

Tap n' Take (TnT): Queue Management System with Kiosk for PansEAT Tagapo Restaurant

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ABSTRACT

Title : Tap n' Take (TnT): Queue Management System
with Kiosk for PansEat Tagapo Restaurant

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The study investigates the operational processes of PansEat Tagapo Restaurant, focusing on queue management, staff management, and sales tracking, with the aim of identifying existing processes, assessing the impact of manual procedures on speed of service, and evaluating the current system's reliability, maintainability, usability, and efficiency. Through a combination of observational studies and customer evaluations, it becomes apparent that while the restaurant demonstrates proficiency in certain service aspects, significant challenges arise from reliance on manual processes, leading to delays, customer discontent, and operational inefficiencies. This study underscores the importance of embracing technological advancements, such as self-ordering kiosks and

point-of-sale systems, to optimize operational performance and enhance customer satisfaction. Recommendations include the implementation of modernized systems, proactive maintenance strategies, comprehensive staff training initiatives, and encouragement for future researchers to seek additional information to fortify their perspectives. By addressing these identified issues and implementing the recommended actions, PansEat Tagapo can elevate its operational effectiveness and ensure sustained success in the dynamic restaurant industry landscape.

Keywords: Polytechnic University of the Philippines, Bachelor of Science in Information Technology, Queue Management, Point-of-Sale System, Self-ordering Kiosk, PansEat Tagapo Restaurant

CHAPTER 1

The chapter consists of various elements involved in the execution of the study. These include the background and rationale of the study and discussing PansEat Tagapo Restaurant's challenges that the researchers are trying to solve. The chapter also includes a theoretical framework, which incorporates theories that relate to the current study, along with a conceptual framework that guides the researcher's investigation. And lastly, questions that the researchers should answer, scope and limitations that the study could cover, and definition of terms that serve a better understanding of the study.

Background and Rationale of the Study

The restaurant industry is constantly evolving, and technology plays a significant role in this transformation. One of the latest technological advancements in the restaurant industry is the adoption of self-ordering kiosks. As the demand for enhanced speed, convenience, and customization grows, self-ordering kiosks have emerged as a solution to address challenges associated with traditional ordering processes. Another technological advancement in the restaurant industry is the automation of kitchen systems, inventory tracking tools, and predictive analytics, which contribute to more effective resource management, reduce waste, and improve overall efficiency. This integration of technology in restaurant operations reflects a broader trend within the restaurant industry, where innovation is embraced to meet the evolving expectations of consumers and enhance the overall competitiveness of food establishments.

PansEat Tagapo Restaurant is a Filipino restaurant located in Santa Rosa, Laguna. The restaurant is known for its delicious and affordable Lutong Bahay (homecooked) dishes. The restaurant was founded in 2015 by a group of friends who shared their love for Filipino food with others. Started out with a small menu of classic

Filipino dishes such as Pancit Canton, Bihon, and Kare-Kareng Gulay. The restaurant quickly became popular with locals and tourists and soon became a favorite spot for family gatherings, birthday parties, and other special occasions. Today, PansEat Tagapo is one of the most popular restaurants in Santa Rosa, known for its delicious food, friendly service, and affordable prices.

However, standing out in a competitive market can be challenging because restaurants need to find a unique selling proposition to constantly attract new customers. Building brand awareness and effectively marketing the restaurant is essential. Initial struggles with branding and marketing can lead to low visibility and customer awareness. Developing efficient kitchen and service operations includes optimizing workflows, minimizing wait times, and ensuring smooth coordination between the kitchen and front-of-house.

To address these issues, implementing a queue management system through self-service kiosks in a restaurant is likely to enhance operational efficiency and elevate the overall customer experience. The system prioritizes efficient order placement by allowing customers to customize orders. The intuitive design ensures a quick and straightforward ordering process. By focusing on convenience, order accuracy, wait time transparency, and system integration, restaurants can utilize kiosk technology to create an ordering process that satisfies customers and optimizes restaurant operations.

The queue management system is integrated with the restaurant's point-of-sale (POS) system. This integration ensures updates within the POS system as orders are placed through the kiosk, contributing to a cohesive and synchronized workflow. The queue management aspect is addressed through the implementation of a POS system that allows restaurants to meticulously track various aspects of the ordering process.

Theoretical Framework

A theoretical framework upon which such a theory may be constructed is presented, which would be useful for all the information professions. (Myburgh, Tammaro, 2013). The steps of the construction of this framework are given, including suitable epistemological approaches for this task. The Queuing theory and UTAUT theory are used in this research.

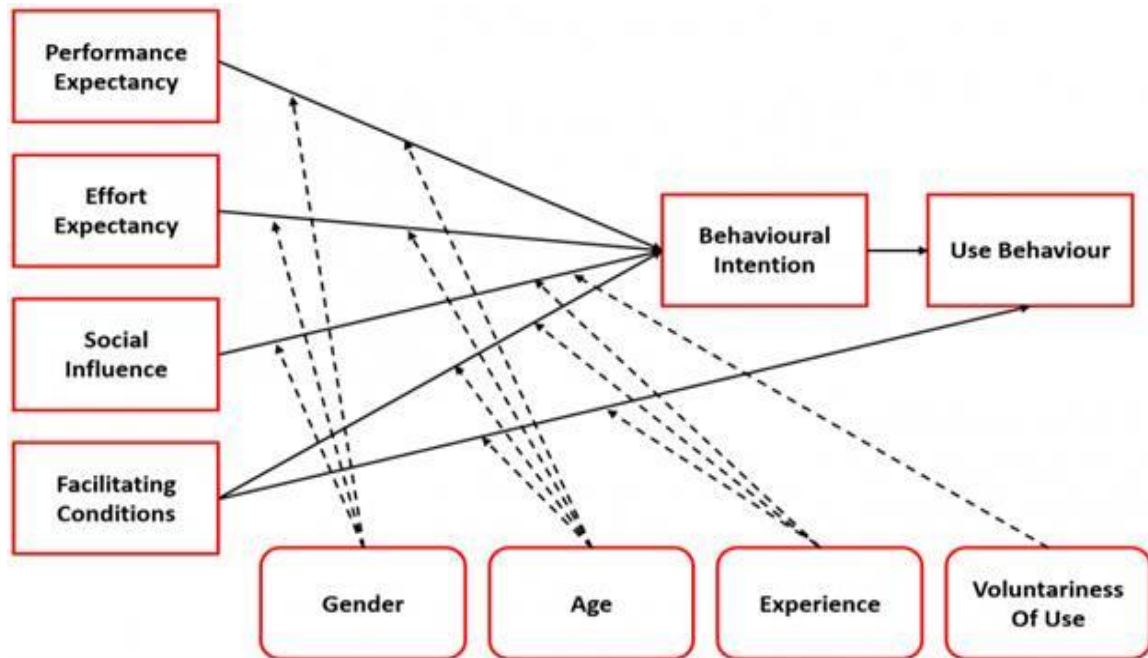
As cited by Lambert and Cullen in 1987, queuing theory is a more practical approach than other operations management techniques to find the optimal point where the cost of providing service and customers' waiting time are simultaneously minimized. Lambert and Cullen believe that a more recent and cost-effective approach to reducing waiting times has been to introduce self-service technologies (SSTs) into the service delivery process. SSTs have been defined as technological interfaces that allow customers to produce services without a service employee's involvement. In this theory, queue management systems discuss the reduction of the waiting time of customers using modern systems such as queue management with Kiosk to serve customers quickly and efficiently and avoid customer service shortfalls. Queuing theory helps reduce the amount of time they spend on manual queues, achieve customer satisfaction, and improve the customer experience, together with the use of modern systems to further increase the development of a business.

This theory was developed by Venkatesh et al. in 2003. This theory is also known as the Unified Theory of Acceptance and Use of Technology (UTAUT). Venkatesh et al. examine the acceptance of technology as determined by the effects of performance expectancy, effort expectancy, social influence, and facilitating conditions. UTAUT has been widely used and evaluated in various contexts and for different technologies, and

UTAUT is a framework for understanding technology acceptance. UTAUT designs strategies to enhance technology adoption and usage. In this case, UTAUT considers queue management with Kiosk the latest innovative technology to be offered by restaurants to improve customer experiences, especially in quick-service restaurants. The relationship between customer self-ordering kiosk usage and post-purchase behavior in quick-service restaurants is an assessment of customers' actual usage. The Unified Theory of Acceptance and Use of Technology (UTAUT) is found to be the most adopted model in foodservice and technology studies. To fit with the proposed research framework, the UTAUT was adopted and modified by incorporating post-purchase behaviors that act as the dependent variable. This study serves as an addition to the digital technology and application adoption such as queue management with Kiosk on menu-ordering transactions and the foodservice system.

As a result, this study considers the key factors of four (PE, EE, SI, and FC) about a kiosk characteristic by the comprehensive reviews of the study. Many of the preceding studies have suggested that the four factors of the UTAUT are the best source for positive behavioral intentions.

Figure 1. Unified Theory of Acceptance and Use of Technology (UTAUT)



Queuing theory deals with the flow of entities such as customers through a modern system to minimize wait times and enhance efficiency, while the Unified Theory of Acceptance and Use of Technology (UTAUT) deals with various factors influencing adoption of technology, including performance expectancy, effort expectancy, social influence, and facilitating conditions, to explain the behavioral intention and usage of a given technology. Both theories are responsive to each other, they emphasize how important the modern system is and how well it serves consumers.

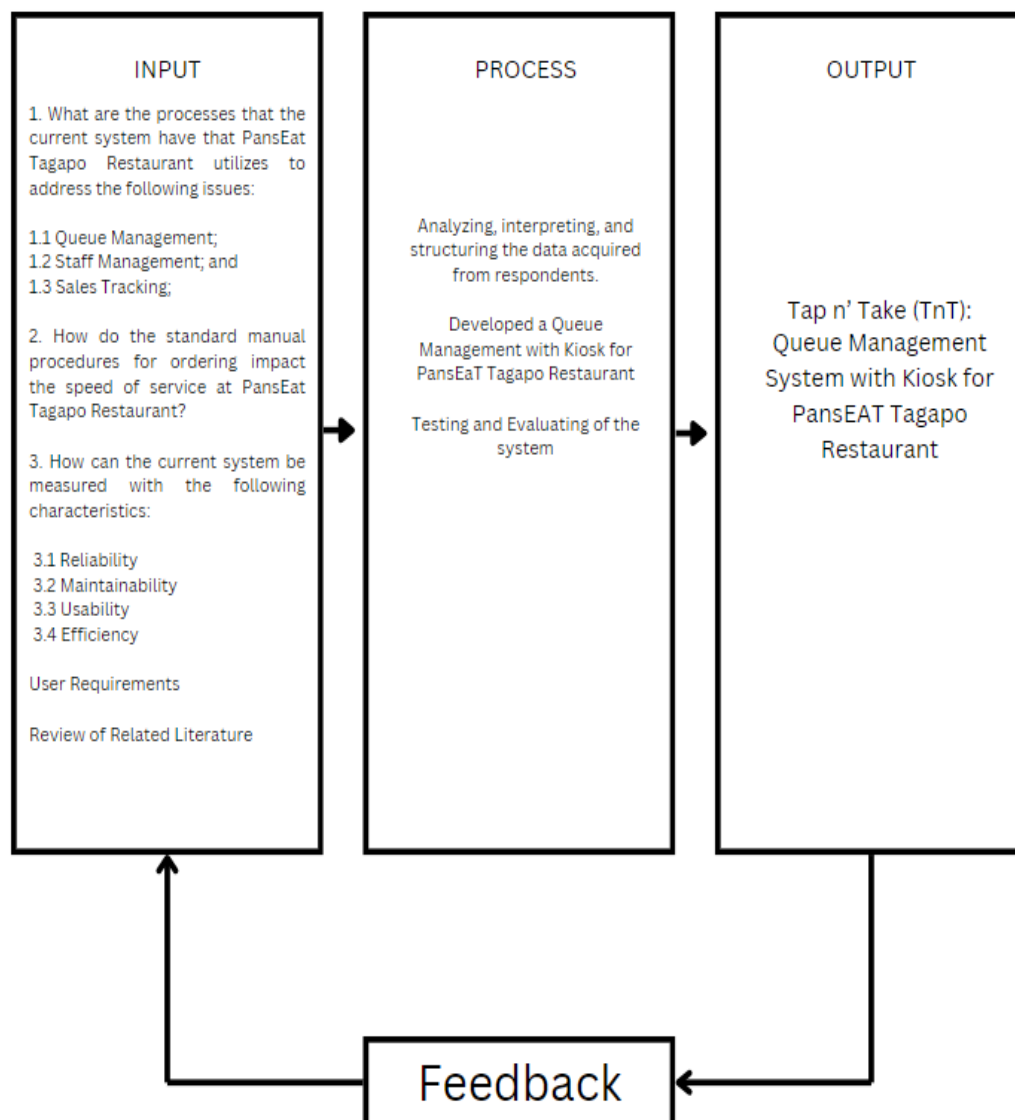
In addition to specifying these theories, the proponents believe that this queuing management can be used to simultaneously minimize the waiting time of customers using modern systems such as Queue Management with Kiosk. This leads to the use of a system to improve customer experiences; customers can interact with the self-service technologies and adopt the proper use of modern technology such as self-ordering kiosks.

This system operates more efficiently because of this advancement. Therefore, the UTAUT and queuing theories are adapted specifically to improve customer satisfaction and specially to improve the modern system, such as by providing a comprehensive approach to the queue management system.

Conceptual Framework

Below is the conceptual frame of Tap n' Take (TnT): Queue Management System with Kiosk for PansEAT Tagapo Restaurant.

Figure 2. Conceptual Framework



The input involves how the PansEat Tagapo Restaurant uses their current system to manage staff, queue management, and sales tracking. It also involves the impact of manual ordering procedure on service speed. Moreover, it seeks to measure the current system performance based on characteristics such as reliability, maintainability, usability, and efficiency. It also explores gathering user requirements by interacting with stakeholders, including restaurant owners, staff, and customers, to identify their needs and expectations from the system. Furthermore, it involves a review of related literature and existing studies in the field of restaurant management systems to gather insights and guidelines for comparison and improvement.

In the Process, data collected from respondents is analyzed, interpreted, and organized. The goal is to extract important insights needed to create the Queue Management system. By combining this information, the researcher creates a system tailored specifically for PansEat Tagapo Restaurant. Also, the development of the Queue Management system begins. It incorporates the insights gained from the analysis. The system is thoroughly evaluated and evaluated to ensure it meets set standards. It aims to fix any potential problems and ensure a strong and efficient system.

Finally, the output phase, after a thorough analysis and a lot of testing, the Tap n' Take (TnT): Queue Management System with Kiosk for PansEat Tagapo Restaurant is finally implemented. The feedback phase is where customers, staff, and restaurant owners provide feedback on the newly implemented Tap n' Take (TnT) Queue Management System. This feedback is crucial for assessing the system's effectiveness and identifying any areas that may need further improvement.

Statement of the Problem

The researcher aims to answer the following questions:

1. What are the processes that the current system of PansEat Tagapo Restaurant utilizes to address the following:

1.1 Queue Management;

1.2 Staff Management; and

1.3 Sales Tracking;

2. How do the standard manual procedures for ordering impact the speed of service at PansEat Tagapo Restaurant?

3. How can the current system be measured with the following characteristics:

3.1 Reliability

3.2 Maintainability

3.3 Usability

3.4 Efficiency

Scope and Limitation

The researchers aimed to implement and develop a Queue Management System with a Kiosk to enhance business operations at PansEat Tagapo Restaurant. The rationale behind this initiative was to introduce a centralized system that improved the efficiency of existing manual processes, addressing specific challenges and limitations within the previous operational framework.

The Queue Management System addressed the existing manual procedures at PansEat Tagapo, encompassing order taking, point-of-sale transaction processing, sales tracking, order transmission to the kitchen, receipt generation, and sales reporting, creating a more streamlined system for order and transaction data management. The proposed system capabilities were only confined to enhancing the overall operational efficiency of PansEat Tagapo restaurant with functionalities limited to the following:

- Self-ordering kiosk, accessible for customers to place orders.
- Point-of-Sale, accessible for the administrator to place and process orders.
- Point-of-Sale (receipt generation), accessible for the administrator to print receipts of orders placed by customers.
- Order list, accessible for the administrator to track placed orders.
- Kitchen side, accessible for the kitchen admin to access placed orders on POS.
- Sales report, accessible for the administrator to track sales within the day or month.
- Top products report, accessible for the administrator to track products with the most sales within the day and all-time.

The Queue Management System presented notable advancements in optimizing the overall operational efficiency of PansEat Tagapo restaurant. However, it was crucial to acknowledge certain inherent limitations within the system. One noteworthy limitation was the absence of support for cashless payments due to technical constraints and regulatory compliance.

Significance of the Study

The research will benefit the following:

To the Customers:

The customers of PansEat Tagapo Restaurant were the majority who benefited from the system. It promoted faster order processing and allowed customers to order independently.

To the Staff:

With the kiosks managing the order placement and payment processes, restaurant staff can redirect their focus to other critical tasks, such as food preparation, customer service, and maintaining a clean and welcoming environment.

To the Admins:

With the use of the point-of-sale (POS) system, administrators have more efficient queue management, staff management, and sales management.

To the Researchers:

The researcher of the study also benefited from this research. It enhanced the capability and competence of developing software that could be beneficial in the field of business.

This was an avenue to explore how information technology could be integrated with business and restaurant management.

To the Future researchers:

The study contributes to the existing body of knowledge in the field of restaurant management and technology integration, which can be used by future researchers who will also tackle restaurant management systems using kiosks.

Definition of Terms

For better understanding of this study, the following terms are defined in the context of this research.

I. Operational Terms:

BOH. It stands for Back of the house. It is any action or area of your restaurant that customers will not interact with (or even necessarily see) during their dining experience.

FOH. It stands for Front of the house. It is any action or area of your restaurant that customers will interact during their dining experience. For that reason, your FOH should be organized, clean, calm, and as quiet and relaxing as possible for your guests.

Menu Book. Is modern, clean and classes up your existing price sheet.

Order Slip. is a slip that is printed to a department printer. Examples of departments would be the kitchen or the bar.

I. Technical Terms:

CSS. An acronym for Cascading Style Sheet. It is a style sheet language used for describing the presentation of a document written in a markup language such as HTML.

HTML. It stands for HyperText Markup Language. It is a standard markup language for web page creation.

Information Technology. Is a set of related fields that encompass computer systems, software, programming languages and data and information processing and storage.

Java. Is a widely used programming language for coding web applications. It has been a popular choice among developers for over two decades, with millions of Java applications in use today.

Javascript. Is a scripting language that enables you to create dynamically updating content, control multimedia, animate images, and everything else.

Kiosk. a small stand-alone device providing information and services on a computer screen. A museum with interactive kiosks.

PHP. Stands for "Hypertext Preprocessor." PHP is a general-purpose scripting language especially suited to web development.

Xampp. is a completely free, easy to install Apache distribution containing Maria DB, PHP, and Perl. The XAMPP open-source package has been set up to be incredibly easy to install and to use.

CHAPTER 2

This chapter presents the relevant literature and studies that the researcher considered in strengthening the importance of the present study. It also represented the synthesis of the art to fully understand the research for better comprehension of the study.

Kiosk and the Food Industry

According to Mikhaylovskiy (2022), self-service kiosks have gained popularity in numerous fast-food establishments, offering time savings for customers and cost reductions for fast-food chains. The study introduces a highly efficient design for a kiosk shopping cart recommendation system, which incorporates a language model for vectorization and a classifier based on neural networks. It also introduces an efficient kiosk-based shopping cart recommendation system for fast-food restaurants. The study strongly supports the adoption of kiosk-based shopping cart recommendation systems in fast-food establishments, which illustrates how innovative technologies such as language models and neural networks can be effectively utilized to enhance queue management and elevate the overall customer experience.

In addition, Poulston (2019) notes that fast-food restaurant kiosks are a popular choice, enhancing customer satisfaction and efficiency. The study highlights that the use of kiosks eliminates queues, allowing more time for menu selection, improving the dining experience, it also provides clear information about menus, ingredients, discounts, and promotions, and giving customers a judgment-free environment in placing orders. However, success of using kiosks still depends on the availability of empathetic alternatives, emphasizing the importance of balancing automation with human interaction for overall service quality. It supports the researcher's study by stating the use of kiosks, which is important because you will know how to use them. Not everybody can use kiosks.

Moreover, among the factors influencing customer value in the context of restaurant kiosks, decision-making convenience stands out as particularly impactful. On the other hand, place convenience and transaction convenience do not wield a major influence over customer value. Notably, customer value has a considerable impact on both trust and satisfaction. Furthermore, trust is a significant driver of overall customer satisfaction. For restaurants seeking to establish long-lasting relationships with their patrons and differentiate themselves in the market, the key lies in adopting kiosks with a primary focus on improving customer service convenience, as opposed to merely reducing labor costs. By prioritizing customer satisfaction and trust, restaurants can foster loyalty and enhance their competitive edge, making the most of this self-service technology (Kim 2020). The study highlights that kiosks significantly enhance customer value in the restaurant industry by simplifying decision-making. In queue management, this underscores the importance of user-friendly kiosks with clear menu info and customization, which can foster customer loyalty and a competitive edge for restaurants. It supports the researcher's study by stating that kiosks significantly enhance customer value in the restaurant industry, which is important because you will know if the kiosks are effective in that restaurant or not.

