Mahmuddin, Pahrul, Nur Arisah, & Hajar Dewantara. (2024). Pengaruh Pengetahuan Kewirausahaan Dan Inovasi Terhadap Motivasi Berwirausaha Mahasiswa Kewirausahaan. Jurnal Ilmiah MEA (Manajemen, Ekonomi, Dan Akuntansi), 8(3), 2303–2318.

27. Prayoga, A., & Kurniawan, B. (2018). Prototype Robot Pelayan di Restoran Cepat Saji Prototype Robot Waiter at Fast Food Restaurants. In Telekontran (Vol. 6, Issue 2). https://doi.org/10.34010/telekontran.v6i2.3802

28. Putera, W., Rakib, M., & Sahabuddin, R. (2021). Competitive advantages influence on marketing performance: Study on food and beverage MSMEs. The American Journal of Humanities and Social Sciences Research (THE AJHSSR, 4(1), 75–83.

29. Putera, W., Sahabuddin, R., Rakib, M., & Girikallo, A. S. (2020). Effect of Service Quality on Customer Satisfaction Through Customer Value in PDAM Kota Makassar (Customer Approach in Developing Clean Water Product Services to Customers). International Journal of Innovative Science and Research Technology, 5(10), 1129–1137.

30. Raharjo, B. (2023). Teori Etika Dalam Kecerdasan Buatan (AI). Penerbit Yayasan Prima Agus Teknik, 1–135.

31. Rakib, M., Asfo, N. S., Sulistyowati, R., & Asiyah, S. (2024). Membangun Masa Depan Kewirausahaan. Penerbit Tahta Media.

32. Rakib, M., Azis, M., Najib, M., & Isma, A. (2024). Impact of Digital Literacy, Business Innovation, Competitive Advantage on The Existence of SMEs: A quantitative study in Makassar City, Indonesia. Quality-Access to Success, 25(198), 277–283.

33. Rakib, M., Isma, A., Rahman, V., Hasdiansa, I. W., & Nugraha, M. E. S. (2023). Technopreneurship: Teori dan Aplikasi. Penerbit Tahta Media.

34. Ramadya, I. R. (2022). Pengaruh Perceived Ease of Use Dan Perceived Usefulness Terhadap Attitude Toward Using Serta Dampaknya Terhadap Behavioral Intention. Jurnal Manajemen Pemasaran Dan Perilaku Konsumen, 1(4), 553–561.

35. Rihantari, R. L., Kausar, D. R. K., & Nurhidayati, H. (2023). Tingkat Penerimaan Pengunjung Kafe Rasa Koffie Terhadap Penggunaan Layanan Robot Menggunakan Analisis Technology Acceptance Model (TAM). Jurnal Ilmiah Hospitality Management, 14(1), 37–52.

36. Seo, K. H., & Lee, J. H. (2021). The emergence of service robots at restaurants: Integrating trust, perceived risk, and satisfaction. Sustainability, 13(8), 4431. https://doi.org/10.3390/su13084431

37. Sitepu, E. A., & Marpaung, N. (2022). Pengaruh Kualitas Pelayanan Terhadap Kepuasan Pelanggan pada Klinik Ms Glow (Studi pada Konsumen Ms Glow Aesthetic Clinic Medan). Journal of Social Research, 1(8), 908–915. https://doi.org/10.55324/josr.v1i8.186

38. Suhendy, V. Y., Ketaren, R. D., Lestari, N., Gaol, A. R. L., Lubis, A. R. A., Hutabarat, D. M., & Faiz, A. (2024). Pengaruh Ketepatan dan Kecepatan Pelayanan Mie Gacoan Medan Pancing Terhadap Kepuasan Pelanggan. Innovative: Journal Of Social Science Research, 4(5), 10052–10062. https://doi.org/10.31004/innovative.v4i5.18065

39. Supriyono, H., Rochman, P. A. N., & Tokhi, M. O. (2021). IoT Technology Involving Wheeled Line Follower Robot for Restaurant Services Automation. Elkomika : Jurnal Teknik Energi Elektrik, Teknik Telekomunikasi, & Teknik Elektronika, 9(1), 100. https://doi.org/10.26760/elkomika.v9i1.100

40. Syaputra, A., Dwi Ananda, M., Juvekillano, M., Tovarel, R., Apriyanto, Y., Sanjaya, V. F., Ekonomi, F., Islam, D. B., Islam, U., Raden, N., Lampung, I., Manajemen, S., & Syariah, B. (2024). Strategi Inovasi Dalam Meningkatkan Competitive Advantage di Era Digital. 3(2). https://doi.org/10.36490/jmdb.v3i2.1489

41. Varadarajan, R. (2024). Inclusive innovations in services: leveraging digital technologies for inclusive innovations in healthcare services. European Journal of Marketing, 58(13), 107–129. https://doi.org/https://doi.org/10.1108/EJM-02-2023-0080

42. Wahyudin, N., Rakib, M., & Jufri, M. (2024). Retail business development using BSI smart agent electronics: a strategy for increasing sales volume in minimarket businesses. International Journal of Current Science Research and Review, 7(01), 197–204.

43. Wahyujati, B. B., & Wicaksono, M. B. (2022). Perancangan Robot Edukasi Sebagai Implementasi Interdisipliner Keilmuan Rekayasa Mekatronika Dengan Desain Produk (Vol. 25, Issue 2). https://doi.org/https://doi.org/10.24821/ars.v25i2.6837

44. Wiastutti, R. D., Ignacia, S. N., Angraini, L. D., Masatip, A., & Sinuraya, E. J. (2024). Service robots in the hotel industry: Customer acceptance among international and local hotel brand. Tourism and Hospitality Management, 30(3), 375–388.

45. Wirtz, J., & Lovelock, C. (2021). Services Marketing: People, Technology, Strategy (9th ed.). World Scientific.

46. Zeithaml, V. A., Bitner, M. J., & Gremler, D. D. (2023). Services Marketing: Integrating Customer Focus Across the Firm. McGraw-Hill.