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Analysing Waiting Times and Service Utilization Using Simulation: A Study of Kluang Rail Coffee

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Abstract

The food service industry in Malaysia is witnessing continuous growth, driven by the increasing prosperity and sophistication of its customers. The full- service restaurants, which offer table service and a wide variety of food and beverage options, are vital to this industry. However, many Malaysian restaurants struggle with customer retention, which is typically caused by service concerns, particularly long waiting times. One of the establishments that is facing this challenge is Kluang Rail Coffee, located in Pusat Perniagaan Tasik, as customers have shared their prolonged waiting times at the restaurant. Therefore, the purpose of this study is: (1) to determine the total customer exits, service process utilisation, and average time in the system to evaluate the waiting times in the restaurant, and (2) To propose practical recommendations for reducing waiting time and enhancing customer satisfaction at Kluang Rail Coffee. Drawing on previous research on waiting time and simulation in the food and beverage business, this study uses time study and simulation methodologies to model and simulate scenarios, finding solutions for reducing waiting times. The data sample of 30 customers from each service step will be observed to collect primary data. The simulation procedure consists of identifying objectives, gathering and analysing system data, constructing and validating the model, conducting simulation experiments, and presenting results with recommendations for improvement. Finally, this study aims to understand and minimise variables that contribute to high wait times at Kluang Rail Coffee, thereby increasing customer satisfaction and operational efficiency.

1. Introduction

In Malaysia, the food service industry is anticipated to maintain its positive trajectory due to the increasing sophistication and affluence of food service customers. Rapid urbanisation and changing lifestyles have significantly influenced local customer preferences. This evolution in consumer behaviour is driving growth in industry (Abdullah, Abdurahman & Hamali, 2012). One of the most lucrative industries in Malaysia is the food service business, which is predicted to grow in income due to rising disposable incomes and increased demand for local cuisine among visitors and Malaysians together (Lada *et al.*, 2024). There are many other kinds of food service businesses, such as cafeterias, self-service or take-away restaurants, canteens, and function rooms in addition to hotel restaurants. Every kind of business provides distinct products, services and concepts (Edwards, 2020). In the Malaysian context, Lai *et al.* (2020) have observed that many restaurants are struggling to attract customers. One significant factor is service problems, particularly related to long waiting times for

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meals (Abhari, Jalali & Jaafar, 2022). Moreover, restaurateurs must avoid service breakdowns, as these can harm a restaurant's reputation and customer satisfaction, especially if appropriate problem resolution is not implemented (Sharma Bhandari, 2023). Besides, Meyer-Waarden & Sabadiee (2023) also emphasise that resolving issues effectively is essential in the restaurant industry to restore customer satisfaction after problems arise. Kluang Rail Coffee, a renowned Malaysian Kopitiam situated in the charming town of Kluang in Johor, Malaysia, boasts a rich history dating back to its establishment in the early 1900s by Ben Winn's ancestor, Lim Luan Hee, and his grandpa, Lim Heng Yong (Moghana, 2022). The restaurant has since gained popularity for its distinctive ambience, historical significance, and delectable traditional Malaysian coffee and cuisine. The main branch is housed inside the historic Kluang Railway Station, this iconic establishment provides guests with a nostalgic taste of Malaysian coffee culture. Presently, Kluang Rail Coffee operates seven branches across Malaysia, with five located in Kluang, one in Yong Peng, and another in Shah Alam (Lim, 2022). This research is conducted and focused on one of the branches located at No. 20 and 21, first floor, Jalan Tasik 1, Pusat Perniagaan Tasik, 86000 Kluang, Johor. Recognised as a prominent dining destination, the restaurant frequently experiences a high influx of customers, resulting in extended waiting periods for dinners.