Kim (2023) stated that during the COVID-19 pandemic, restaurants faced financial struggles due to reduced customer traffic. Even post-pandemic, lingering concerns about crowded spaces deterred some from dining out. To combat this and address labor shortages, restaurants turned to electronic solutions, particularly kiosks, as they offered reduced human interaction and showcased safety measures. Kiosks gained popularity for their ability to cut labor costs, streamline ordering, and boost customer satisfaction and loyalty. A study focused on these self-service technologies highlights their effectiveness in catering to COVID-cautious customers, aiding restaurant resilience. It explores various kiosk features and their impact on customer experiences, linking them to potential revenue

growth. This research aims to understand how kiosk attributes contribute to creating memorable customer experiences within the framework of the experience economy. It supports the researcher study because it states how kiosks impacted the food industry during the pandemic.

Furthermore, according to El-Said (2019) self-service kiosks in food service establishments are becoming a new method of service delivery. Competition in the restaurant sector is intensifying. The different predictors of customers' behavioral intentions to use self-service kiosks and found that effort and performance expectations have a significant and positive impact on price perception customer value and the impact of stronger performance expectations. The positive impact of effort expectancy, performance expectancy, facilitating conditions, social influence, and perceived value on behavioral intention towards self-service kiosk usage. In addition, facilitating conditions, social influence and perceived value served as strong predictors of behavioral intention toward the usage of self-service kiosk. A set of recommendations were offered for fast-food managers on how to improve customers' intention to adopt self-service kiosk.

According to Zulkafly (2021) technological developments are changing countless economic or commercial activities. This situation provides competence and speed to customers and businesses, and technological developments, without exception in the restaurant industry, have played a dynamic role in increasing customer satisfaction levels. customers for self-service kiosks in restaurants. Therefore, kiosks in businesses are an asset to attract customers since most customers today are technology oriented. Technology-based self-service kiosks allow customers to facilitate the ordering process with little or no support from service providers. Therefore, this study aims to examine the relationship between self-service terminal features and customer satisfaction. The results indicate that customer satisfaction is directly affected by the speed of ordering, convenience, and accuracy of ordering to the restaurant's self-service kiosks.

In addition, as stated by Kim (2019) the technology-based self-service has been increasingly installed and operated in recent years in the restaurant industry. The relationship between kiosk quality features and experiential value, satisfaction, and behavioral intentions. Perceived value based on kiosk experience positively affects satisfaction and behavioral intention. Additionally, satisfaction with kiosk use positively influences behavioral intention. The use of kiosks in the food industry is an effective system to improve management efficiency and effectiveness. Ease of use, improved speed, reliability, time and effort savings, accurate service, and improved customer experience. However, arising from the adoption of kiosks, improving business efficiency, and increasing customer convenience have led to increasing demand. Therefore, achieving a harmonious balance between business, customers and modern technology is crucial for sustainable business growth.

Yang (2019) stated that the research findings indicate that while kiosks enhance customer satisfaction, they may also diminish perceptions of hospitality. Users noted that kiosks boosted efficiency by eliminating queues and allowing more relaxed decision-making for menu selections. Although kiosks did not necessarily expedite service, they offered contemplation time and reduced waiting. These kiosks presented clear menu categories, pictures, straightforward English instructions, and simplified processes for ordering and payment, surpassing the information available at service counters. Additionally, compared to counter information, kiosks provided more comprehensive details about menus, ingredients, discounts, and promotions. Users also experienced a sense of empowerment and control when using kiosks, enabling meal customization and order changes without feeling like a bother to employees or other customers. This empowerment alleviated the pressure to hastily place orders at the counter or inconvenience fellow patrons. It supports the researcher because it states that the kiosk is helpful during rush orders.

In addition, Samengon (2022) stated that restaurants use self-service kiosks (SSK) to allow customers to find, customize, and pay for their food and drinks. These kiosks have become popular in fast-food settings because they reduce labor costs, improve order accuracy, increase sales through additional offerings, and are attractive to younger consumers. Previous research has focused on why people choose to use these kiosks, mostly concentrating on initial adoption factors and using student samples. This study delves into the motivations of millennials aged 18 to 34 for using SSK in fast-food restaurants. Through qualitative research involving interviews with SSK users, it was found that convenience, meeting specific needs, and having alternative options were key motivations. The study suggests that these findings can assist restaurants in effectively implementing and enhancing their SSK technology to better serve millennial customers.

According to Hamid (2021) fast-food industry has witnessed a standard change in customer service strategies with the widespread adoption of self-service kiosks. As a typical example, McDonald's has introduced these interactive terminals to integrate the ordering process, offering customers greater control and efficiency. However, despite the potential benefits of self-service kiosks implementation, concerns have arisen regarding the impact on customer satisfaction, particularly in relation to waiting times. A growing body of research has identified waiting time as a critical factor influencing customer satisfaction in fast-food restaurants. In particular, the integration of self-service kiosks at McDonald's has been accompanied by a noticeable increase in complaints about waiting times, prompting a need for an exploration of the difficult gesture between user experience, waiting time, and overall customer satisfaction. This study seeks to resolve the various relationships between user experience and waiting time, with a particular focus on their collective influence on customer satisfaction. By examining these connections, we aim to provide valuable insights into the determinants of customer satisfaction and behavioral intention in the context of self-service kiosks within the fast-food industry.

In addition, as stated by Baek (2023) within the developing food service industry, the integration of innovative technologies, such as kiosks, has become a key aspect for enhancing customer experience and satisfaction. This study examines the strategies adopted by food service companies in other places, aimed at addressing the diversified needs of customers utilizing kiosks. By examining the difficulties of customer perceptions and characteristics associated with kiosk usage, the authors seek to resolve the factual factors that significantly influence customer experience. Furthermore, this research aims to shed light on the effects of these factors on overall customer satisfaction and their consecutive intention to continue using kiosk services. Through a comprehensive examination of these facets, this study contributes valuable insights to both practitioners and researchers in the food service industry, offering a roadmap for strategies that align with the specific needs of the customer in other places.

Queue Management

According to Ardiansyah (2021), In an age of rapid technological advancement, the demand for essential goods among people is on the rise. This increased demand leads to a buildup of processes in getting these goods to consumers, resulting in what is commonly referred to as queues. The study focuses on addressing queuing issues caused by increased demand for essential goods, especially in restaurants. The study highlights the importance of using technology, specifically kiosk-based systems, to manage queues effectively during high demand and limited-service availability. Such systems have the potential to optimize customer flow, reduce wait times, and enhance the overall dining experience especially and also addressing issues during periods of high demand and limited-service availability.

Furthermore, one of the common issues encountered in community business processes is the presence of lines at the cash registers during food purchases. These

queues typically form due to a discrepancy between the number of customers seeking service and the rate at which service is provided. According to Hasugian (2020), the average time it takes to serve a customer and the intervals between their arrivals are approximately 125.1 seconds and 67.5 seconds, respectively. Initial observations indicate that the average service times at counters 1, 2, and 3 are 111 seconds, 136 seconds, and 138 seconds, respectively. This data suggests that there are long queues, a relatively small number of customers being served within a given timeframe, and an imbalance in the workload among the staff. This statement supports the researcher's study about Queue Management System by highlighting the real-world problem of queues, the negative impact on customers, and the need for efficient solutions. It justifies the study's focus on addressing the challenges associated with queues, particularly in the restaurant sector, and suggests that the research aims to provide practical solutions to enhance service delivery and customer experiences.

Moreover, Chen (2018) explores the development and implementation of an advanced restaurant management system aimed at optimizing restaurant operations, improving customer experiences, and resource utilization. This innovative system integrates components like smart ordering, table management, inventory control, and customer relationship management. It heavily relies on artificial intelligence and data analytics to enhance decision-making and operational efficiency. This research presents a holistic view of an intelligent restaurant management system that harnesses technology to enhance service quality, operational efficiency, and overall customer experiences in the restaurant industry. In the context of queue management systems, this study is particularly relevant because the intelligent restaurant management system proposed by Chen Peizhi includes a smart ordering component, which could also be interpreted in implementing a queue management system using self-service kiosks.

Vries (2018), investigates the impact of waiting time on customer behavior and resulting revenue in a popular Indian restaurant, utilizing data from 94,404 customers over a 12-month period. The results reveal that longer waiting times correlate with reneging behavior, an extended time until a customer returns, and a shorter dining duration. A simulation experiment based on empirical findings suggests that eliminating waiting could potentially increase the restaurant's total revenue by nearly 15%. The study proposes strategies such as encouraging reservations to mitigate waiting-related consequences. Additionally, simulation experiments indicate that, within current capacity limits, revenue could be maximally increased by 7.5% through more flexible customer allocation rules or by expanding seating capacity by 20%, resulting in a 7.7% revenue boost without attracting additional customers. These findings contribute valuable insights for service providers to comprehend the financial and operational implications of waiting-related decisions in service settings, enhancing the customer experience and optimizing revenue.

Weiss (2018), discusses the impact of queues on customer satisfaction within service processes, presenting a three-principle framework for effective queue management. These principles encompass (1) reducing or eliminating wait times through process enhancements, (2) managing expectations via timely communication, and (3) enhancing the waiting experience. The article underscores the importance of queues as indicators of unmet customer needs that can lead to frustration. Historical innovations, including the introduction of a single snake line, are explored in the context of minimizing unfair waits and addressing service time variability. Realistic wait time expectations, exemplified in practices such as those observed in Disney theme parks, are advocated for anxiety alleviation. The study also recommends leveraging technology to eliminate processes that necessitate customer waiting. Additionally, the article emphasizes the value of integrating unavoidable queues into the service process for improved outcomes.

The overall discussion encourages managers to regularly review processes, identify customer queues, and assess waiting experiences to ensure comprehensive customer satisfaction.

Staff Management

According to Troger (2021), Effective staff management requires managers to balance company needs with the needs of individual employees. This involves providing continuous feedback, listening to employees, and taking a flexible, situation-specific approach to remuneration and meeting individual needs considering labor market changes. Diversity management calls on managers to utilize differences strategically rather than eliminate them. Company culture also plays a critical role, requiring managers to be sensitive and ensure employee well-being, especially during challenging times. Overall, a key focus for managers should be supporting the individual work-life balance of their staff. Meeting these challenges will require communication, flexibility, and sensitivity on the part of managers.

Kudaktin (2023), emphasizes the pivotal role of staff development management in shaping the personnel potential of a business entity, providing essential insights into principles, tasks, and factors influencing employee development efficiency. The refined categorical apparatus, featuring concepts such as "personnel development" and "personnel development management," underscores their critical contribution to maintaining competitive advantages and sustaining market activity. The study advocates for the strategic positioning of staff development as an integral component of the Employee Value Proposition, urging its consideration during competency map reviews. The importance of high-quality information and documentation support for personnel development, including competency maps, IDP plans, and personnel policy, is highlighted as essential for enhancing efficiency and ensuring personnel potential and intellectual

security. The study concludes by exploring the profound impact of effective staff development management on the economic security of business entities, emphasizing the need for strategic alignment with organizational elements for optimal outcomes. Overall, the findings underscore the significance of an integrated and strategic approach to staff development in achieving broader organizational objectives.

Staff Productivity Management Information System is a comprehensive software application designed to aid organizations in managing and enhancing the productivity of their staff. Addressing the challenge of task management and performance evaluation, the system provides a platform for managers and supervisors to assess staff performance based on predefined metrics such as quality of work, productivity, communication skills, teamwork, and problem-solving abilities. The evaluation process incorporates metrics and rating scales to ensure fairness and consistency across the organization. This user-friendly and scalable system employs HTML, CSS, JavaScript for the front-end and PHP, and MySQL for the back end. It offers tools for setting performance goals, tracking progress, and providing feedback to staff members. By automating processes such as order-taking and queue management, the system reduces errors, minimizes wait times, and enhances overall operational efficiency. The integration of data analytics provides valuable insights into customer preferences, menu popularity, and peak hours, enabling data-driven decision-making for optimized staff scheduling and performance. The study underscores the significance of such systems in addressing the evolving dynamics of the business environment, enhancing organizational performance, and fostering employee engagement and job satisfaction through a data-driven approach to managing staff productivity. The implementation of the system is crucial for organizations to evaluate employee performance systematically, align individual goals with company objectives, and succeed and thrive in the competitive business landscape. (Odey, 2023)

Queue Algorithm

Indra Sidabutar (2018) stated that in everyday life, many activities are found. One of them is waiting in line. Queuing is a boring thing. Moreover, the queue arrangement was irregular, and officers did not pay attention to who was queuing first. So, it is common to cause complaints and even get angry. Therefore, to manage problems in queuing, queuing simulation is applied using the first in first out algorithm. With this algorithm, it can help determine who will be served first. Simulation is a way that is done to apply a more real system estimate. In this case, the writer uses the first in first out algorithm. The first in first out algorithm, which is first to enter, first to exit. In this case, who is the first to queue, he will be served first and finish first. In this way, it is hoped that it can help in determining who will be served first. So that there are no complaints from customers at the Parkson department store shopping center. The study implemented a Queue Numbering System and used the First-In-First-Out (FIFO) algorithm to improve our system's efficiency. By allowing clients to prioritize and conduct orders in the order that they were received, this system guarantees that the earliest requests are fulfilled first. An orderly and equitable method of order execution is made possible by the FIFO algorithm, which creates a distinct and well-organized queue. Customers can easily discern the order in which they made their requests, allowing for a more efficient process that corresponds with the order in which orders were received. This methodical approach offers a fair and transparent order execution system that not only improves client satisfaction but also smooth workflow management.

Also, in the article "Are you using queuing theory to accelerate performance test analysis?", Moorthy (2022) underscores the significance of employing queuing theory principles in performance testing, especially in the context of agile and DevOps practices in software development. The author also explains the three primary elements of a queuing system: input (job arrivals), the service center (processing), and output (job

completions). The article offers formulas to compute essential performance metrics like arrival rate, throughput, utilization, and mean service time, facilitating the swift identification of performance, scalability, and capacity issues. Queuing theory also aids in resource allocation, determining the right number of kiosks to manage demand efficiently. The study on queuing theory's application in performance testing finds relevance in the context of restaurant kiosks. The application of queuing theory can help optimize the queue management system by analyzing factors such as arrival rates, service rates, and the number of servers (kiosks), the restaurant can make informed decisions to improve customer satisfaction and operational efficiency.

In addition, Youbing (2018) introduces a pioneering algorithm for distributing and processing queue data, comprising essential components like a data encoder, a data queue manager, a waiting queue manager, and multiple task machines. The primary aim of this algorithm is to efficiently address data processing requirements in both scenarios, ultimately elevating the efficiency and effectiveness of data distribution and processing. By implementing this algorithm, restaurants could optimize resource utilization and enhance the overall workflow of their Queue Management System; this would not only improve operational efficiency but also contribute to a better customer experience by reducing waiting times and improving service delivery.

The study explores the optimization of point-of-sale (POS) operations in fast food restaurants through the application of process mining principles and machine learning techniques. The research analyzes event log data related to order-taking processes in the hospitality sector, specifically focusing on fast food POS systems. Methodologies such as heuristics miner and directly follows graph (DFG) under process mining are employed to identify bottlenecks in the existing POS system. Regression analysis is utilized to uncover reasons for increased order-taking times, with a comprehensive exploration of feature engineering, descriptive statistics, and outlier elimination. The findings highlight significant

contributors to order processing times, including factors such as product sales and operator workload. Specific actions are suggested to decrease order-taking times, projecting a potential 21% improvement in a territorial business, thereby increasing productivity in POS environments. The study underscores the effectiveness of integrating machine learning and process mining techniques while emphasizing the importance of understanding the factors influencing restaurant POS processes. The research opens avenues for further exploration into the efficiency of the proposed process structure for operator usage (Yildiz, 2023).

Restaurant Operations

Shigeki (2018) explores the operational implications of implementing a restaurant management system (RMS) in restaurant businesses and identifies a notable positive impact across various operational aspects. RMSs centralize order management, enhancing order accuracy and minimizing errors during order and food preparation. The study expedites food preparation by providing real-time order information to kitchen staff, minimizing waiting times for food. RMSs significantly enhance restaurant operations through improved order accuracy, reduced preparation and service times, and efficient labor and inventory management. Integrating RMS with a kiosk-based queue management system can significantly enhance operational efficiency and customer satisfaction in restaurants. The implementation of RMS and kiosk-based queue management systems not only improves operational efficiency by reducing manual tasks and optimizing resource allocation but also enhances customer satisfaction by providing a more convenient and personalized dining experience.

According to Kim (2020), Small restaurants facing competition often struggle to manage queues during busy periods. The paper also investigates how such small restaurants enhance their profitability by adjusting their pricing, table allocation, and

utilization rates, and it presents the following findings based on two distinct studies. The implementation of a table allocation strategy results in increased seat occupancy and profits, along with the identification of equilibrium points for utilization rates. In the context of a queuing system, the study uncovers a trade-off relationship between utilization rates and average waiting times. The study supports using a Queue Management System like a Kiosk to simplify queues, reduce wait times, and improve customer satisfaction. The use of this approach offers restaurants a pathway to not only survive in a competitive landscape but also thrive by improving their operational efficiency and customer experience.

In addition, Obermeier (2020) investigates how queuing technology influences the customer experience in physical retail settings. The study attributes this positive impact to queuing technology's ability to reduce perceived waiting times, leading to shorter wait perceptions and reduced customer boredom or frustration, particularly when compared to human-operated systems. The research provides compelling evidence that queuing technology positively contributes to the customer experience in physical retail environments, increasing satisfaction and fostering greater customer loyalty. This provides convincing evidence supporting the implementation of advanced queuing technologies such as kiosk-based systems in physical retail settings. Compared to human-operated systems, a Queue Management System could provide a more efficient and consistent service, further improving the customer dining experience in restaurants.

Customer-Centric Perspective

According to Sheth (2023) Customer service is becoming increasingly crucial for improving customer experience by including help needs at all stages of the customer journey. Customer service is growing as an essential component of outstanding customer experiences; nonetheless, it is frequently regarded as a post-purchase touchpoint. There

is a scarcity of research that focuses on the multiple responsibilities of customer support service throughout customer experience journeys. As a result, while studying the consumer, apply the concepts of customer journey and customer experience. This study supports the researcher's system for the effectiveness and efficiency of customer-focused support services and the impact of services on the overall customer experience. It clarifies the restaurant queue experiences and how they affect customer satisfaction and loyalty. Adopting a good queue management system reduces waiting times and enhances satisfaction.

Besides that, according to Hagh (2021) A system and method for queue management for a facility that provides items, services, or a combination thereof to a client is provided, the system includes a multi-tenant policy management module and a queue creation engine. The management module stores queue policies or rules linked with the items, services, or combinations thereof, and establishes a risk rating for the client. This study can help the researcher's system to enhance the restaurant's queue management system by examining modern technologies and ideas that optimize client flow, reduce waiting times, and boost service efficiency.

As cited by Dimitrakopoulos (2021) Strategic customer behavior is strongly influenced by the level of information that is provided to customers. Hence, to optimize the design of queueing systems, many studies consider various versions of the same service model and compare them under different information structures. More importantly, the researcher's findings indicate that an alternating information structure implies in general higher equilibrium throughput and social welfare in comparison to both the observable and unobservable cases. In this situation, studying customer behavior in queues supports the researcher's system for designing queue management strategies and improving restaurant queues. Information structure on customer choices helps how communication

and information flows affect queue management systems that improve customer communication and decisions making.

Sales Tracking

Saeed (2019) discusses that an automated point of sale (POS) system offers significant benefits for several types of businesses. A major advantage is all sales information is stored remotely and accessible from anywhere with an internet connection. This enables retailers and restaurant chains to monitor purchasing trends, inventory levels, and other metrics seamlessly across their various stores. The data can be utilized to optimize everything from inventory management to targeted marketing campaigns. For example, purchasing habits based on demographics and geography can inform promotional strategies. Overall, the automated POS approach outlined allows for data-driven decision making through actionable, up-to-date sales insights. This provides an efficient, cost-effective means for multi-location businesses to centralize sales tracking and use those insights to facilitate growth.

Singh (2022) Restaurant dine-in system with sales analysis. Most of the restaurant's meal orders rely on the interaction with waiters to place orders into the kitchen. Because of the pandemic, talking with waiters and other restaurant staff members might be uncomfortable. To address such issues, this system was created. This system covers the whole restaurant order process, including interactions between the customer, the waiter, the kitchen, and the cashier, via a web application. Additionally, restaurant owners will be able to increase sales by utilizing this technology to evaluate sales collected. This technology aims to replace the old human ordering method. A better user experience with meal suggestions might indirectly increase customer loyalty to the restaurant. It is a full solution for managing restaurant services with little human involvement and optimum frictionless service.

Technology in Restaurant

In addition, as stated by Bin (2018) A technique for managing restaurant queues and a system for managing restaurant queues. Besides, the system counts the latest dining status in real time and amends the predicted queuing time, thus the user can acquire the most exact queuing time and the user experience is improved. It supports the researcher's system to help monitor new advances in queue management for the selection of up-to-date technologies for the researcher's system, utilizing the knowledge from other sectors to ensure industry-standard development and implementation.

Furthermore, according to Peizhi (2018) Describes an intelligent restaurant management system that includes a main controller module, a first network ordering module, a second spot ordering module, a back kitchen management module, and a queue waiting module. According to the intelligent restaurant management system, multichannel reservation is conducted, the loss amount is small, queue waiting experience is optimized, the dining rate is ensured, code scanning at a table edge for ordering is conducted, manpower is reduced. The study helps the researcher's system consisting of order handling, customer interacting, and involving POS systems. The knowledge of these elements support researchers' study as a basis for producing a good queue management system in tune with the modern technology of the present day.

According to Kim (2020) Competing small eateries face long lines during peak hours, they lack coping skills. However, few studies have looked at the revenue management techniques of small restaurants during peak hours. To boost profitability, examine the quantity and timing of price increases. The utilization rate and average waiting time are also noted as having a trade-off connection in a queuing system. The findings provide light on how managers of small restaurants with long lines might devise effective revenue management techniques to manage peak hours. To improve your queue management system, consider using technology such as self-order kiosks. This study

supports the researcher's system not only for efficiency but also helps financial sustainability for the restaurants. From sustainable revenue management techniques, the researchers can extract essential elements of the queue management system to improve profitability.

This research aims to investigate current practices in facilities management (FM) work order processing, as outlined by Ensafi (2024), offers valuable insights applicable to the implementation of a queue management system. The study emphasizes the challenges related to inconsistency and subjectivity in processing and prioritizing work orders, urging the adoption of data-driven approaches. Integrating the specific data requirements identified into a queue management system can significantly enhance accuracy and consistency. The study's findings on criteria selection, rankings, and challenges in work order can inform the development of an effective decision-making framework for optimizing queue management. Additionally, insights into variations based on experience, facility types, and sizes provide a foundation for tailoring the queue management system to diverse. By implementing this comprehensive framework for data-driven decision-making, organizations can address challenges, streamline processes, and enhance the overall efficiency of their queue management systems in the realm of facilities and maintenance management.

Chen (2018), study on independent restaurants sheds light on crucial findings that reshape the traditional understanding of success in the industry. Despite facing challenges such as intense competition and limited support, restaurateurs in Auckland perceive success beyond financial metrics, linking it to personal achievements and satisfaction. The research underscores the significance of three key factors influencing restaurant success: the operational environment, stakeholder relationships, and management decisions. Intense competition and changing consumer trends are identified as crucial aspects of the operational landscape. Stakeholders, including restaurateurs, customers, suppliers, and

employees, play pivotal roles, with positive relationships contributing to a restaurant's success. Importantly, restaurateurs emerge as foundational figures, requiring in-depth industry understanding and effective management skills to navigate challenges. Management decisions, encompassing location, staff, product quality, and financial control, are highlighted as pivotal contributors to success. The study recommends a well-designed management system, involving thorough pre-entry research, financial control, and marketing strategies, for sustained success in the independent restaurant business. Overall, the research provides valuable insights into a multifaceted understanding of success in the restaurant industry, urging a comprehensive approach beyond financial considerations.

Emerging Technology

Besides that, according to Hagh (2020) The current invention pertains to a queue management system and method for providing one or more service kinds to clients. The system features a feature that allows clients to place themselves in a line for the chosen service by activating a token issued by the system. The system generates a queue number and places the user in a line for the service. This involves efficient client line management, reducing wait times, and enhancing customer satisfaction. Borrowing methods from other sectors can be valuable in creating a successful restaurant system. It supports establishing better strategies and highlighting areas in need of improvement in the researcher's system. This study will support in creating a custom restaurant system that will enable the researchers to distinguish and offer new insights into the industry.

In addition, as stated by Soon (2018) Describes relates to a queue management system and method, and more specifically, but not exclusively, to a time-based queue management system and method for providing a user with a dynamic and unique time-based queue number and enabling a user to queue for a product and/or service via a

communication device onsite or remote from another location. Additionally, the efficiency of queue management helps how it is used in your restaurant, which will assist in establishing assessment criteria. It supports researcher's systems for a user-friendly system that is designed to cater for the needs of customers and employees while also helping the researcher's system to solve problems and create a system that is necessary to us.

Furthermore, according to Yunfei (2018) The innovation is a method and system for making restaurant reservations and ordering. Customers inquire dining information of all restaurants in the area at the platform; customers select restaurants based on their own actual needs, select seats and carry out ordering in advance, determine arrival time, and carry out advance payment; restaurants determine order information and carry out real-time updating a platform; customers arrive at restaurants and dine; when eating is over, restaurants settle at the platform, cancel orders, and update and preserve seat information in the platform. The system can be network-connected to a queuing system of each restaurant to update restaurant seat information and queuing information in real time; and the system can display seat information of many restaurants to customers simultaneously, allowing customers to select seats more conveniently. It develops a queue management system which helps the researchers with ordering and expectations of customers through the modern ordering system and customers' expectations, resulting in a complete solution.

Automated Ordering

According to Callarman (2023), using technology and processes, automated order processing makes it possible to complete orders more quickly. Order processing may be made more efficient through automation, which also helps to decrease human error and speed up fulfillment and shipment. It highlights the role of technology and automated

methods in significantly accelerating the process of order fulfillment. It supports the researcher's system by stating the efficiency of automated order processing, which is vital for the contextualization of the researcher's study.

In fact, Woon (2019) highlights a system for ordering food in a restaurant. It includes a device for taking orders, a cash register, a kitchen screen, and a central server. The order-taking device has a list of dishes, a way to know which table was ordered, and a way to gather customer details. It is used to collect what the customers want to eat and send that information to the central server. The server then shares the order with the kitchen and the cash register. The kitchen screen shows the chef what to cook, and the cash register makes the bill and manages payments. This system makes ordering food easier and smarter. It supports the researcher's study by stating the importance of learning the basics of how restaurant ordering systems work, which is vital for the contextualization of researchers' study.

In addition, Chandekar (2023) stated that automation involves using mechanical, electronic, and computer systems. In restaurants, you usually find menus on the tables, and customers use them to place orders through a waiter. This traditional process often means customers must wait for the waiter's help. Restaurant managers may also face challenges keeping track of menu price changes. Additionally, adding added items to the same menu can be a time-consuming task for the person responsible, as making quick menu changes can result in higher expenses. It discusses the challenges faced by traditional restaurant ordering systems and highlights the need for automation to speed up the process. It supports the researcher's study by stating the challenges faced by traditional restaurant ordering systems, which is important to know so it can help determine what to do and how to make it easy for the customers.

Data Management

Moreover, Storey (2019) stated that in an increasingly digitized world, the handling and administration of data have become more critical than ever. We have transitioned from the traditional management of data, passed through the era of big data, and now find ourselves in an age characterized by digitalization. While many of the traditional data challenges endure, they can be described in terms of data semantics, structure, syntax, and context. These challenges provide important guidance for ongoing work in the context of emerging technologies. Understanding and dealing with these common data challenges is crucial for the queue management system to work effectively. Making sure data is correctly understood, well-organized, properly formatted, and fits into the restaurant's operations is essential for its success.

Besides, Enkhtaivan (2020) stated that a data management approach within a data distribution system that utilizes blockchain technology to oversee the distribution of data offered by a data provider. The method involves registering two transactions on the blockchain. The first transaction signifies a data usage request from a data user, and the second transaction includes a token that represents the data provider's decision regarding the request from the first transaction. Once the method receives the allowance token from the second transaction, it then delivers the data to the data user, contingent upon the receipt of the token. It employs blockchain technology to efficiently handle data distribution, and in the researcher's case, this could translate to managing customer orders, preferences, and service requests.

Meanwhile, data management involves actions and approaches associated with storing, structuring, and providing information about data and various research resources. It plays a crucial role in making datasets useful, not only for the team conducting the original research but also for others. When integrated into the broader research process, data management techniques can serve to encourage other practices, such as those

supporting reproducibility and the principles of open science. While not every research dataset must be made publicly available, effective data management is essential to documenting the research journey comprehensively (Borghi & Van Gulick, 2021). It supports the researcher's study by stating the effective data management techniques, which is important because it will ensure that the data collected is organized, stored securely, and can be readily accessed when needed.

System Security

Furthermore, security is the protection of information assets through the application of technology, procedures, and training. Attacks on software systems are bound to happen, but the software must function properly despite these dangers. Integrity, authentication, and availability are three crucial components that the security process is expected to offer. Security is a collection of procedures and methods used to protect sensitive data in printed or electronic form against alteration, erasure, and illegal access. (Zamfiroiu,2022). It highlights the necessity for software systems to continue functioning properly even in the face of potential risks or attacks. In the context of the restaurant's queue management system, this underscores the importance of resilience and data integrity. The proposed system should be designed and managed to ensure its continuous operation, even in the presence of potential security threats.

In addition, Sharma (2018) stated that system security is an important task that needs to be carefully considered while designing a system. It is defined as a methodology and procedure followed by a system head to protect the system components or data from undesirable threats and unauthorized users. Since it is responsible for protecting all information that passes through a system, system security is a crucial component of data security. Currently, network security is more important than ever for information flow between computers, within organizations, and within the armed forces. With the

development of the internet, security has become a significant concern for protecting important data. Numerous solutions have been developed because of the associations' rapidly growing PC population. We needed security on the system because of the growing number of clients and systems around the globe, as well as the increasing number of risks and unauthorized users. It highlights the value of system security in protecting information and components from harmful threats and unauthorized users. It supports the researcher's study by stating the value of system security, which is important because given that the system holds private customer information and operational data, establishing strong system security is essential to protect this data from potential breaches and illegal access.

However, Divakarla (2023) highlights that a security system is a way of securing something that is implemented through a network of cooperating parts and gadgets. It has risen to the top of everyone's list of priorities. One encounters numerous types of locking devices everywhere, from opening the car in the morning to locking the doors and closets before bed. In other words, having everything secure has become essential in everyday life. It supports the researcher's study by stating how interconnected devices and components make up security systems, which is important because this has to do with the system, which consists of different parts to manage client lines effectively and safely. It highlights the significance of a thorough security framework within the system to protect sensitive client data and guarantee efficient operations.

Effectiveness of Implementing KIOSK and POS System in Restaurants

Point-of-sale systems (POS) represent the computerization of the cash register and its linking to databases, thus providing businesses with more digital data and the ability to know them. Likewise, Sakiru Abiola LAWAL, Ph.D (2022), stated that POS systems give businesses the ability to retain and analyze a wide variety of inventory and transaction data on a continuous basis. They have been touted as valuable tools for a

wide variety of business purposes, including refining target marketing strategies; tracking supplier purchases; determining customer purchasing patterns; analyzing sales (on a daily, monthly, or annual basis) of each inventory item, department, or supplier; and creating reports for use in making purchases, reorders, etc. The findings of this study are that the evolution of Point of Sale (POS) systems, from James Ritty's cash register to modern touchscreen technology, has significantly benefited both businesses and customer relationships. These systems enable efficient transactions, cost savings, and comprehensive record-keeping, benefiting manufacturers and retailers alike. The implementation of a POS system can have a significant impact on a restaurant's sales by increasing efficiency and accuracy in recording transactions, which is pertinent to the researchers' study. Additionally, it assists in avoiding inventory losses and sales variances, ensuring a more efficient and financially stable operation for the restaurant.

In addition, Osman Ahmed El-Said (2019) stated that the competition in the restaurant sector is intensifying. Therefore, restaurant brands that wish to win will be those that best use modern technology to respond to their customer needs. Recently, several restaurant brands have used self-service kiosks (SSKs) as a replacement to traditional point of sale. A set of recommendations were offered for fast-food managers on how to improve customers' intention to adopt SSKs. Insights from Osman Ahmed ElSaid's study in 2019 on the escalating competition in the restaurant sector and the uptake of self-service kiosks (SSKs) provide a pertinent context for the current study, which focuses on implementing a "Queue Management System with Kiosk." By comprehending the increasing significance of technology, particularly self-service kiosks, in the restaurant industry, the current study can draw upon these findings to design and optimize a queue management system in the context of queue management in restaurants, El-Said's advice to connect operations with modern technology and customer expectations is helpful for boosting customer experiences and operational effectiveness.

The self-ordering kiosks (SOKs) in the foodservice industry provides a better financial measure, consumer loyalty, and positive employee feedback. According to Farah Adibah Che Ishak (2021) The foodservice industry embraces this current revolution, where digital dining offers mesmerizing experiences by making the trip to restaurants more appealing and interactive. The customer acceptances, technology restrictions, and the need for regular updates are within the restaurants' external challenges in executing this innovation. The findings of this research can facilitate existing restaurants in managing the technology applied and, at the same time, improve their service in offering a digital dining experience to millennial customers. The results of this study are expected to bring about a positive influence on the Faculty of Food in Malaysia. In line with the findings of this research, the upcoming study to be conducted by researchers is anticipated to yield an elevated level of success. This study follows a similar approach to implement a Kiosk system in restaurants.

Sharma (2023) highlights the transformative impact of Point of Sale (POS) terminal technology on businesses, particularly in the restaurant industry. From its evolution from traditional cash registers to modern digital systems, POS terminals have become integral in streamlining sales, inventory management, and customer service. The study emphasizes the efficiency and reliability of POS technology, highlighting its role in automating tasks, preventing errors, and enhancing the overall operational efficiency of businesses. Real-time sales tracking, inventory management, and customer relationship features contribute significantly to improved decision-making, increased profitability, and a seamless dining experience. The restaurant industry, in particular, benefits from POS terminals by allowing for data-driven insights, identifying best-selling items, and preventing wastage. The study explores emerging trends such as cloud-based systems, mobile technology integration, and the use of AI and machine learning in POS systems. Success stories underscore the positive outcomes of POS system implementation, emphasizing

the need for careful consideration when choosing the right system. While challenges like initial costs and learning curves exist, the study emphasizes the ongoing growth of the restaurant point of sale market as businesses increasingly recognize the necessity of adopting POS terminal technology to stay competitive and efficient in the dynamic business landscape.

Synthesis

The RRL looked at numerous studies on the application of technology in the food industry, with a particular emphasis on the use of kiosks and how they affected restaurant operations and line management. The literature covers a wide range of topics, such as data management, system security, operational effectiveness, and customer satisfaction. Everyone agrees that self-service kiosks, by cutting wait times and simplifying the ordering process, increase customer satisfaction and operational efficiency. Research like that conducted by the authors demonstrates the advantages of tailored recommendations and improved client experiences. Like this, queue management is frequently mentioned as having advantages over kiosk systems, as demonstrated by the better customer flow and service times in the works of the authors.

Although there are many benefits that are agreed upon by the studies, their approaches to the effects of technology on customer behavior and human labor are different. The researchers emphasized the data-driven optimization of restaurant operations, potentially at the expense of human jobs. Some studies have highlighted the significance of striking a balance between automation and human interaction. Furthermore, there are several ways in which kiosks affect consumer behavior. For example, researchers talk about how convenient it is for customers to make decisions, while authors investigate how information from kiosks influences customers' strategic behavior.

The literature provided compelling evidence that restaurants could improve customer satisfaction and operational efficiency by implementing POS and kiosk systems.

It also necessitated, though, striking a careful balance between the continued use of human elements in customer service and technological advancements. While service efficiency increased, the customer experience was kept private and secure by deploying such systems with consideration for customer behavior, data management, and system

security. Given the circumstances, the operational management of the restaurant as well as the patron experience stand to gain from the integration of these systems.

CHAPTER 3

This chapter guided the researchers to gather information that assisted in accurately understanding the research problem. This chapter presents the research methodologies that were used in this study. The discussion will include the research design, which refers to the overall plan or strategy chosen; the research locale, indicating the physical location or setting; the source of data, the information needed for the study; the research instrument, methods used to collect data; the data gathering procedures, procedures to collect data; and the statistical data analysis, which analyzes the collected data, as well as ethical considerations that were utilized.

Research Design

The researchers used a descriptive-quantitative research design to systematically examine this study on how the process of implementing this research in a proper strategy and to identify what the problem of this study is, as well as to justify and satisfy the study aims to comprehend the necessity of the proposed system by the researchers for this study.

The design of this study is descriptive research, the data is presented in numerical and descriptive form. Descriptive research is a research method for describing the characteristics of a population or phenomenon precisely and methodically. This type of research focuses more on the “what” of the research topic than the “why” of the research topic. In this study, descriptive research enhances comprehension of a particular problem and provides good perception to guide future research.

As cited by Sirisilla in 2023, descriptive research design is a powerful tool used by researchers to gather information about a particular group or phenomenon. This type of research provides a detailed and accurate picture of the characteristics and behaviors of a particular population or subject. The descriptive quantitative research design provided importance in this research. In this study, the researchers used descriptive-quantitative

research, which helped the study focus on the analysis of facts for having Kiosk in PanSEAT Tagapo Restaurant to enhance the Queue Management system. The researchers provided a comprehensive approach to understanding the process of implementing the Queue Management System with Kiosk. This approach was the quantitative method of research. This method aimed to have an accurate and systematic description of several individual experiences to achieve and to address issues in efficiency for giving customer service satisfaction. The presentation of the data is a summary of the profile and experience of the respondents at PanSEAT Tagapo Restaurant. This study aimed to evaluate the difficulties faced and the statistical analysis of the researchers' proposed system.

As expressed, it described the development and evaluation of the researchers' proposed systems. It ensured that the explanation in this study was to understand the method of the proposed system by the researchers and have a statistical analysis for implementing this study.

Research Locale

This study was conducted at PansEat Tagapo Restaurant. It was chosen by the researchers as the locale of the study since it is one of the best panciterias in Barangay Tagapo, Santa Rosa Laguna. It was located specifically on a route leading to Rizal Boulevard at Barangay Tagapo, Santa Rosa, Laguna. Figures No. 3 and 4 show the map location and the 3D view of the location of the client.

Figure 3. PansEat Tagapo Restaurant Map

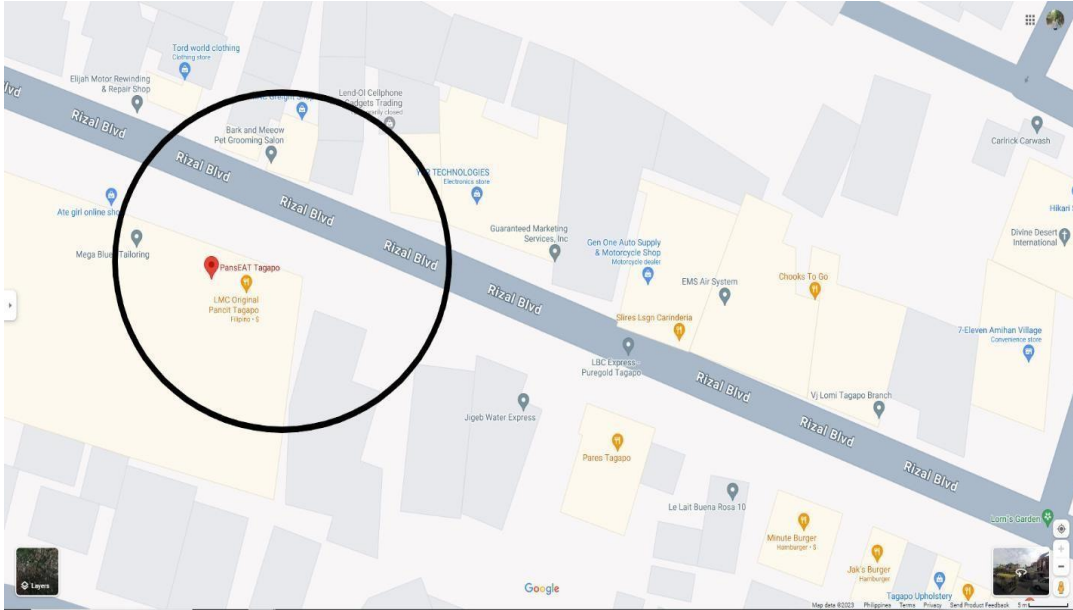


Figure 4. PansEat Tagapo Restaurant (3D View /Google Images)



Sources of Data

This study was conducted at the PansEat Tagapo Restaurant. The respondents were chosen as needed, and it was helpful for the researchers to conduct a necessary study for the queue management system that was conducted, and they were the primary source for collecting data.

The sampling method that the researchers used was the probability method. To determine an appropriate sample size, the researchers factored in both the minimum and maximum number of customers and staff present in the restaurant daily. The number of sample respondents was based on the minimum daily combined customer and staff count. Meanwhile, the total number of respondents was based on the maximum combined customer and staff count. This approach ensured that the selected sample contained enough respondents to produce meaningful insights while also considering the range of customers and staff passing through the restaurant daily.

Table 1

Sources of Data

Name of Population	Total	Sample
Owner/Manager	2	1
Staff	10	8
Customer	40	20

As the main participants in the Queue Management System, PansEat Tagapo Restaurant owner, staffs, and customers were among the data sources. The sampling method that the researchers used will be the probability method. The respondents' varying viewpoints, backgrounds, and expectations with respect to the present and suggested systems are significant for the research study.

Research Instrument

Instrumentation involved creating research tools to collect data for a study. In this research, data was gathered using methods such as questionnaires, surveys, interviews, and observation.