In this research, the primary focus is on the length of time customers wait in queue before receiving service in the restaurant. Customers must wait in line outside the restaurant to be seated and served whenever they visit. Based on the researcher's review of Kluang Rail Coffee, customers planning to dine in cannot reserve a place. Due to the high demand, reservation services are unavailable, making it impractical to handle customer inquiries and bookings through phone calls or messaging apps like WhatsApp. As a result, customers at any Kluang Rail Coffee location are required to wait in queue to be seated and receive their meals. According to some of the most recent Google Reviews selected as evidence by the researcher, there are customers who have some complaints about their experiences of crowded situations when visiting the restaurant. Many customers are concerned about long waiting times because the restaurant is nearly filled during peak hours. This recurring observation indicates that the restaurant frequently struggles to accommodate its flood of customers efficiently, which leads to long waiting times for those looking for a table. Therefore, this study is intended to analyze the waiting time at Kluang Rail Coffee by using the simulation approaches. This research addresses questions derived from the study's objectives, focusing on the Kluang Rail Coffee branch located at No. 20 and 21, First Floor, Jalan Tasik 1, Pusat Perniagaan Tasik, 86000 Kluang, Johor. The scope of this study is to examine the operations of Kluang Rail Coffee and determine the average waiting time experienced by regular customers who visit the restaurant, particularly during busy days such as Friday, Saturday, and Sunday.

The study will use simulation methods to analyze waiting times, staff service times, and transaction completion times. The ProModel simulation software will be used to optimize waiting times and enhance customer satisfaction. Data on waiting times were collected from Kluang Rail Coffee customers, focusing on variables such as arrival times, service times, and meal delivery times. The collected data allowed for an appropriate solution to the current service process, which was modelled and simulated using ProModel Professional Version software. Based on this analysis, the study aims to develop actionable recommendations tailored specifically to the challenges faced by Kluang Rail Coffee, with clear and practical implementation actions to effectively minimize customer waiting times. This research aims to determine the total customer exits, service process utilisation, and average time in the system to evaluate the waiting times in the restaurant, and to propose practical recommendations for reducing waiting time and enhancing customer satisfaction at Kluang Rail Coffee.

2. Literature Review

2.1 Queuing Theory

Queuing theory is derived from mathematical models and performance measures to evaluate and potentially enhance customer flow through queuing systems (Dudin, Klimenok & Vishnevsky, 2020). The queuing theory model utilises mathematical analysis to calculate various metrics, including the average time each customer spends in the queue, the average queue length, the average time each customer spends within the entire queuing system, the average number of customers in the system, and the probability that the service facility is in certain states, such as being full or empty (Nnaemeka & Adaora, 2023).

2.2 The Basic Structure of Queuing Models

Fig. 1 shows the basic structure of queueing progress. According to Nielsen *et al.* (2012), an input source generates customers looking for services as time passes. These customers join a queue, which may be endless or finite, upon entering the queuing system. A queue member is chosen for service based on a rule known as the queue discipline (for example, first-come, first-served) at specific times. The customer then exits the queueing system after their service mechanism has completed the necessary service for them.

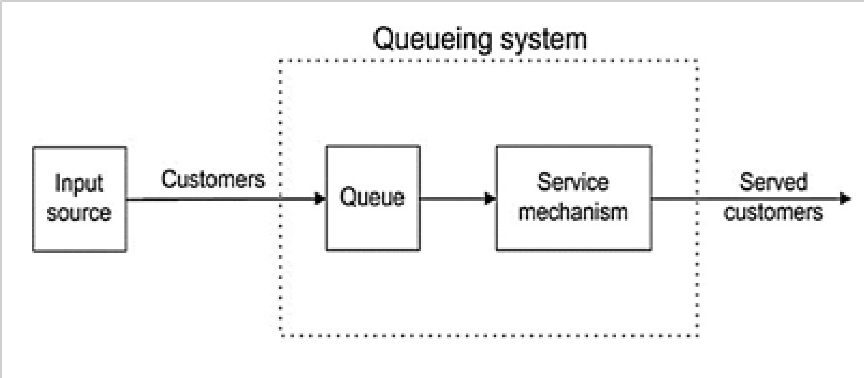

Fig. 1 *The basic structure of queueing model (Nielsen et al., 2012)*

According to Harrell, Ghosh, and Bowden (2012), descriptive operational research (OR) methods like queuing theory are useful for basic problems. However, as systems become more complex, these problems quickly become mathematically intractable. In contrast, simulation can provide accurate estimations for even the most complicated systems, as long as the model is valid. Simulation outputs are not limited to a few metrics but include data on all performance indicators. Moreover, while OR methods provide only average performance measurements, simulation can produce precise time-series data and histograms, offering a comprehensive view of performance over time. Therefore, using the simulation method is preferable to relying solely on OR queuing theory.