Questionnaire. A questionnaire was the primary tool for collecting quantitative data regarding the current ordering system and the implementation of an automatic ordering system. The study used two separate questionnaires to gather information from both the PansEat Tagapo Restaurant staff and customers. The first questionnaire was for the customers, and it was a 5-question questionnaire that dealt with the current ordering system and the implementation of an automatic ordering system. Twenty customers of PansEat Tagapo Restaurant answered this questionnaire. The second questionnaire was for the staff, and the number of the questionnaire was the same as those for the customers. Eight staff members of PansEat Tagapo Restaurant answered this.

For Customer

Likert Scale
5 – Very Satisfied
4 – Satisfied
3 – Neutral
2 – Unsatisfied
1 – Very Unsatisfied

Selecting a "5" indicates high satisfaction, while a "4" signifies satisfaction with room for improvement. A choice of "3" implies neutrality without strong feelings either way. Opting for a "2" reflects dissatisfaction, and a "1" represents extreme dissatisfaction or unhappiness.

For Staff

Likert Scale
5 – Strongly Agree
4 – Agree
3 – Neutral
2 – Disagree
1 – Strongly Disagree

Choosing a "5" indicates a strong agreement, while a "4" reflects a moderate level of agreement. A selection of "3" signifies a neutral stance without a strong inclination towards agreement or disagreement. Opting for a "2" shows disagreement, albeit not very intense. Finally, picking a "1" denotes a strong disagreement or a complete lack of support for the idea or statement.

Interview. The interviews collected essential information from PansEat Tagapo Restaurant's owners, and the name of the owner is Ms. Leamor Maingat, helping the researcher learn how PansEat Tagapo Restaurant used their current system to manage staff, queue management, and sales tracking. These interviews were the primary data source.

Observation. It was also a primary source of data. The researcher observed the current manual ordering procedure at PansEat Tagapo Restaurant without interfering to gather more information. The restaurant was asked if they were willing to take part in the study. This observation focused on aspects like the order process and how they used their current system, aiming to assist in creating a queue management system with Kiosk specifically for the restaurant.

Data Gathering Procedure

Once the permit to conduct the study was obtained by the client, handing a formal letter to the respondent was the first step in the data gathering procedure. This letter served as the initial point of contact between the customers and the researchers. The letter made clear the objective of the data collection process and listed the details that must be provided by the target respondents to obtain insights on their individual experiences with PansEat Tagapo Restaurant, this served as the primary data source. Additionally, the correspondence-built expectations regarding the process, efficiency, and potential impact on the client's purpose. By applying this systematic approach, the researchers wanted to gain a thorough and complete knowledge of the Restaurant Management Process at PansEat Tagapo Restaurant.

The next step in gathering information about the respondents' experiences and opinions on the current system at PansEat Tagapo Restaurant was conducting interviews with the owner. Researchers received more detailed information on the current management procedure from this interview. The insights that the owner gave provided information about addressing issues such as system effectiveness, customer satisfaction, and areas that require improvement.

Additionally, in-depth observation of areas that required improvement was also conducted. Examples of this include the current ordering system, the point-of-sale system, and billing management. By combining these three methods of gathering data questionnaires, interviews, and observations a comprehensive and well-rounded understanding of the present Restaurant Management System was achieved. Data from these instruments were analyzed, synthesized, and applied to produce the study's outcome, which aimed to offer insightful analysis and recommendations for enhancing the effectiveness of the PansEat Tagapo Queue Management System.

Table 2

Data Gathering Procedure

Answers the following	Data collection	Data type	Data level	Basis
<p>1. What are the processes that the current system of PansEat Tagapo Restaurant utilizes to address the following:</p> <p>1.1 Queue Management;</p> <p>1.2 Staff Management; and</p> <p>1.3 Sales Tracking;</p>	Interview & Observation	Quantitative	Primary	Interview analysis
<p>2. How do the standard manual procedures for ordering impact the speed of service at PansEat Tagapo Restaurant?</p>	Survey Questionnaire & Observation	Quantitative	Primary	Validated questionnaire, interview analysis, gathered data from observation
<p>3. How can the current system be measured with the following characteristics:</p> <p>3.1 Reliability</p> <p>3.2 Maintainability</p> <p>3.3 Usability</p> <p>3.4 Efficiency</p>	Survey questionnaire & Observation	Quantitative	Primary	Validated questionnaire, interview analysis, gathered data from observation

Statistical Data Analysis

The researcher employed specific methods and various tools, utilizing Microsoft Excel for precise calculations and complex statistical analysis. The researcher's analysis relied on important statistical formulas, particularly the weighted mean. These methods helped the researcher dig into the data, uncovering hidden complexities and deeper patterns. The researchers used the weighted mean to find the middle value of participants' responses, giving a clear idea of where the data centers. The frequency of employing this method and various tools was 2 to 4. This method helped the researchers understand the dataset better. The weighted mean formula was expressed as:

$$\underline{x} = \frac{\sum (fx)}{n}$$

Where: x = weighted mean

\sum = summation

f = frequency of response

x = weight of each item

n = total number of respondents

Ethical Consideration

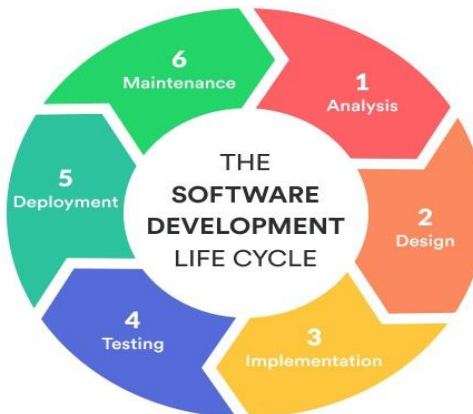
The researchers upheld maintaining ethical standards to protect the rights, privacy, and welfare of all study participants, which included the owner, staff, and customers of PansEat Tagapo Restaurant. Full disclosure about the study's objectives, methods, and results was provided to participants, ensuring voluntary involvement and the freedom to withdraw, aligning with the principles outlined in Republic Act No. 10173, commonly known as the Data Privacy Act of 2012. The gathered information, including the questionnaire answers and audio recordings of interviews, was treated with the highest level of confidentiality. Participant identities were anonymized, and precautions were taken to safeguard participant welfare by minimizing any discomfort or distress associated with their involvement. The identification of participants was a collaborative effort, with approval and backing from PansEat Tagapo. The presentation of findings prioritized transparency and accuracy, acknowledging any potential conflicts of interest or biases.

SYSTEM ARCHITECTURE

This chapter provided an architectural visualization of the organization and essential capabilities of the proposed system. It contained Software Development Life Cycle (SDLC), System Flow Diagram (SFD), Hierarchical Input Process and Output (HIPO), and Contextual Diagram. Together, these System Architectures coupled with explanatory outlines offer a functional and technical plan for the development of the system.

Software Development Life Cycle

Figure 5. Software Development Life Cycle



The researchers chose agile software development for the implementation of the queue management system with Kiosk because of the method's inherent flexibility, iterative approach, and focus on frequent customer collaboration. Given that the system was innovative in its aim to optimize queue management and ordering experience, employing a dynamic Agile approach supported responding to arising needs and priorities in creating an optimal system.

In addition, the methodology's iterative cycles allowed systematic development because the restaurant workflows were lively and subject to shifts in volumes and

constraints. This adaptive technique permitted evolving the system based on usage and case-specific constraints that were well-suited to such an environment. The advantage of regularly deploying useful features with every Agile iteration aligns well with fast-paced environments that demand continuous delivery of solutions rather than infrequent, comprehensive releases.

In terms of planning and design, requirements and functions needed for the ordering system were identified, such as order processing, queue management, sales tracking, and the point-of-sale system. The researchers prioritized features based on their importance to the user. During the implementation stage, all the components of the software were implemented into the system, including the installation of databases, code, and libraries. In testing and deployment, the researchers created specific test cases to cover all aspects of the software's functionalities and to evaluate if there were any bugs or issues. And finally, if the software was fully operational, the researcher's regular maintenance helped the software adapt to changing environments and user needs, keeping it relevant and valuable over time.

In conclusion, the Agile Software Development Life Cycle (SDLC) aligned seamlessly with the functionality requirements of a queue management system with Kiosk. This methodology not only accommodated evolving needs but also fostered a balance between innovation and practical integration into the real-world restaurant environment. The Agile approach provided an ideal framework for the proposed system, allowing for emergent discoveries and continual progress throughout the development process.

System Flow Diagram (SFD)



- This is the start of the process.



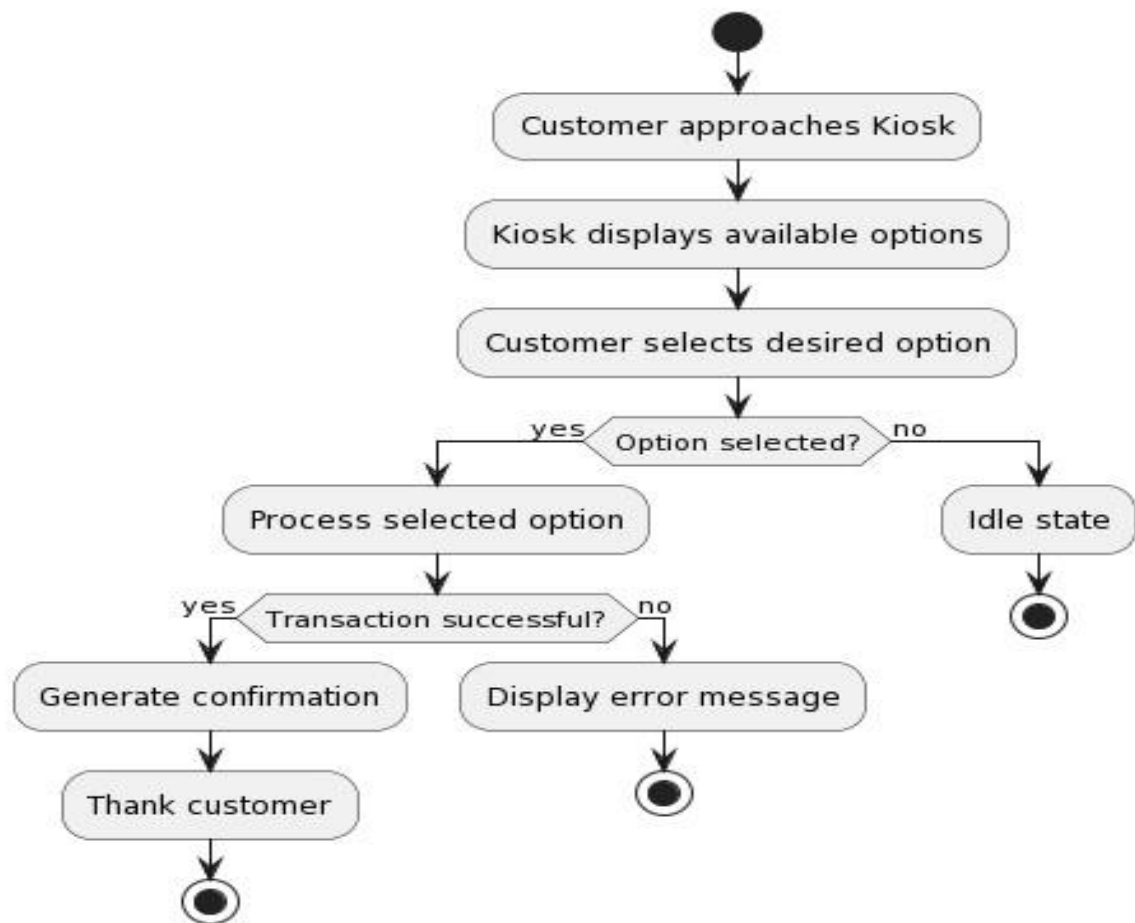
-  - This is the end of the process.
-  - This is a merger in which two processes result in one outcome.

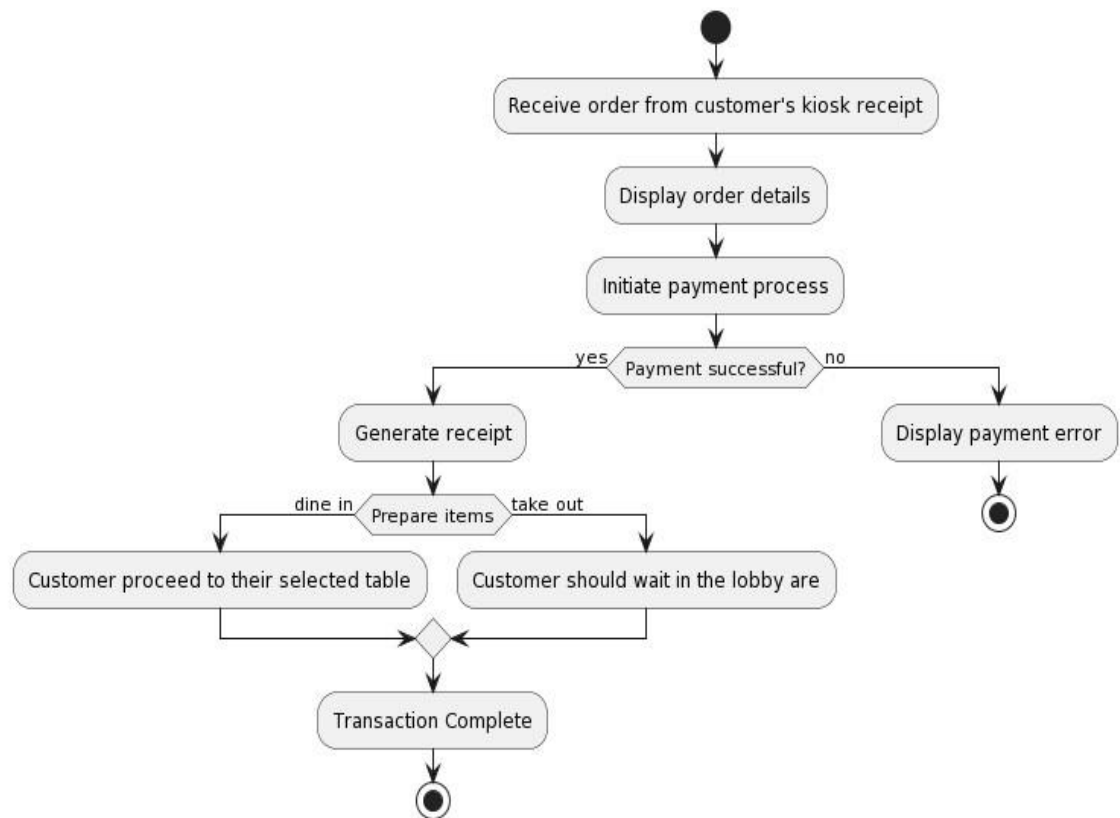
Figure 6. System Flow Diagram



The process above represents a system flow diagram for a Kiosk interaction. The process began with a customer approaching the kiosk, which then displayed available options. The customer selected a desired option, triggering the system to process the selection. The flowchart checked if the option selection was successful, and if so, it proceeded to generate a confirmation and express gratitude to the customer. In the case of an unsuccessful transaction, an error message was displayed. If no option was selected, the system entered an idle state. This flowchart captured the essential steps of

a Kiosk system, encompassing customer interaction, option processing, transaction outcomes, and feedback mechanisms.

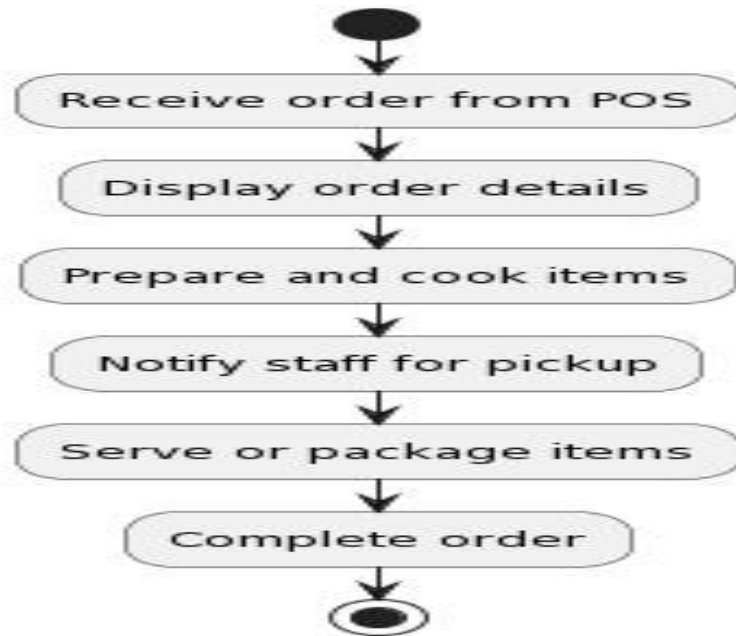
Figure 7. System Flow Diagram



The process above represents a system flow diagram for a point-of-sale (POS) system following the receipt of an order from a customer's kiosk transaction. The process began by receiving the order details and initiating the payment process. Upon successful payment, a receipt was generated, and the flowchart diverged based on whether the order was for dining in or takeout. If it was for dining in, the customer proceeded to their selected table, while for takeout, the customer was directed to wait in the lobby area. Subsequently, the flowchart converged to the "Transaction Complete" step, indicating the successful completion of the entire POS process. In the event of a payment failure, an error message

was displayed, and the process stopped. This flowchart captures the essential steps of order processing, payment handling, and customer guidance in a restaurant or similar service environment.

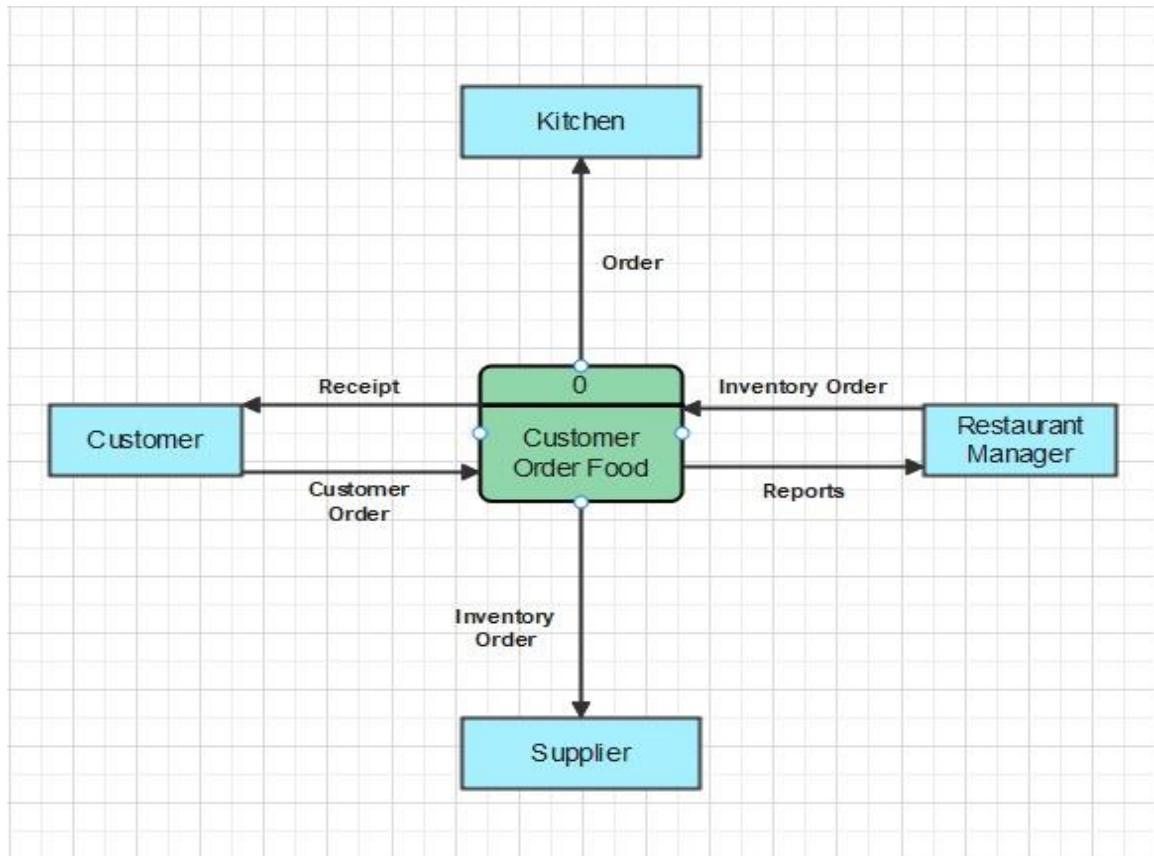
Figure 8. System Flow Diagram



The process above illustrates a system flow diagram for the kitchen-side process following the reception of an order from the POS system. The process began with the receipt of the order details, which were displayed for the kitchen staff to review. Subsequently, the staff initiated the preparation and cooking of the specified items. Once ready, the staff was notified for pickup, and depending on the order type (dine-in or takeout), the items were either served or packaged accordingly. The flowchart concluded with the completion of the order, encompassing the entire sequence of actions undertaken by the kitchen in response to an incoming order from the POS system. This simplified representation captured the fundamental steps involved in the kitchen's workflow, from order reception to fulfillment.

Data Flow Diagram (DFD)

Figure 9. Data Flow Diagram



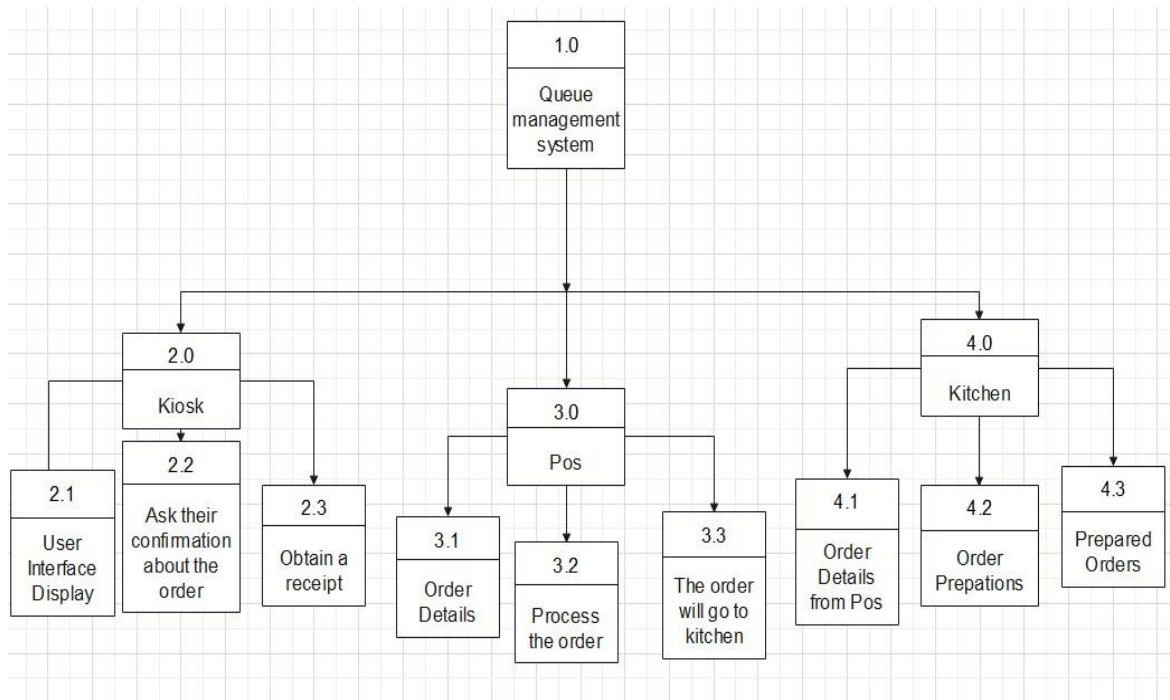
The data flow process of the ordering system provided a visual representation of interactions and how orders were processed. External entities such as customers, kitchens, restaurant managers, and suppliers were important to the system's functioning. This phase was not just about the process of order placement but also included processes such as updating inventory and creating management reports. In this data flow diagram, it is described how information flowed consistently through the system and how the restaurant system was productive in order processing and inventory management.

In addition to that, the external entities in this data flow process represented the entities interacting with the system. Customers initiated the process by placing food orders, while the kitchen received these orders to prepare their orders. The restaurant manager managed all operations and interacted with the system to create management reports, and the supplier provided updates on inventory. The process of this data flow diagram was Customer Food Order, describing the initiation of the order process. The data flow in the diagram illustrated how information moved within the system.

In conclusion, this data flow diagram efficiently interacted between external entities, processes, and data flows. The processes, from customer order initiation to management report creation, emphasized the system functionalities, which were important in maintaining and organizing needed information. The data flow showed the movement of information, accurate order processing, inventory management, and accurate reporting. This data flow diagram provided a clear visual representation of the system's operations and data management.

Hierarchical Input Process and Output (HIPO)

Figure 10. Hierarchical Input Process and Output



The hierarchical input, process, and output of the queue management system involved the kiosk and the POS. In the kiosk, customers used the touchscreen or buttons to enter their orders. After an order was placed, the kiosk verified the customer's order by asking them to confirm again, making sure everything was correct. Then, it printed a receipt that indicated where the customer stood in the queue, confirming their order.

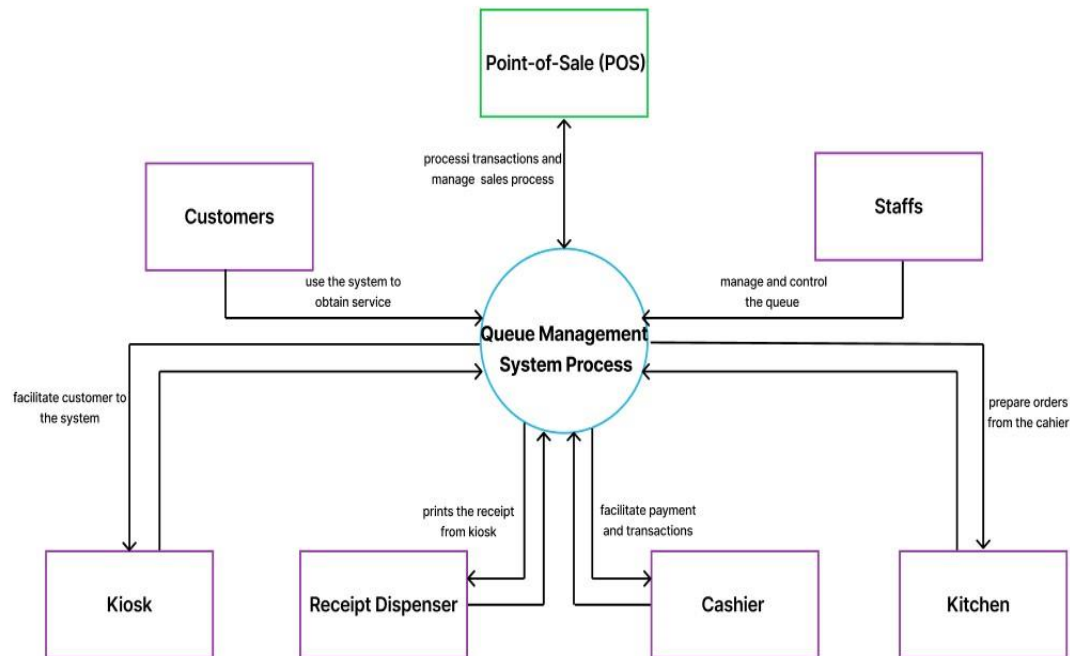
On the other hand, POS operated a bit behind the scenes. It did not directly interact with the customers; it got its task when a staff member gathered orders from customers coming from kiosk receipts. It sent all the order details to the POS. The POS took these details and got to work, processing each order, and preparing it for the kitchen staff. Once

the orders were all sorted and prepared, the POS sent them to the kitchen, informing the cooks about what needed to be made.

After the POS sent them to the kitchen, the kitchen side received the order details from the POS, and then they gathered information such as items, chosen, and quantities. Next was the order preparation, where the gathered details were utilized to prepare the order; this could involve cooking, assembling, or arranging items for purchase. Finally, the prepared orders were ready to be served.

Contextual Diagram (CD)

Figure 11. Contextual Diagram



The included contextual diagram depicted the key external entities that interacted with the central Queue Management System (QMS) and its embedded kiosk components. Two main external modules represented points of contact, including customers and restaurant staff.

As modeled, customers directly interfaced with the self-service kiosk to join waiting lists, place food orders, and make secure payment transactions. Kiosk transactions were transmitted internally to synchronize with real-time inventory availability from the point-of-sale (POS) along with restaurant staff for order notifications and table management. While the cashier connected between the customer, kiosk, and payment process.

These modeled integrations between customers, the software system, and other data sources tracked end-to-end information exchanges supporting core system events,

structuring workflows from restaurant arrival to order pickup. The presented diagram offered a high-level overview of key system actors and touchpoints facilitating waitlist placement, menu ordering, inventory checks, payment processing, and staff coordination for the optimal queue management system.

Chapter 4

RESULTS AND DISCUSSIONS

In this chapter, the researchers will discuss the data analysis and findings derived from the survey, which employed questionnaires, interviews, and observations. The survey was executed in a face-to-face format, targeting respondents from various categories, including customers, staff, and the restaurant owner. Responses were gathered and recorded using Microsoft Excel for the computation of results. Furthermore, this chapter will expound upon relevant figures and existing literature that contribute to addressing the research problem. The researchers formulated a set of 30 questions, strategically distributed among customer and staff questionnaires, an interview with the owner, and observations within the restaurant. The outcome of this analysis will be meaningful in determining the necessity for the PansEat Tagapo Restaurant to embrace the digitalization of their manual processes.

Objective 1: Identification of the current processes implemented by PansEat Tagapo Restaurant regarding Queue Management, Staff Management, and Sales Tracking.

The researchers interviewed the owner of PansEat Tagapo Restaurant, to explore and identify the existing processes implemented by the owner in the conduct of queue management, staff management, and sales tracking in the restaurant. The recorded audio responses were analyzed and interpreted thematically to make an overall presentation of the findings.

1. Queue Management

Current queue management processes.

The restaurant uses a step-by-step paper-based system for order processing. First, they manually write down each customer's order. Next, they collect payments from the customer. After that, they pass the written orders to the kitchen for food preparation. When the order is complete, the customer gets a handwritten receipt as confirmation of payment. The restaurant also keeps a record book to log daily sales in an organized way. While this process seems straightforward, the cashier admits it does not always work smoothly. Even with extra staff, busy times with lots of customers can still cause delays. The owner recognizes that this manual system has limitations in terms of efficiency.

The restaurant's current paper-based order processing system, involving manual order taking, payment collection, handwritten receipts, and a daily sales record book, has proven to be inefficient and prone to challenges. Despite its apparent simplicity, the system encounters operational difficulties, particularly during busy periods with high customer traffic, leading to delays even with additional staff. The owner acknowledges the limitations of this manual approach, recognizing the need for a more efficient and streamlined process to cope with the demands of a bustling restaurant environment. This aligns to Ardiansyah (2021), study on significance of technology and emerging technologies. These technological imperative gains relevance when examining the operational procedures of a specific restaurant, which, despite advancements in other sectors, relies on a manual, paper-based system for order processing.

Issues regarding current queue management processes.

When the restaurant is filled with many dining customers during peak hours, shortcomings in the current queue management system become evident. One significant

factor contributing to the issue is the reliance on manual, non-automated processes, leading to extended queues during busy periods. This results in customer frustration and dissatisfaction, with some choosing to leave rather than endure prolonged wait times. This directly reduces the restaurant's revenue when potential customers choose to go to other places instead. It also creates operational issues like slow service and lower morale for staff.

The restaurant's evident deficiencies in its current queue management system coincide with Vries's (2018) investigation into the impacts of waiting time on customer behavior and revenue within a restaurant. The study reveals a direct correlation between prolonged waiting times and customer reneging behavior, a delay in a customer's return, and shortened dining durations. The findings offer valuable insights for service providers, underscoring the significance of considering the financial and operational consequences associated with waiting-related decisions in service settings.

Possible solutions that can be utilized.

The restaurant owner acknowledges the existence of technological solutions that have the potential to enhance operational efficiency but admits to a lack of detailed knowledge regarding their specific applications for modernizing processes. When presented with the idea of implementing a self-service kiosk and automated queue management system, the owner agrees this could help modernize and streamline processes. In particular, the owner sees how an automated system could replace manual order-taking, kitchen queue management, and receipt printing. The owner acknowledges that this type of automation could provide benefits for managing customer traffic more efficiently.

Specifically, the owner envisions how such an automated system could replace manual tasks like order-taking, kitchen queue management, and receipt printing, leading

to more efficient management of customer traffic. This aligns with Callarman's (2023) emphasis on the use of technology and efficient processes in automated order processing to accelerate order completion. Callarman underscores that automation not only enhances the efficiency of order processing but also reduces human errors, facilitating faster order fulfillment and shipping. The restaurant owner's openness to technological advancements resonates with Callarman's argument, emphasizing the transformative impact of automation in making order processing more efficient and error resistant. This alignment highlights the potential benefits of incorporating automated solutions for a more streamlined and technologically advanced restaurant operation.

Average wait time for customers to be seated and served.

The restaurant always strives to process orders as fast as they can. During normal business hours, the restaurant usually seats and serves customers in a timely fashion. The primary difficulty occurs when there is an extremely high influx of customers. However, the owner's staff management approach helps address these problems in queue management.

This aligns with Kim (2020), suggested approach to boost profitability that involves examining both the quantity and timing of increases, considering the trade-off connection between utilization rate and average waiting time in a queuing system. This insight provides valuable guidance on how managers of small restaurants, grappling with long lines, can develop effective revenue management techniques to manage peak hours.

2. Staff Management

Current staff management processes.

To effectively manage the restaurant operations despite relying mostly on manual processes, the owner highlighted the importance of efficient staff management. She believes that the key to providing excellent customer service lies in increasing the number of staff members. This is particularly necessary during busy periods, as it helps ensure that the restaurant functions smoothly and offers an exceptional dining experience. The owner mentioned that the primary objective is to guarantee that there are enough staff members available to deliver prompt and attentive service to customers.

Troger's (2021) insights on effective employee management resonate with the owner's approach, emphasizing the need to balance organizational requirements and individual staff needs. This validates the restaurant owner's strategy of maintaining adequate staffing levels, particularly during peak hours, to deliver exceptional customer service. The owner's focus on having sufficient staff aligns with Troger's emphasis on regular feedback, listening to employees, and flexible compensation. Furthermore, the owner's commitment to supporting work-life balance mirrors Troger's overarching theme of managerial attention to employee well-being. This alignment highlights the significance of effective communication, flexibility, and sensitivity in staff management, demonstrating the shared goal of achieving optimal staffing levels for exceptional customer service and operational efficiency.

Issues regarding current staff management processes.

While having a higher number of staff present really helps in effectively managing restaurant operations, balancing the number of staff members to meet demand without overburdening the budget or compromising operational efficiency is a challenging task.

Also, overstaffing must be observed so it does not result in underutilization of resources during slower periods, contributing to inefficiencies. The goal is to balance labor costs and efficiency by matching staff levels to customer demand.

The Staff Productivity Management Information System, as outlined by Odey (2023), serves as a crucial tool for organizations to enhance staff productivity systematically. This comprehensive software application addresses challenges related to task management and performance evaluation, providing managers with a platform to assess staff based on predefined metrics. It ensures fairness and consistency using metrics and rating scales. Simultaneously, it automates processes like order-taking and queue management, minimizing errors and wait times, thus improving overall operational efficiency. The integration of data analytics provides insights into customer preferences and peak hours, facilitating data-driven decisions for optimized staff scheduling and performance. The study emphasizes the significance of such systems in adapting to the dynamic business environment, enhancing organizational performance, and fostering employee engagement.

Possible solutions that can be utilized.

The owner agrees that implementing a queue management system could be crucial for efficient staff management. The system allows for optimized staff allocation through active queueing and workload balancing. The real-time monitoring capabilities enable managers to swiftly adapt to changes in demand. Additionally, the system also supplies data insights to support flexible staffing and boost productivity and cost savings. However, the owner notes that while they understand the system's benefits, staff will also need proper training on utilizing such tools to maximize the advantages.

Kudakhtin's (2023) study on staff development management principles offers crucial insights for the restaurant industry. Addressing obstacles to efficient employee

development and promoting self-growth is pivotal in a sector where skilled and motivated staff are vital for delivering exceptional service. The emphasis on forming personnel potential for competitive advantage aligns directly with the restaurant's need for a competent workforce to stay competitive. Implementing robust management tools, including an automated point-of-sale system, can streamline staff management, enhance efficiency, and ensure a skilled and secure workforce. The alignment of strategic orientations in personnel development with broader organizational goals is crucial for sustained success and market relevance in the restaurant setting.

3. Sales Tracking

Current sales tracking processes.

Recognizing the significance of sales tracking, the owner emphasizes its importance to the staff, particularly the cashier, who bears the responsibility of meticulously recording sales. This entails manually documenting the quantity of items ordered and payment details in a record book while simultaneously managing customer orders. However, the accuracy of sales tracking becomes challenging for the cashier due to the substantial volume of customer inquiries. This challenge arises from the cashier's primary focus on essential tasks like order taking, coordinating with the kitchen, and providing receipts to customers. Juggling these multiple responsibilities concurrently heightens the likelihood of mistakes or oversights during the recording and review of sales transactions. The demanding workload and the necessity to multitask increase the potential for errors or omissions in the precise documentation and monitoring of sales. Considering this, CommerceCRM (2019) highlights the broader significance of sales tracking for businesses across several types and sizes. Sales tracking, facilitated through comprehensive metrics, offers a detailed overview of the entire sales process, from lead

generation to conversion. This data-driven approach minimizes guesswork, making customer data more interpretable and actionable. Metrics such as lead response time, win rate, sales-to-cost ratio, monthly sales, and others provide a holistic view of sales team performance, aiding businesses in making informed decisions, preventing losses, forecasting growth, and understanding trends and causality in sales.

Issues regarding current sales tracking processes.

The owner highlights that the challenges associated with manual sales tracking extend beyond simple difficulty. Achieving precision in tracking becomes exceptionally challenging, especially during busy periods when a high volume of customers is consistently at the counter. Inaccuracy and confusion become unavoidable for the staff, especially given the heavy workload on the cashier. Naturally, the cashier prioritizes order-taking and payment processing over meticulously logging each transaction. This frequent practice results in errors in records, financial mismanagement, and discrepancies that have adverse effects on overall operations and reporting. The owner acknowledges the severity of this major issue, recognizing its impact on sales data, finances, and the overall business, and expresses a commitment to addressing it.

Recognizing the severity of this issue, the owner expresses a commitment to addressing it. Technology-driven solutions, such as the restaurant digital ordering system proposed in Singh's (2022) study, perfectly complement, and address these concerns. The study emphasizes the importance of real-time sales tracking and graphical visualization for informed decision-making. The digital ordering system, as outlined, provides a solution to the challenges of manual tracking by prioritizing sales tracking, offering real-time insights, and streamlining order management. By doing so, it not only addresses the owner's highlighted issues but also presents a comprehensive approach to enhance

decision-making, improve efficiency, and mitigate the adverse effects of errors on sales data and overall business operations.

Possible solutions that can be utilized.

The business owner was aware of the need for better sales tracking, as this had been a specific request during the initial project proposal. When asked if any tools or strategies were currently being used to improve sales tracking, the owner only mentioned adding extra staff at checkout to help the cashier. However, she is not satisfied with the solution and admitted it was not fully meeting their expectations, and they are still looking for a better way to resolve the sales tracking issues.

Saeed (2019) discusses that an automated point of sale (POS) system offers significant benefits for several types of businesses. A major advantage is that all sales information is stored remotely and accessible from anywhere with an internet connection. This enables retailers and restaurant chains to monitor purchasing trends, inventory levels, and other metrics seamlessly across their various stores. The data can be utilized to optimize everything, from inventory management to targeted marketing campaigns. For example, purchasing habits based on demographics and geography can inform promotional strategies. Overall, the automated POS approach outlined allows for data-driven decision-making through actionable, up-to-date sales insights. This provides an efficient, cost-effective means for multi-location businesses to centralize sales tracking and use those insights to facilitate growth.

Identification of the current processes implemented by PansEat Tagapo Restaurant in terms of Queue Management, Staff Management, and Sales Tracking.

The researchers conducted observations at PansEat Tagapo Restaurant during its peak hours on January 9th to 14th from 7 to 8 pm, which is known to be the restaurant's

busiest period. The primary objective of the study is to examine and identify the existing procedures employed by the restaurant in the domains of queue management, staff management, and sales tracking.

Table 3
Observation of Current Manual Processes

Days of Observation	Time	Queue Management	Staff Management	Sales Tracking
1. January 9, 2024	7 PM to 8 PM	Unsatisfied	Unsatisfied	Unsatisfied
2. January 10, 2024	7 PM to 8 PM	Unsatisfied	Unsatisfied	Unsatisfied
3. January 11, 2024	7 PM to 8 PM	Unsatisfied	Satisfied	Unsatisfied
4. January 12, 2024	7 PM to 8 PM	Satisfied	Satisfied	Satisfied
5. January 13, 2024	7 PM to 8 PM	Unsatisfied	Unsatisfied	Unsatisfied
6. January 14, 2024	7 PM to 8 PM	Unsatisfied	Unsatisfied	Unsatisfied
Satisfaction %	—	83.3% (Unsatisfied)	66.6% (Unsatisfied)	83.3% (Unsatisfied)

1. Queue Management

The researcher observed that the staff were not managing queues efficiently with 83.3% of the six observations indicating dissatisfaction. One of the main reasons that the researcher noticed for this issue was the fact that there was a manual counter setup. This manual setup required the cashier to try and do multiple things at once. The cashier had to not only take the orders from each customer and write down those orders by hand, but they also had to manage the customer's payment and then transfer the order details back to the kitchen staff to prepare the food. Doing all these tasks at the same time led to delays in service because it overloaded the cashiers with so many responsibilities all at once. The delays were especially bad when customers had large orders, because large orders added more steps for the cashier to have to keep track of. All this multitasking and the

delays can result in confusion as well as dissatisfaction over the long wait times and service issues.