2.3 Service Delivery Process and Waiting Time

Noone *et al.* (2009) divided the service process into three stages: pre-process, in-process, and post- processing. These stages begin with seating the customer, move to taking the initial order and providing the first meal, and end with settling the bill and leaving the restaurant. Alternatively, Namkung and Jang (2010) divided the service delivery process into four stages: greeting and seating, order taking, meal consumption, payment and exiting. It is worth noting that clients might encounter waiting periods at many stages of the service delivery process (Li, Yuan & Zhao, 2024). Besides, Dube-Rioux, Schmitt & Leclerc (1989) divided these waits into three categories: service entry waits, in-service waits, and departure waits. The service entry wait refers to the initial period of waiting to be seated, during which consumers may get more anxious as the wait time increases. According to research, the service entry wait has a greater impact on customer satisfaction than the in-service wait (Tasar, Ventura, & Cicekli, 2020).

2.4 The Consequences of Waiting Time in Service Delivery

As the research of Özkul, Bilgili & Koç (2020) mentioned, waiting time plays a crucial role in shaping customers' perceptions of service quality and their overall satisfaction in the restaurant industry. When customers have to wait for an extended period, they may feel frustrated, impatient, and even annoyed (Tasar *et al.*, 2020). Then, past scholars such as Hidayat, Bismo & Basri (2020) have discussed the relationship between service quality and their customers' contentment and propensity to return and repurchase at hot plate restaurants, that prolonged waiting times can significantly diminish and negatively impact on a customer's dining experience, resulting in lower satisfaction levels and potentially harm a restaurant's reputation.

Besides, the psychological repercussions of waiting should not be underestimated. Studies by researchers such as Munichor & Cooke (2022) indicate that prolonged waiting periods can lead to increasing levels of anticipation, which often devolve into frustration. This frustration not only adversely impacts on the customers' mood but also diminishes their perception of the overall service quality. For example, fine dining restaurants are renowned for their exemplary customer service. However, during periods of high congestion, they encounter significant challenges related to service time and efficiency. These challenges can adversely affect the mood and satisfaction of diners, potentially diminishing the overall dining experience despite the high standards of service typically associated with such establishments.

It is important to consider the contextual factors and surroundings in which customers await service, as these elements significantly influence their perceptions. The negative consequences of long wait times can be avoided by a welcoming and comfortable waiting space. For instance, places like restaurants that provide cosy seating, entertainment options, or a pleasant atmosphere can improve the whole waiting experience, thereby reducing the perceived duration of the wait. This approach is consistent with the idea of 'perceived waiting time,' which may diverge significantly from the real amount of time spent waiting based on the activities offered to customers to spend the time (Mwinuka, 2023).

2.5 The Reasons for Queuing and Waiting Implementations

A queue typically forms when customers arrive and the service facility is busy (Adan, Hathaway & Kulkarni, 2019). Limited-service facilities that cannot meet the demand create bottlenecks, leading to queues or waiting lines where arriving consumers cannot receive immediate service (Appiah & Osei, 2019). This point of view was also expressed by Khajeh (2020), who stated that bottlenecks arise when facilities are unable to satisfy demand, leading to lines that are typically disliked by customers.

Moreover, Yang, Debo & Gupta (2019) stated that queues arise when there are too few service providers. These perspectives highlight that inadequate facilities are a major cause of customer waiting, especially when arrivals are scheduled, and service times are consistent. In a similar vein, researchers including Upadhyaya (2020) and Adeleke, Iposu & Gbadebo (2023) have observed that queues occur when units in need of service cannot be served right away and attended to immediately while examining various types of lineups.