Weiss (2018), discusses the impact of queues on customer satisfaction within service processes, presenting a three-principle framework for effective queue management. These principles encompass (1) reducing or eliminating wait times through process enhancements, (2) managing expectations via timely communication, and (3) enhancing the waiting experience. The article underscores the importance of queues as indicators of unmet customer needs that can lead to frustration. Historical innovations, including the introduction of a single snake line, are explored in the context of minimizing unfair waits and addressing service time variability. Realistic wait time expectations, exemplified in practices such as those observed in Disney theme parks, are advocated for anxiety alleviation. The study also recommends leveraging technology to eliminate processes that necessitate customer waiting. Additionally, the article emphasizes the value of integrating unavoidable queues into the service process for improved outcomes. The overall discussion encourages managers to regularly review processes, identify customer queues, and assess waiting experiences to ensure comprehensive customer satisfaction.

2. Staff Management

The staff manages customer inquiries and requirements with friendliness, showing they are well-trained even in high customer volumes. The considerable number of staff facilitates efficiency through division of labor and optimized personnel allocation. However, in 4 out of 6 observations (66.6%), dissatisfaction was observed due to an excessive workload - taking orders, providing receipts, processing payments, bringing orders to the kitchen, and tracking sales. This concentration of numerous responsibilities onto the

cashiers results in slower order processing. To improve speed and efficiency, the workload at the counter should be distributed across more positions beyond just the cashier role.

Kudakhtin (2023), states that conceptualizing staff development management principles, analyzing impediments to employee development efficiency, and examining reasons for employees' reluctance towards self-development and growth. It introduces key personnel management concepts like "personnel development" and "personnel development management." An important connection is made between personnel development management and forming personnel potential within a business, which is crucial for competitive edge and continuous market activity. The study stresses the integral role of staff development as part of the Employee Value Proposition at management levels, emphasizing the need to consider it during competency map reviews and updates. It suggests creating robust information and documentation support systems, including competency maps, IDP plans, and personnel policies, to enhance personnel management efficiency. Competent development and adherence to these documents by management is pivotal for shaping the enterprise's personnel potential and ensuring high intellectual and personnel security, per the study. It concludes by examining how effective staff development management can impact a business's economic security, stressing the alignment of strategic orientations in personnel development with broader organizational goals and values.

3.Sales Tracking

As highlighted by the researchers, dissatisfaction was observed in 5 out of 6 instances (83.3%) the cashier encountered difficulties in efficiently tracking sales, mainly attributed to the substantial volume of customer inquiries she had to manage. The attention of the cashier is primarily dedicated to receiving orders, transmitting them to the kitchen, and issuing receipts. A preliminary observation suggests that this operational

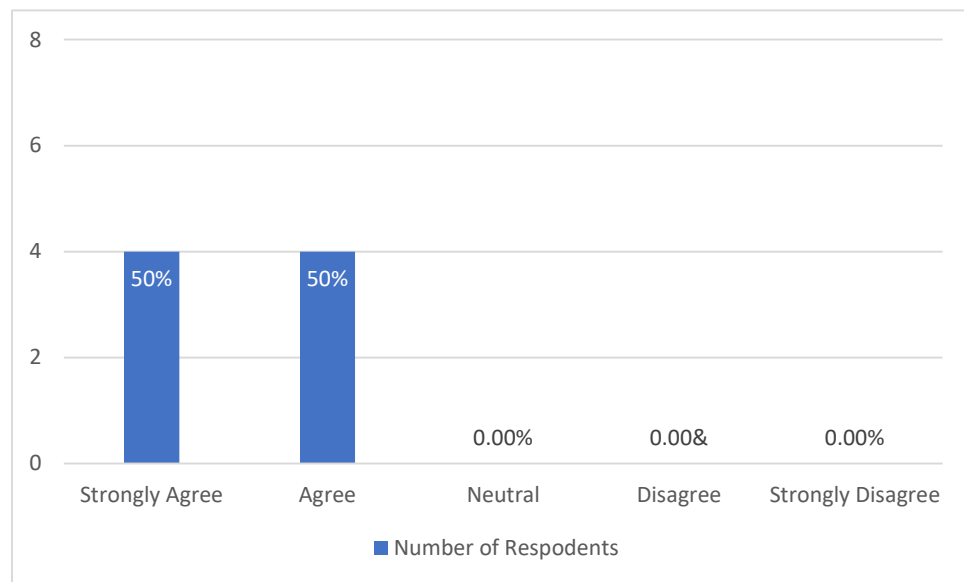
workflow may lead to inaccuracies in sales tracking. The cashier's overwhelming workload and the multitasking nature of her responsibilities may potentially result in lapses or omissions in accurately recording and monitoring sales transactions.

In the 2019 article "Why is Sales Tracking Important" by CommerceCRM, the significance of sales tracking in businesses across all sectors and sizes is underscored. The article posits that sales tracking, using sales metrics, provides a comprehensive view of the sales process, from the generation of leads to their conversion. This data-driven approach eliminates reliance on guesswork and intuition, making customer data more interpretable and actionable. A variety of metrics, including lead response time, win/conversion rate, sales to cost ratio, monthly sales, average deal size, sales funnel leakage, and visitor to lead conversion, provide a holistic view of a sales team's performance and the overall sales process. These metrics empower businesses to make informed decisions, mitigate losses, forecast growth, identify trends, and establish causality within the sales process. The implementation of a sales tracking system, such as Commence, offers a customizable and efficient method for managing and interpreting sales data, enabling businesses to optimize performance, make data-driven decisions, and enhance their success (CommerceCRM, 2019).

Objective 2: Identification of the standard manual procedures that impact the speed of service at PansEat Tagapo Restaurant.

In this objective, the researcher used research tools like questionnaires and observation to determine the current ordering and the implementation of an automatic ordering system.

Figure 12. Evaluation by the Staff regarding Speed of Service

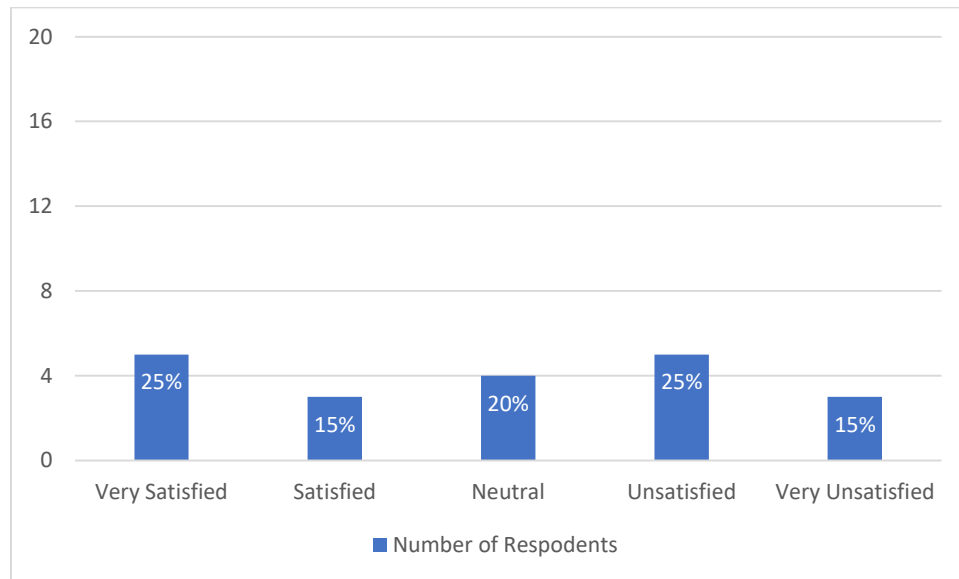


As illustrated in Figure 12, 50% of the respondents express a strong agreement, while the remaining 50% agree that the staff efficiently processes and delivers orders quickly. The data in Figure 12 only shows that the respondents agree with the staff process and deliver orders fast.

According to Yang (2019), the research results show that although kiosks improve customer satisfaction, they may also make people feel less welcoming. These kiosks outperformed the information at service counters with their clear menu categories, pictures, simple English instructions, and streamlined ordering and payment processes. Furthermore, kiosks offered more thorough information about menus, ingredients, discounts, and promotions than counter information did. Using kiosks gave users a sense

of empowerment and control as well, allowing them to customize their meals and make order changes without bothering staff members or other customers.

Figure 13. Evaluation by the Customers regarding Speed of Service



According to Figure 13, the inferential analysis revealed that 20 customers regarding their satisfaction with the speed of processing orders found that while a plurality (5 people) were very satisfied, and unsatisfied there were still a notable number of dissatisfied customers, with 3 rating it satisfied, very and unsatisfied and 4 rating it neutral. Specifically, out of 20 total respondents, 25% rated the speed of processing orders placement as very satisfied, 15% as satisfied, 20% as neutral, 25% as unsatisfied, and 15% as very unsatisfied.

Kim (2019) stated technology-based self-service has been more widely implemented and used in the restaurant business. The usage of kiosks in the food business is an excellent way to increase managerial efficiency and effectiveness. Ease of use, improved speed, more dependable, saves time and effort, provides correct service, and improves customer experience. Perceived value based on kiosk experience favorably

increases satisfaction and behavioral intention. Additionally, happiness with kiosk usage has a beneficial impact on behavioral intention.

Identification of the standard manual procedures that impact the speed of service at PansEat Tagapo Restaurant.

The researchers conducted observations at PansEat Tagapo Restaurant during its peak hours on January 9th to 14th from 7 to 8 pm, which is known to be the restaurant's busiest period. The primary objective of the study is to examine and identify the existing procedures employed by the restaurant in the domains of queue management, staff management, and sales tracking.

Table 4

Observation of Speed of Service

Days of Observation	Time	Speed of Service
1. January 9, 2024	7 PM to 8 PM	Unsatisfied
2. January 10, 2024	7 PM to 8 PM	Unsatisfied
3. January 11, 2024	7 PM to 8 PM	Unsatisfied
4. January 12, 2024	7 PM to 8 PM	Satisfied
5. January 13, 2024	7 PM to 8 PM	Unsatisfied
6. January 14, 2024	7 PM to 8 PM	Unsatisfied
Satisfaction %	—	83.3% (Unsatisfied)

The researchers had observed that the speed of service in the restaurant was unsatisfactory in 5 out of 6 instances. Manual processes, particularly in tasks like order processing and staff management significantly influenced the service speed. The processing of orders and seating of customers took a bit longer due to these manual

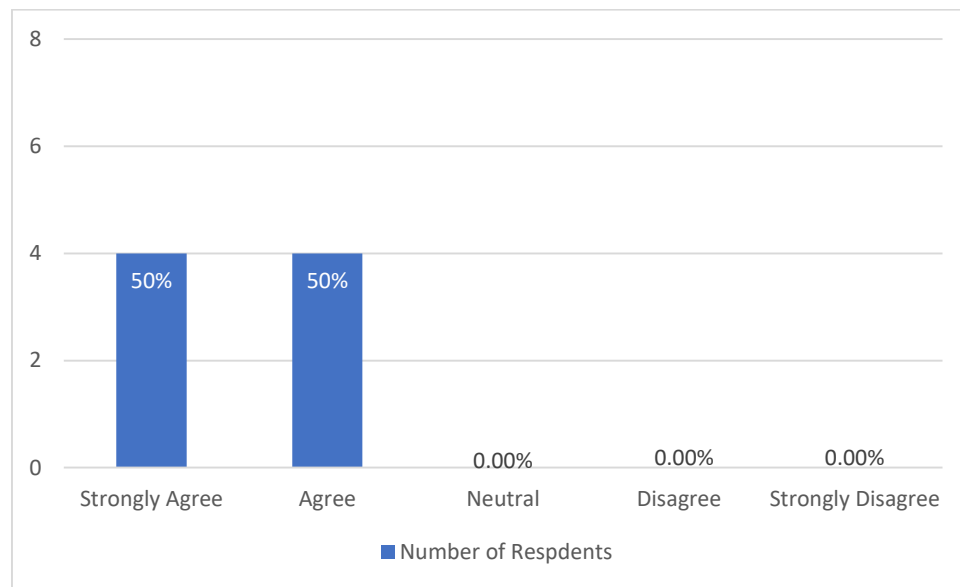
procedures. Such service delays proved to be a drawback, especially given the crucial importance of customer satisfaction.

The study conducted by Kim (2019) emphasizes the increasing prevalence of technology-based self-service in the restaurant industry, specifically using kiosks. The research investigates the relationship between the quality features of these kiosks and various aspects of customer experience, such as experiential value, satisfaction, and behavioral intentions. Notably, the findings highlight that the perceived value derived from the kiosk experience has a positive impact on both customer satisfaction and behavioral intentions. Furthermore, the study identifies satisfaction with kiosk use as a significant factor positively influencing behavioral intentions. One key advantage emphasized in the integration of kiosks in the food industry is the improvement in management efficiency and effectiveness. This is reflected in benefits such as the ease of use, but notably, it also mentions the positive impact on service speed. The use of kiosks is associated with improved speed of service, contributing to enhanced customer experiences and satisfaction. This recognition of increased speed aligns with the broader advantages of kiosk adoption, including reliability, time and effort savings, accurate service, and overall improved customer convenience.

Objective 3: Identification of the current processes implemented by PansEat Tagapo Restaurant in terms of reliability, maintainability, usability, and efficiency.

In this objective, the researcher used research tools like questionnaires and observation to the processes and systems PansEat Tagapo uses to manage the restaurant in a way that promotes reliability, maintainability, usability, and efficiency.

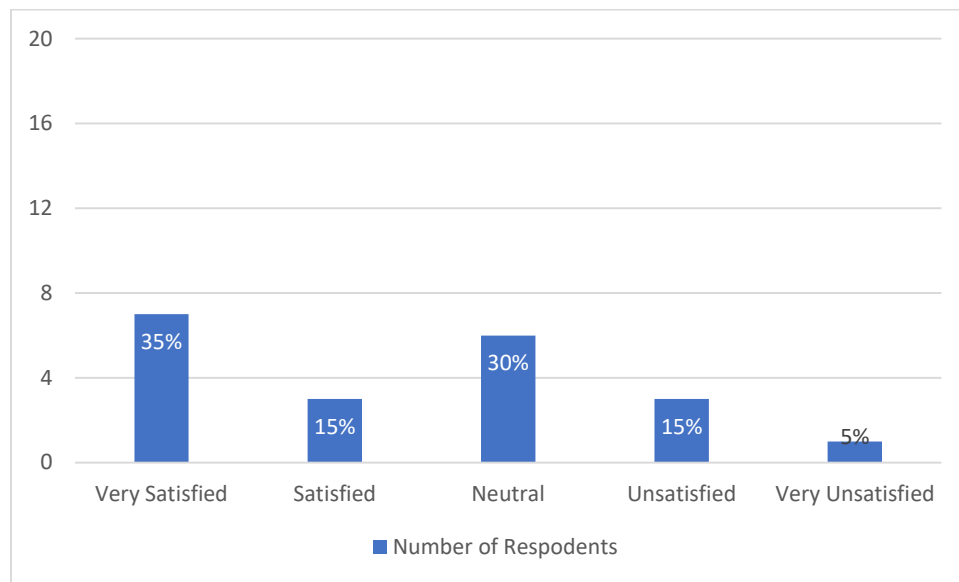
Figure 14. Staff Overview regarding Reliability in Order Processing



As illustrated in Figure 14, 50% of the respondents strongly agree, and the remaining 50% agree that the staff accurately processes orders. The data in Figure 14 only shows that the respondents agree with the staff accurately processing orders.

Callarman (2023) states that automated order processing allows orders to be completed more quickly by utilizing technology and procedures. Automation can increase the efficiency of order processing, reduce human error, and speed up fulfillment and delivery.

Figure 15. Customer Overview regarding Reliability in Order Processing

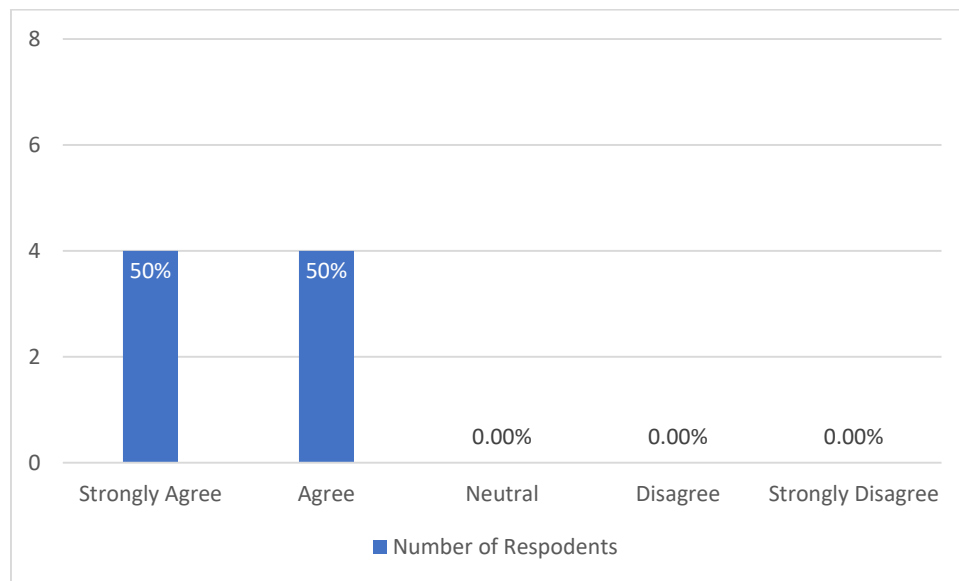


As shown in Figure 15 showed that 20 respondents who were surveyed regarding their satisfaction with the accuracy of processed orders 7 selected (very satisfied), 3 selected (satisfied), 6 selected (neutral), 3 selected (unsatisfied), and 1 selected 1 (very unsatisfied).

The results show a three-way split between very satisfied, satisfied (10 respondents), neutral (6 respondents), unsatisfied, very unsatisfied (4 respondents) customers. The majority (50%) are satisfied, suggesting the restaurant's order processing accuracy meets the expectations of most customers. However, the unsatisfied minority (20%) indicate improvement. The neutral responses (30%) represent a middling level of satisfaction.

Zulkafly (2021) This study aims to examine the relationship between self- service terminal features and customer satisfaction. According to the findings, order accuracy and convenience with the restaurant's self-service kiosks have a direct impact on customer happiness. Customers and restaurants benefit from this circumstance, and technological advancements, particularly in the restaurant industry, have played a dynamic role in increasing customer satisfaction levels. Customers use self-service kiosks at restaurants.

Figure 16. Staff Overview regarding Maintainability in Order Processing



As illustrated in Figure 16, 50% of the respondents express a strong agreement, while the remaining 50% agree that the staff maintains and updates the ordering process. The data in Figure 16 only shows that the respondents agree that the staff maintains and updates the ordering process.

Furthermore, according to Osman Ahmed El-Said (2019), there is more rivalry in the restaurant industry. As a result, restaurant companies hoping to succeed will be those who best adapt to the demands of their customers through the use modern technology. In recent times, several fast-food restaurants have replaced traditional point of sale with self-service kiosks (SSKs). The current study focuses on developing a "Queue Management System with Kiosk." It is relevant to consider insights from Osman Ahmed ElSaid's 2019 study on the increasing competitiveness in the restaurant sector and the growing popularity of self-service kiosks (SSKs). In the context of queuing management in restaurants, El-Said's advice to connect operations with modern technology and customer expectations is helpful for boosting customer experiences and operational effectiveness. The current study can benefit from this understanding of the growing significance of technology, especially self- service kiosks, in the restaurant industry.

Figure 17. Customer Overview regarding Maintainability in Order Processing

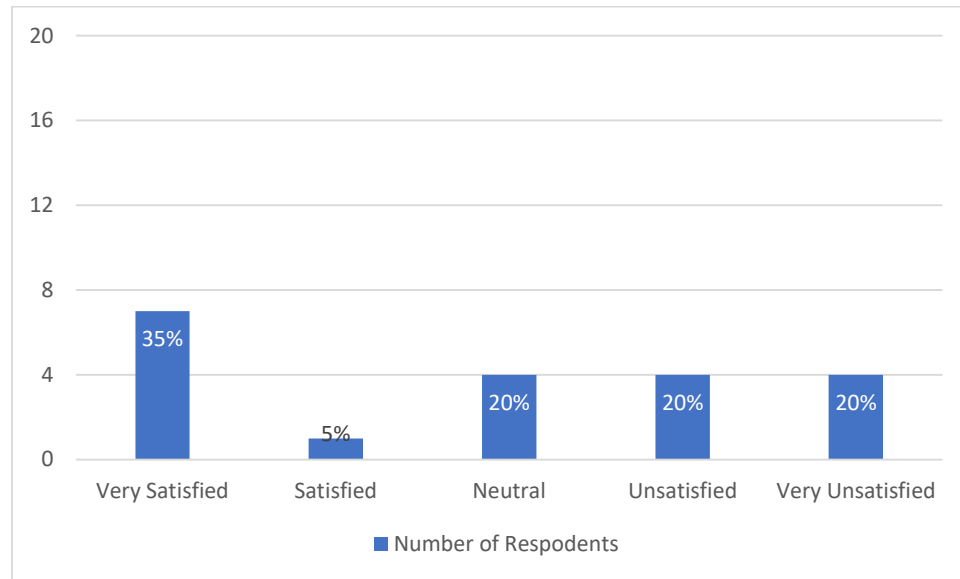
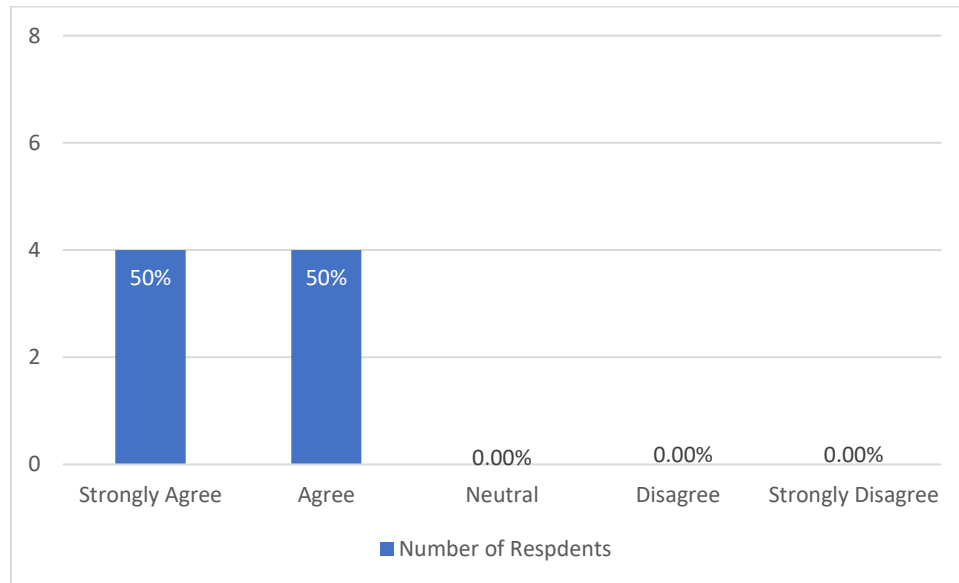


Figure 17 shows the survey data on user satisfaction with the maintainability of an ordering process. Out of 20 respondents, 7 were very satisfied, 1 was satisfied, 4 were neutral, 4 were unsatisfied, and 4 were very unsatisfied. This figure shows the majority (40% combined) were very satisfied and satisfied, while 20% were neutral and 40% were dissatisfied to some degree with the accuracy of processed orders.

However, an equal number were neutral to very unsatisfied group makes up a significant percentage that indicates some issues or problems with the maintainability that should be addressed.

Callarman (2023), using technology and processes, automated order processing makes it possible to complete orders more quickly. Order processing may be made more efficient through automation, which also helps to decrease human error and speed up fulfillment and shipment. It highlights the role of technology and automated methods in significantly accelerating the process of order fulfillment. It supports the researcher's system by stating the efficiency of automated order processing, which is vital for the contextualization of the researcher's study.

Figure 18. Staff Overview regarding Usability in Order Processing



As illustrated in Figure 18, 50% of the respondents strongly agree, and the remaining 50% agree that the staff easily takes orders from customers. The data in Figure 18 only shows that the respondents agree with the staff taking orders from customers easily.

According to Sheth (2023), providing good customer service is becoming more important to enhance the overall customer experience by assisting customers at every step of their journey. While customer service is often seen as something that happens after a purchase, it is now seen as a crucial part of making customer experiences exceptional.

Figure 19. Customer Overview regarding Usability in Order Processing

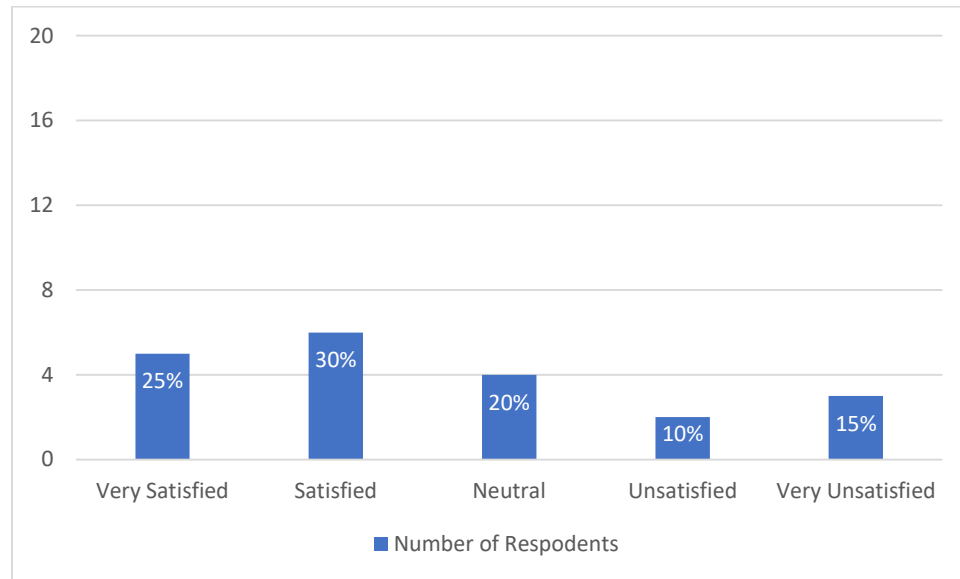
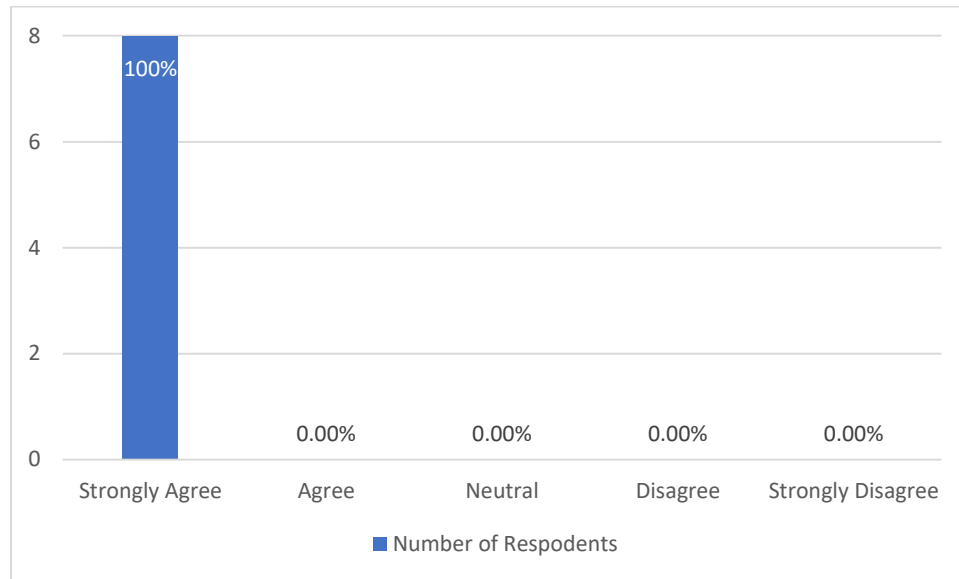


Figure 19 shows the survey results that most customers are satisfied with the ease of placing an order, though there is still need for improvement. Out of 20 respondents, 11 (55%) said they were very satisfied or satisfied and 4 (20%) just a neutral level of satisfaction. Meanwhile, 5 respondents (25%) expressed some level of dissatisfaction. These mixed results suggest that while the restaurant's ordering process works well for many customers, there are opportunities to make it even easier for those who currently find it inconvenient. Optimizing the ordering system could increase satisfaction rates and improve the customer experience.

Poulston (2019) The study highlights that the use of kiosks eliminates queues, allowing more time for menu selection, improving the dining experience, it also provides clear information about menus, ingredients, discounts, and promotions, and giving customers a judgment-free environment in placing orders. However, success of using kiosks still depends on the availability of empathetic alternatives, emphasizing the importance of balancing automation with human interaction for overall service quality. Notes that fast-food restaurant kiosks are a popular choice, enhancing customer satisfaction and efficiency.

Figure 20. Staff Overview regarding Efficiency in Order Processing



As illustrated in Figure 20, every respondent strongly agrees that staff members process orders in an efficient manner. The data in Figure 20 only shows that the respondents agree with the staff process and deliver orders fast.

According to Sakiru Abiola Lawal, Ph.D. (2022), point-of-sale (POS) systems are the digital equivalent of cash registers, connecting them to databases for improved data management. These systems give companies the capacity to store and process a wide variety of transaction and inventory data on a regular basis.

Figure 21. Customer Overview regarding Efficiency in Order Processing

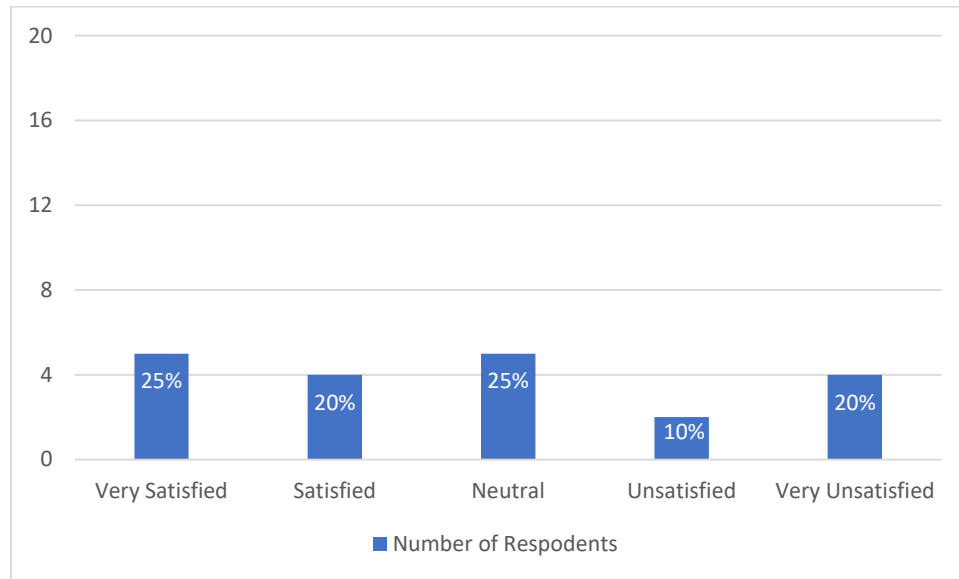


Figure 21 shows the results response about the efficiency of order processing, with equal numbers expressing satisfaction and dissatisfaction. Specifically, out of 20 respondents, 5 (25%) were very satisfied and 4 (20%) were satisfied, while 4 (20%) were very unsatisfied and 2 (10%) were unsatisfied. The remaining 5 respondents (25%) were neutral.

This satisfaction rating suggests the restaurant needs to evaluate its order processing system to determine why certain customers are highly dissatisfied while others are highly satisfied. Targeted improvements to the system could help increase satisfaction among dissatisfied customers.

Sheth (2023) This study supports the researcher's system for the effectiveness and efficiency of customer-focused support services and the impact of services on the overall customer experience. It clarifies the restaurant queue experiences and how they affect customer satisfaction and loyalty. Adopting a good queue management system reduces waiting times and enhances satisfaction. Customer service is becoming increasingly crucial for improving customer experience by including help needs at all stages of the customer journey. Customer service is growing as an essential component

of outstanding customer experiences; nonetheless, it is frequently regarded as a post-purchase touchpoint. As a result, while studying the consumer, apply the concepts of customer journey and customer experience.

In summarization of the Staff and Customer feedback, the researchers used weighted mean calculations to determine the average rating across the evaluation criteria, providing an overall assessment of the proposed system's effectiveness. The verbal interpretation corresponding to each weighted mean score from the respondents is displayed in the tables below.

Table 5

Evaluation of Staff on Current Manual Procedures via Agreement Scale

Statements	Weighted Mean	Verbal Interpretation
The staff take orders from customers easily.	4.5	Strongly Agree
The staff accurately process orders.	4.5	Strongly Agree
The staff process and deliver orders fast.	4.5	Strongly Agree
The staff efficiently process orders.	5	Strongly Agree
The staff maintain and update the ordering process.	4.5	Strongly Agree
Overall Weighted Mean	4.6	Strong Agree

Legend:

4.50 - 5.00	Strongly Agree	1.50 - 2.49	Disagree
3.50 - 4.49	Agree	1.00 - 1.49	Strong Disagree
2.50 - 3.49	Neutral		

Respondents indicated a strong agreement with the staff's performance in various aspects. Taking orders from customers, accurately processing orders, and delivering orders quickly were all perceived as strongly agreed upon, each receiving a weighted mean of 4.5. Furthermore, the efficient processing of orders garnered a particularly elevated level of agreement, with a weighted mean of 5.0. Additionally, respondents strongly agreed that the staff's maintenance and updates to the ordering process were commendable, with a weighted mean of 4.5. The total weighted mean of 4.6 indicates an overall strong agreement with the staff performance.

Findings from Table 5 indicate staff contentment with the current ordering processes, in accordance with Kudakhtin's (2023) focus on effective management of staff development. Overcoming challenges in employee development and fostering self-growth is crucial in industries where a skilled and motivated workforce is essential for providing outstanding service.

Table 6

Evaluation of Customers on Current Manual Procedures via Satisfaction Scale

Statements	Weighted Mean	Verbal Interpretation
The ease of placing an order is satisfactory.	3.4	Neutral
The accuracy at which my orders are processed is satisfactory.	3.55	Satisfied
The speed at which my orders are processed is satisfactory.	3.1	Neutral
The efficiency at which my orders are processed is satisfactory.	3.2	Neutral
The maintainability of the ordering process is satisfactory.	3.15	Neutral
Overall Weighted Mean	3.28	Neutral

Legend: **4.50 - 5.00 Very Satisfied** **1.50 - 2.49 Unsatisfied**
 3.50 - 4.49 Satisfied **1.00 - 1.49 Very Unsatisfied**
 2.50 - 3.49 Neutral

Respondents found the ease of placing orders to be neither particularly positive nor negative, as indicated by a weighted mean of 3.4. Similarly, the speed and efficiency of order processing were perceived as neutral, with weighted means of 3.1 and 3.2, respectively. The maintainability of the ordering process also received a neutral perception, with a weighted mean of 3.15. On the other hand, respondents expressed satisfaction with the accuracy of order processing, giving it a weighted mean of 3.55. The total weighted mean of 3.28 indicates that there is room for improvements with the current order processing within the business.

Findings in Table 6 indicate customers exhibiting a neutral stance on order processing, indicating a need for improvement. This observation resonates with Sheth's (2023) argument emphasizing the importance of effective and efficient customer-focused support services, especially in restaurant queue scenarios, highlighting their influence on customer satisfaction and loyalty.

Identification of the current processes implemented by PansEat Tagapo Restaurant that highlight reliability, maintainability, usability, and efficiency.

The researchers conducted observations at PansEat Tagapo Restaurant during its peak hours on January 9th to 14th from 7 to 8 pm, which is known to be the restaurant's busiest period. The primary objective of the study is to examine and identify the existing procedures employed by the restaurant in the domains of queue management, staff management, and sales tracking.

Table 7
Observation of Current Manual Processes

Days of Observation	Time	Reliability	Maintainability	Usability	Efficiency
1. January 9, 2024	7 PM to 8 PM	Satisfied	Unsatisfied	Satisfied	Unsatisfied
2. January 10, 2024	7 PM to 8 PM	Satisfied	Unsatisfied	Satisfied	Unsatisfied
3. January 11, 2024	7 PM to 8 PM	Unsatisfied	Satisfied	Unsatisfied	Unsatisfied
4. January 12, 2024	7 PM to 8 PM	Satisfied	Satisfied	Satisfied	Satisfied
5. January 13, 2024	7 PM to 8 PM	Unsatisfied	Unsatisfied	Unsatisfied	Unsatisfied
6. January 14, 2024	7 PM to 8 PM	Unsatisfied	Unsatisfied	Unsatisfied	Unsatisfied
Satisfaction %	—	50% (Neutral)	66.6% (Unsatisfied)	50% (Neutral)	83.3% (Unsatisfied)

1. Reliability

The restaurant's reliability in service quality and the amiable nature of the staff, who manage customer inquiries is commendable. However, a number of dissatisfaction rating was observed in 3 out of 6 instances (50%) a notable area of concern lies in the unreliability of the restaurant's sales tracking and queue management, particularly during busy hours. Despite the positive aspects of the dining experience, the observed inconsistency in sales tracking and queue management processes reveals a need for improvement in efficiently managing large volumes of customers. This issue may potentially impact on overall customer satisfaction, indicating a specific operational aspect that requires attention and enhancement within the restaurant's management approach.

This inconsistency, identified in 50% of instances, highlights the need for improvement in handling large customer volumes, potentially impacting overall customer satisfaction and indicating an operational aspect requiring attention. In the context of technological advancements, as highlighted by Zulkafly (2021), transformative changes in economic activities contribute to enhanced efficiency. Specifically, within the restaurant industry, technology-driven progress, such as self-service kiosks, plays a crucial role in elevating customer satisfaction. Zulkafly's study underscores the significance of self-service kiosks, allowing customers to navigate the ordering process independently. Investigating the correlation between self-service terminal features and customer satisfaction, the research reveals that factors like speed, convenience, and ordering accuracy through these kiosks directly influence customer satisfaction. Implementing such technological solutions could potentially address the observed challenges in sales tracking and queue management, enhancing the restaurant's overall operational efficiency and customer satisfaction.

2. Maintainability

The researcher noted the restaurant's adept planning and efficient management practices, particularly in staff management, leading to the delivery of high-quality service. However, in 4 out of 6 observations (66.6%) dissatisfaction was observed, the restaurant's reluctance to embrace change and modernization, preferring to adhere to traditional methods. While the establishment excelled in maintaining a well-trained and motivated staff, the resistance to adapting to contemporary trends and technologies raises questions about its overall maintainability. The refusal to evolve from an "old school" approach may impact the restaurant's long-term viability, potentially hindering its competitiveness in an industry where innovation often plays a pivotal role. Despite effective management in

certain aspects, the need for a more dynamic and adaptable approach to stay relevant in the evolving market becomes apparent.

While a restaurant's maintainability can be sustained for a certain period without adapting to modern technologies, it may face challenges in the long run. In an era where technology plays a significant role in various aspects of the hospitality industry, from online reservations and order management to customer engagement and marketing, a restaurant's reluctance to embrace technological advancements can limit its operational efficiency and potentially hinder its competitiveness. Adapting to modern technologies can enhance overall customer experience, streamline internal processes, and contribute to improved business performance. Therefore, while immediate success may be achievable without embracing modern technologies, long-term maintainability and relevance in the evolving market may be compromised without a willingness to integrate and leverage technological innovations.

While excelling in maintaining a well-trained staff, the resistance to contemporary trends raises concerns about the restaurant's long-term viability. In this context, El-Said's (2019) study emphasizes the growing competition in the restaurant sector, urging brands to leverage modern technology. This aligns with the current study focusing on a "Queue Management System with Kiosk." El-Said's insights provide recommendations for enhancing customer acceptance of self-service kiosks (SSKs), serving as a backdrop for the study. Integrating SSKs into the proposed system could address the reluctance to modernize, enhancing operational efficiency and competitiveness in the evolving market, ensuring a more adaptive approach to stay relevant.

3. Usability

Regarding usability, the manual ordering process becomes notably challenging, particularly during peak hours with a high influx of customers. Although the restaurant

employs well-presented table menus, their effectiveness is constrained by a limitation accommodating a maximum of 10 customers at a time. This restriction can result in delays and inefficiencies during busy periods. Furthermore, the manual payment process, while accurate, poses a considerable time-consuming hurdle, particularly in the meticulous task of writing receipts. This time-intensive aspect of the payment procedure might impede the overall efficiency of the restaurant's operations, emphasizing the need for a more streamlined and scalable approach to order processing and payment processing, through the integration of technology or alternative strategies to expedite these crucial aspects of the dining experience.

In this context, the transformative impact of technological advancements, as highlighted by Zulkafly (2021), becomes crucial. The adoption of self-service kiosks in restaurants aligns with the challenges identified in manual processes. These kiosks, recognized as valuable assets for attracting a technology-oriented customer base, empower customers to streamline the ordering process independently. Integrating technology, such as self-service kiosks, could effectively address the limitations of the manual ordering and payment processes, enhancing operational efficiency and customer satisfaction in the restaurant.

4. Efficiency

The staff excels in delivering efficient service and maintaining overall service quality; however, certain manual tasks such as order taking, sales tracking, and receipt handling pose challenges to the restaurant's operational flow. These labor-intensive processes not only increase the likelihood of errors but also contribute to operational delays.

Sharma's (2023) study on Transforming Businesses with Advanced POS Terminal Features, underscores the transformative impact of Point of Sale (POS) terminal

technology, especially in the restaurant industry. Evolving from traditional cash registers to modern digital systems, POS terminals streamline sales, inventory management, and customer service. The study emphasizes the efficiency and reliability of POS technology in automating tasks, preventing errors, and enhancing overall operational efficiency. Real-time sales tracking, inventory management, and customer relationship features contribute significantly to improved decision-making, increased profitability, and a seamless dining experience. The integration of POS terminals in the restaurant not only addresses manual task challenges but also provides data-driven insights, identifies best-selling items, prevents wastage, and embraces emerging trends such as cloud-based systems, mobile technology integration, and the use of AI and machine learning. While challenges like initial costs and learning curves exist, POS technology, as highlighted by Sharma, is crucial for restaurants to stay competitive and efficient in the dynamic business landscape, complementing the staff's effort.