Fig. 2 illustrates common queuing scenarios encountered in daily operations management as discussed by Heizer, Render & Munson (2017), where customers queue up to await service. Applying this concept to the situation at Kluang Rail Coffee restaurant, customers are the arrivals in the queue, and the service process involves restaurant staff serving customers and carrying out transaction activities.

SITUATION	ARRIVALS IN QUEUE	SERVICE PROCESS
Supermarket	Grocery shoppers	Checkout clerks at cash register
Highway toll booth	Automobiles	Collection of tolls at booth
Doctor's office	Patients	Treatment by doctors and nurses
Computer system	Programs to be run	Computer processes jobs
Telephone company	Callers	Switching equipment forwards calls
Bank	Customers	Transactions handled by teller
Machine maintenance	Broken machines	Repair people fix machines
Harbor	Ships and barges	Dock workers load and unload

Fig. 2 *The example of a common queuing situation with arrival in queue and the related service process (Heizer, Render & Munson, 2017)*

2.6 Managing the Waiting Line and Customer Satisfaction

Long queues can disrupt the smooth flow of operations, causing bottlenecks that slow down service delivery and affect the overall efficiency of the business. Non-queuing customers might also be negatively impacted by the congestion and noise of long queues, which can detract from their overall experience and satisfaction (Arndt, Poujol & Siadou-Martin, 2021; Attari *et al.*, 2022). The quality of a customer's experience is often closely tied to the ease and speed with which they are served. Long waiting times can overshadow other positive aspects of a business, leading to lower overall satisfaction. In a competitive market, businesses that fail to manage waiting lines effectively may lose customers to competitors who offer quicker service, resulting in a loss of market share over time. Consistently long wait times can erode long-term customer loyalty, making it more challenging to build a stable and repeat customer base (Bissong & Ndu, 2024).

2.7 Service System Characteristics

Service systems have unique characteristics that differentiate them from manufacturing systems. Sasser, Olsen & Wyckoff (1978) have identified four distinct characteristics that set services apart from manufactured products.

i. Intangibility of services

Services are intangible, meaning they cannot be touched, seen, or physically measured like a product. For instance, in a restaurant, you cannot see or touch the quality of the dining experience, the taste of the food, or the level of customer service before it is provided (Moore *et al.*, 2024).

ii. Perishability of services

Services are perishable and cannot be stored for future use. Unlike products, which can be inventoried and sold later, a service must be consumed at the moment it is produced. For example, an unoccupied table in a restaurant represents lost revenue that cannot be recovered (Yoo & Yang, 2021).

iii. Heterogeneity of services

Services provide heterogeneous output, meaning the outcome can vary each time the service is delivered. According to Wei, Yu & Li (2024), this variability can stem from differences in the service provider, the timing of the service, the location, the recipient, and price variation among service providers. For instance, the quality and price of a meal at a restaurant can vary depending on the chef, the time of day, or specific circumstances (Meng & Sadjady Naeeni, 2024).

iv. Simultaneity of production and consumption

Services involve simultaneous production and consumption, meaning the service is produced and consumed at the same time. In contrast to manufactured products, which are produced, sold, and then consumed, services require the presence of both the customer and the service provider (Kamal *et al.*, 2020). For example, in a restaurant, the dining experience cannot be provided until it has been sold, and it is produced and consumed simultaneously (Principato *et al.*, 2021). This often entails the customer being present during the production service and possibly participating in the process.

2.8 Service Performance Measures

According to Benevento, Aloini & Squicciarini (2023), internal performance measures include waiting times, processing time for applications, cost per transaction, and the percentage of time spent correcting errors. Collier (1994) describes 'interlinking' as establishing quantitative, causal relationships between these internal measures and external performance criteria, making it a powerful strategic tool. Examples of common internal performance measures that can be evaluated through simulation are as follows.

(a) Service time

This metric refers to the duration taken to complete a service for a customer, from the beginning of service to its completion. It is a critical measure as it directly impacts customer satisfaction and the overall efficiency of the service system (Krishnamoorthy, Shajin & Narayanan, 2021). For instance, service time at a restaurant is the time a customer orders then the time it takes for the food to be produced, served, consumed, and the bill to be paid (Tasar *et al.*, 2020).