Chapter 5

SUMMARY OF FINDINGS, CONCLUSION, AND RECOMMENDATIONS

This chapter aims to highlight the key findings of the study. It examines the observed outcomes and presents recommendations to tackle the identified issues, offering valuable guidance for upcoming researchers. The chapter summarizes the obtained results in a concise manner and draw meaningful conclusions, helping readers understand the practical and theoretical implications of the study.

Summary of the Findings

It presents a brief, but important summary of the main findings and conclusions gathered from this research. The primary findings are accessed through it, and it provides a brief overview of the aim, its scope, and significant concerns this researcher addressed.

Processes in the current system of PansEat Tagapo can still be improved.

There is still room for improvement in particular areas, such as queue management, staff management, and sales tracking. Based on the observation results, the researcher conducted a 6-day observation, which shows dissatisfaction. The observations during peak hours highlight specific issues that need addressing for improved operational effectiveness. The owner acknowledges the need for technological solutions and automation to enhance efficiency, customer satisfaction, and overall business performance. This suggests that there is potential to make things work better and easier.

The speed of service is being affected by manual processes.

The speed of service of PansEat Tagapo is significantly affected by manual processes, especially in order processing and staff management. Speed of service is essential for keeping customers happy and satisfied, encouraging repeat visits. Slow service can lead to dissatisfaction and discourage customers from returning. Therefore, maintaining quick service at PansEat Tagapo is vital. Maintaining the speed of service will surely help improve the customer satisfaction and contribute to the overall success of the restaurant.

The current system of PansEat Tagapo is inefficient to use.

The current system at PansEat Tagapo is notably inefficient in its current state. However, there's agreement on the staff being accurate and efficient in processing orders, but there are difficulties in maintaining this due to resistance to change. During busy times, there are problems with manual ordering and slow payment processes. This shows that reliability and user friendliness could be decreased even though the system performs its function well. A more improved and dependable user experience might arise from improvements in these areas. It is critical to recognize and act on this improvement suggestion to optimize PansEat Tagapo's operational performance. By doing this, the current system will be improved and made more dependable and efficient while maintaining a user-friendly interface.

Conclusion

Starting out as a small eatery in 2015, PansEat Tagapo Restaurant has expanded into a three-floor establishment with ambitions of becoming one of the best pancit restaurants in the country. However, in the restaurant industry, where excellent customer service is vital, the manual processes used to manage the restaurant seem to hinder the ability to provide high-quality service to customers.

The existing manual procedures utilized by PansEat Tagapo in their current system to manage order processing, staff management, and sales tracking encounter various challenges. Despite the effectiveness of their existing processes, there exists a clear opportunity for enhancement, particularly in critical aspects such as the improvement of order processing, staff management, the accuracy of sales tracking, and the generation of daily sales reports. The findings from the customer survey indicate that most responses fall into the "Neutral" category when evaluating various aspects of the current restaurant processes. Conversely, observations on manual processes yielded predominantly "unsatisfactory" evaluations. The feedback strongly emphasizes the necessity to focus on areas for improvement, with the overarching goal of ensuring a prompter and effective service experience for customers. Focusing on the improvement of order processing, staff management, sales tracking, and the generation of daily sales reports, PansEat Tagapo may enhance efficiency in restaurant management and achieve more customer satisfaction. Lawal (2022), highlights that Point-of-Sale (POS) systems bring substantial advantages to businesses. The efficiency in transactions facilitated by POS systems not only leads to cost savings but also enables comprehensive record-keeping. This, in turn, contributes to improved business operations and positively influences customer relationships by ensuring accuracy, streamlined processes, and financial stability. Moreover, Ishak (2021) states that the utilization of Self-Ordering Kiosks (SOKs) plays a

pivotal role in managing costs and is a fundamental component of the digital dining landscape. The adoption of SOKs is seen as an investment to meet changing consumer preferences, guaranteeing economic advantages and increased customer loyalty. The insights from Lawal and Ishak supports the argument made in this research and emphasize the transformative impact of technology, specifically Point-of-Sale (POS) systems and Self-Ordering Kiosks (SOKs), in achieving operational excellence, cost management, and meeting evolving consumer expectations. Adopting these technological improvements allows PansEat Tagapo to develop a streamlined and customer-focused dining experience.

PansEat Tagapo heavily depends on manual procedures for order processing, involving the manual recording of orders, transmitting orders to the kitchen, manually generating receipts, and collecting order slips for daily sales tracking. While this process seems straightforward, it introduces potential challenges and limitations. The manual nature of these tasks can lead to inefficiencies, errors, and slower service delivery. Especially during peak hours when there is a surge in orders, the manual process becomes susceptible to delay and confusion, potentially affecting the quality and speed of service. Additionally, it may hinder the ability to track sales data promptly and accurately, impacting financial management and overall operational efficiency. Also, the issue of excessive staffing also requires attention, emphasizing the importance of addressing staff management to maintain a balance, preventing underutilization during slower periods, and minimizing inefficiencies. It is imperative for PansEat Tagapo to undertake a strategic overhaul, implementing modernized automated systems, to effectively address operational challenges and rectify the deficiencies linked with manual processes.

Recommendations

This section is intended to provide a concise and clear summary of the recommended actions to address the issues identified in the study.

Maintenance of the new system. To make sure the new system keeps working well for a long time, it is important to have a good plan for taking care of it. This plan should include regular updates and checks to fix any problems that might come up. It is also a good idea to have a team of people who focus on taking care of the system, or you can hire others to do it. This way, if there are any technical issues, they can be found and fixed quickly, reducing the time the system is not working. Getting feedback from the people using the system is also helpful for making it better over time. Taking proactive steps to maintain the system does not just make it work better, but it also helps it last longer. This means you get more value for your investment, and it ensures that users have a smooth experience with the system.

Providing a kiosk machine, POS device, and kitchen-side monitor. The use of technologies like self-ordering kiosks, POS devices and kitchen monitors is recommended to increase efficiency and customer experience at Pans Eat Tagapo. Kiosks machines allow customers to order quickly, reduce the waiting time and ensure accuracy. Advanced POS devices are more than capable of speeding up transactions, they also help manage inventory to facilitate better decision making. The kitchen monitors improve the communication between the front of house and the back of house, leading to a faster order processing and a lower error rate. Implementing these technologies not only modernizes the restaurant

setting but also boosts operational efficiency, resulting in increased customer satisfaction and business success.

Training of staff in using the proposed system. To ensure a smooth transition to the proposed system, it is essential to conduct a comprehensive training session for the PansEat Tagapo staff. The main objective of these training sessions is to share knowledge about the complexities of the new system, enabling staff members to navigate its features with confidence. Special emphasis will be placed on key components, particularly sales tracking, where detailed instructions will be provided to ensure proficient use of the system. Additionally, thorough training will be provided to personnel to equip them with essential skills for efficient utilization of the point-of-sale system, enabling them to process orders quickly and stay informed about order statuses. By investing in these training programs, PansEat Tagapo can help its employees make the most of the new system, making operations more efficient and improving customer satisfaction.

For Future Researchers. Future researchers who want to use this study as a reference for their own research should look for more reliable information outside of what is in this document. It would be helpful for them to check out theories and ideas that match the findings of this study to strengthen their perspective. But it's important to note that the researchers don't endorse or support plagiarism, as it's seen as a type of stealing.

REFERENCES

Kiosk and the Food Industry

- Zubchuk, E., Menshikov, D., & Mikhaylovskiy, N. (2022). Using a language model in a kiosk recommender system at Fast-Food restaurants. *SciSpace - Paper*.
<https://typeset.io/papers/using-a-language-model-in-a-kiosk-recommendersystem-at-fast-3gc4v7a4>
- Yang, Q., Goodsir, W., & Poulston, J. (2019). Automation of the fast-food industry: Gen Z perspectives of self-service kiosks versus employee service. *Hospitality Insights*, 3(2), 7–8. <https://doi.org/10.24135/hi.v3i2.66>
- Kim, N. (2020). A Study on the Relationships between the Service Convenience of Restaurant Kiosk and Customer Value, Trust, and Satisfaction. *Journal of the Korea Academia Industrial Cooperation Society*, 21(6), 187–195.
<https://doi.org/10.5762/kais.2020.21.6.187>
- Kim, J., Yang, J., & Lee, Y. (2023). How do Self-Service kiosks improve COVID-19 pandemic resilience in the restaurant industry? *Sustainability*, 15(13), 10168.
<https://doi.org/10.3390/su151310168>
- El-Said, O. A., & Tall, T. A. (2019). Studying the factors influencing customers' intention to use self-service kiosks in fast food restaurants. In *Springer eBooks* (pp. 206–217).
https://doi.org/10.1007/978-3-030-36737-4_17
- Zulkafly, H. A., Ismail, N. S., & Sharif, N. U. N. M. (2021). Customer satisfaction towards Self-Service Kiosks for Quick Service Restaurants (QSRs) in Klang Valley. *International Journal of Academic Research in Business & Social Sciences*, 11(13). <https://doi.org/10.6007/ijarbss/v11-i13/8502>
- Kim, M. (2019). A study on the effects of kiosk quality characteristics of food service companies on experiential value, satisfaction, and behavioral intention.

International Journal of Tourism and Hospitality Research, 33(9), 71–86.

<https://doi.org/10.21298/ijthr.2019.9.33.9.71>

Yang, Q. (2019). *Automation of the fast-food industry: Gen Z perspectives of self-service kiosks versus employee service*.

<https://www.semanticscholar.org/paper/Automation-of-the-fast-food-industry%3A-Gen-Z-of-Yang-Goodsir/d11bdf89e32ebac45b888a9d25e452f586780ede>

Samengon. H. (2022). *Consumer's motivations to used self-service kiosk in fast food restaurant/ Harnidah Samengon - UiTM Institutional Repository*.

<https://ir.uitm.edu.my/id/eprint/68318/>

Hamid, N. a. A., Author_Id, N., Abdullah, N. H., Chian, N. S., Author_Id, N., & Author_Id, N. (2021). The User Experience (UX) Analysis of Self-Service Kiosk (SSK) in

Waiting time at fast food Restaurant using User Experience (UX) model. *JOURNAL OF SOCIAL TRANSFORMATION AND REGIONAL DEVELOPMENT*, 3(2).

<https://doi.org/10.30880/jstard.2021.03.02.010>

Baek, J. (2023). Effects of kiosk characteristics of food service companies on customer experience, satisfaction, and continuous use intention. *Culinary Science &*

Hospitality Research, 29(5), 98–111. <https://doi.org/10.20878/cshr.2023.29.5.010>

Queue Management

Ardiansyah, M. R. (2021). *The Website-Based Food Booking System Equipped with RealTime Booking Status to Address Queuing Issues at Restaurants*.

[https://www.semanticscholar.org/paper/The-Website-Based-Food-Booking-System-Equipped-with-Ardiansyah-](https://www.semanticscholar.org/paper/The-Website-Based-Food-Booking-System-Equipped-with-Ardiansyah-Kusuma/08e7fee8f67c391b8bde4bad6412303b05a61185)

[Kusuma/08e7fee8f67c391b8bde4bad6412303b05a61185](https://www.semanticscholar.org/paper/The-Website-Based-Food-Booking-System-Equipped-with-Ardiansyah-Kusuma/08e7fee8f67c391b8bde4bad6412303b05a61185)

- Hasugian, I. A., Vandrick, & Dewi, E. (2020). Analysis Of Queuing Models Of Fast Food Restaurant with Simulation Approach. *IOP Conference Series*, 851(1), 012028. <https://doi.org/10.1088/1757-899x/851/1/012028>
- De Vries, J., Roy, D., & De Koster, R. (2018). Worth the wait? How restaurant waiting time influences customer behavior and revenue. *Journal of Operations Management*, 63(1), 59–78. <https://doi.org/10.1016/j.jom.2018.05.001>
- Weiss, E. N., & Tucker, C. (2018). Queue management: Elimination, expectation, and enhancement. *Business Horizons*, 61(5), 671–678. <https://doi.org/10.1016/j.bushor.2018.05.002>

Staff Management

- Troger, H. (2021). The staff management process. In *Future of Business and Finance* (pp. 145–174). https://doi.org/10.1007/978-3-030-67470-0_8
- Kudaktin, S., & Nazarenko, S. (2023). STAFF DEVELOPMENT MANAGEMENT ON a WAY TO STRENGTHEN PERSONNEL POTENTIAL AND THE STATE OF BUSINESS ENTITIES' ECONOMIC SECURITY. *Finansovo-kreditna Diâlnîst': Problemi Teorîi Ta Praktiki*, 2(49), 413–425. <https://doi.org/10.55643/fcaptp.2.49.2023.3992>
- Odey, J. A., Otiko, A. O., & Ana, P. O. (2023). *Design and Implementation of Staff Productivity Management Information System*. https://www.researchgate.net/publication/374327205_Design_and_Implementation_of_Staff_Productivity_Management_Information_System#fullTextFileContent

Queue Algorithm

- Indra, Sidabutar. (2018). Queue Simulation using the First In First Out Algorithms. Log in, 12(2):40-43. doi: 10.24224/LOGIN.V12I2.26 <https://typeset.io/papers/queue-simulation-using-the-first-in-first-out-algorithm-4i5pofsd80>
- Moorthy, R. (2020, May 7). *Are you using queuing theory to accelerate performance test analysis?* TechBeacon. <https://techbeacon.com/app-dev-testing/are-you-using-queuing-theory-accelerate-performance-test-analysis>
- Youbing, J. (2018). Queue data distribution and processing algorithm. *SciSpace - Paper*. <https://typeset.io/papers/queue-data-distribution-and-processing-algorithm-2t0s8mh69z>
- Yildiz, O. T. (2023). *Evaluating Performance of Restaurant POS Processes in Fast-Food Restaurants*. https://openaccess.cms-conferences.org/publications/book/978-1-958651-91-9/article/978-1-958651-91-9_3

Restaurant Operations

- Shigeki, K. (2018). Operation management system for restaurant. *SciSpace - Paper*. <https://typeset.io/papers/operation-management-system-for-restaurant-4iw92u3byz>
- Kim, K., Kim, M., & Jun, J. (2020). Small queuing restaurant Sustainable Revenue management. *Sustainability*, 12(8), 3477. <https://doi.org/10.3390/su12083477>
- Obermeier, G., Zimmermann, R., & Auinger, A. (2020). The effect of queuing technology on customer experience in physical retail environments. In *Lecture Notes in Computer Science*. https://doi.org/10.1007/978-3-030-50341-3_12

Customer-Centric Perspective

- Sheth, J. N., Jain, V., & Ambika, A. (2023b). The growing importance of customer-centric support services for improving customer experience. *Journal of Business Research*, 164, 113943. <https://doi.org/10.1016/j.jbusres.2023.113943>
- Hagh, S. M., Adila, M. Z. N., Kiam, L. C., Fuad, M. M., & Ezam, S. N. (2021). System and method for personalized and policy-based customer queue management. *SciSpace-Paper*. <https://typeset.io/papers/system-and-method-for-personalizedand-policy-based-customer-26avgr5v3c>
- Dimitrakopoulos, Y., Economou, A., & Leonardos, S. (2021). Strategic customer behavior in a queueing system with alternating information structure. *European Journal of Operational Research*, 291(3), 1024–1040. <https://doi.org/10.1016/j.ejor.2020.10.054>

Sales Tracking

- Saeed, S., Nizamani, M. A., Shaikh, A., Memon, M. A., Abbasi, F. A., & Naqvi, S. M. R. (2019). Evaluating the quality of point of sale (POS) software. *SciSpace - Paper*. <https://typeset.io/papers/evaluating-the-quality-of-point-of-sale-pos-software-todk1rs4n9>
- Singh, R., Sonje, R., Salkar, S., & Jadhav, A. (2022). Smart QR-based Restaurant Dine-in System with Sales Analysis. *ITM Web of Conferences*, 44, 03014. <https://doi.org/10.1051/itmconf/20224403014>

Technology in Restaurant

- Bin, C., Guanghuang, L., Yong, W., Wanjian, L., Ruiqian, H., Zhongliang, H., & Chunxiang, W. (2018). Restaurant queuing management method and system. *SciSpace - Paper*. <https://typeset.io/papers/restaurant-queuing-managementmethod-and-system-3uzcktejgb>

- Peizhi, C. (2018). Intelligent restaurant management system. *SciSpace - Paper*.
<https://typeset.io/papers/intelligent-restaurant-management-system-3hihsuplr4>
- Kim, K., Kim, M., & Jun, J. (2020b). Small queuing restaurant Sustainable Revenue management. *Sustainability*, 12(8), 3477. <https://doi.org/10.3390/su12083477>
- Ensafi, M., Thabet, W., & Besiktepe, D. (2024). Investigation of work order processing in different facilities: a questionnaire-based survey. *Facilities*.
<https://doi.org/10.1108/f-05-2023-0048>
- Chen, B. S. (2018). What makes restaurants successful? *Hospitality Insights*, 2(1), 10–12. <https://doi.org/10.24135/hi.v2i1.22>

Emerging Technology

- Hagh, S. M., Kiam, L. C., Aini, B. Z. a. N., Jamaluddin, B. J. M. A., & Hwa, L. S. (2020). Queue management system and method thereof. *SciSpace - Paper*.
<https://typeset.io/papers/queue-management-system-and-methodthereof-m9bmhq2kmo>
- Soon, K. T. (2018). Queue management system and method. *SciSpace - Paper*.
<https://typeset.io/papers/queue-management-system-and-method-1mj5j3k8l3>
- Yunfei, Y. (2018). Restaurant reservation and ordering method and system. *SciSpace - Paper*.
<https://typeset.io/papers/restaurant-reservation-and-ordering-method-andssystem-18ggy3pwav>

Automated Ordering

- Callarman, S. (2023). Automated Order processing benefits for ecommerce | ShipBob. ShipBob. <https://www.shipbob.com/blog/automated-order-processing/>
- Woon, S. H. (2019). Automated ordering method and automated ordering machine. *SciSpace - Paper*. <https://typeset.io/papers/automated-ordering-method-andautomated-ordering-machine-4299c3w8jt>

Chandekar, R. (2023). Automatic Restaurant Ordering system.
<https://www.semanticscholar.org/paper/AutomaticRestaurantOrdering%20SystemChandekarSawant/41ad56de87f9719e208d3addbde3ccbb76f57155>

Data Management

Storey, V. (2019). Data management in the era of digitalization. <https://www.semanticscholar.org/paper/Data-Management-in-the-Era-of-Digitalization-Storey/312b910036ed5150408ea73ee4ed63f326b651cc>

Enkhtaivan, B., Sanami, N., Keisuke, K., & Takenouchi, T. (2020). Data management method, data distribution system, computer program, and recording medium. SciSpace - Paper. <https://typeset.io/papers/data-management-method-datadistribution-system-computer-3x3n3x7ibl>

Borghi, J. A., & Van Gulick, A. (2021). Promoting open science through research data management. SciSpace - Paper. <https://typeset.io/papers/promoting-openscience-through-research-data-management-1voc3mualz>

System Security

Zamfiroiu, A. (2022). Cybersecurity management for incident response. <https://www.semanticscholar.org/paper/Cybersecurity-Managementfor-Incident-Response-ZamfiroiuSharma/41345eb03306d11fcfb756e53482a544a1ed0231>

Sharma, C. (2018). Comparative analysis of hash function and symmetric algorithm for data security in wireless sensor networks. <https://www.semanticscholar.org/paper/Comparative-Analysis-of-Hash-Functionand-Symmetric-SharmaKumar/4b009c330e8ba5221c53c777bb7730c8171da258>

Divakarla, S. G. L., & Vardhan, J. N. V. (2023). Door Locking System using RFID and GSM Technology. SciSpace - Paper. <https://typeset.io/papers/door-lockingsystem-using-rfid-and-gsm-technology-10vdt82w>

Effectiveness of Implementing KIOSK and POS System in Restaurants

Lawal, S. (2022). A Critical Analysis of Point of Sale (POS) types and their efficiency for business. <https://globalacademicstar.com/download/article/a-critical-analysis-ofpoint-of-sales-pos-types-and-their-efficiency-for-business.pdf>

El-Said, O. A., & Tall, T. A. (2019). Studying the factors influencing customers' intention to use self-service kiosks in fast food restaurants. In Springer eBooks (pp. 206–217). https://doi.org/10.1007/978-3-030-36737-4_17

Ishak, F. a. C., Lah, N. a. C., Samengon, H., Mohamad, S. F., & Bakar, A. Z. A. (2021). The Implementation of Self-Ordering Kiosks (SOKs): Investigating the challenges in fast food restaurants. *International Journal of Academic Research in Business & Social Sciences*, 11(10). <https://doi.org/10.6007/ijarbss/v11-i10/11491>

Sharma, M., & Yadav, B. (2023). Transforming Businesses with Advanced POS Terminal Features. *ResearchGate*. https://www.researchgate.net/publication/372561004_Transforming_Businesses_with_Advanced_POS_Terminal_Features