(b) Waiting time

This metric measures the length of time a customer must wait in a queue before receiving service. Reducing waiting times is frequently the primary objective because long lines can lead to customer dissatisfaction and potential loss of business (Ayodeji & Rjoub, 2021). For example, wait times in restaurants include the time a customer spends arriving, making a table request, and being seated, as well as the time they spend placing an order and waiting for their food to be served (Qin, Xu & Wang, 2023).

(c) Queue length

This indicator shows how many customers are waiting in queue for assistance at any particular moment (Elalouf & Wachtel, 2021). For example, in a restaurant, queue length can refer to the number of customers waiting for a table or the number of orders waiting to be cooked. If there are always long queues for tables during peak times, the restaurant might need more tables or a better reservation system. Moreover, if many orders are waiting in the kitchen, more staff or improved cooking processes might be needed (Goswami, Rao & Verma, 2023).

(d) Service level

Defined as the percentage of customers who are promptly serviced without any waiting. High service levels are indicators of a properly operating system that can quickly meet customer needs (Rane, Achari & Choudhary, 2023). For example, if a restaurant can promptly seat customers and serve their orders during peak times, it shows that the restaurant is effectively managing its resources and operations to meet customer demands (Cavadia Pájaro, 2023).

(e) Abandonment rate

This metric indicates the proportion of customers who, out of frustration, exit the system before obtaining the requested service. To increase customer happiness and retention, it is important to address general issues like long wait times, which are frequently indicated by a high abandonment rate (Soni, 2023). For instance, in a restaurant, if lots of customers leave due to long waits before being seated or getting their food, it shows a high abandonment rate(Umar, Adehi & Auwal, 2023).

2.9 Simulation Model

According to Molnar (2023), simulation models can be classified as either a 'base model' or a 'current state model', which are utilised to assess the performance of an existing outlet's layout. Additionally, simulations are among the most effective methods for identifying optimal alternatives to reduce waiting times across various systems, including production systems, service systems, and even daily decision-making processes (Hörl, Becker & Axhausen, 2021).According to Ghosh *et al.* (2022), although simulation is beneficial in some areas, including healthcare (hospitals, clinics), food (restaurants, cafeterias), and finance (banks, credit unions), its use in the service sector has generally been rather limited. For example, in healthcare services, Varshoei, Patrick, & Ozturk (2024) used simulation to calculate the ideal number of beds needed to meet patient demand, while Singh *et al.* (2024) examined the impact of staffing on utilisation and cost.

Within the food services industry, Tasar *et al.* (2020) developed a model to determine the ideal seating arrangement for a fast-food restaurant, and Kambli, Sinha & Srinivas (2020) used simulation to evaluate staffing levels, equipment layout, workflow, customer service, and capacity in the canteen in the campus. Therefore, it is evident that the service industry is becoming more and more reliant on simulation. In the context of Kluang Rail Coffee, the simulation allowed for the modelling of service processes, enabling the identification of waiting time. By simulating different scenarios, the study was able to determine the optimal staffing levels and service point arrangements necessary to minimise wait times and optimise service delivery.

2.9.1ProModel Simulation Software

ProModel Professional Version Software is a user-friendly simulation tool for modelling various manufacturing systems, from small job shops to large-scale production and supply chain systems. It operates on Windows and offers an intuitive graphical interface, eliminating the need for programming (Harrell & Price, 2003). This software is a simulation and animation tool designed to model a wide variety of manufacturing systems both quickly and accurately (Naciri *et al.*, 2024). This tool combines the versatility of a general-purpose simulation language with the practicality of a data-driven simulator. Furthermore, ProModel incorporates an optimisation tool called SimRunner, which performs advanced 'what-if' analyses by executing automatic factorial design experiments on the model, thereby providing the most optimal solutions (Harrell & Price, 2003).

When applied to Kluang Rail Coffee, this tool can help reduce waiting times. Kluang Rail Coffee can identify operational inefficiencies by modelling various scenarios, such as different service processes. The simulation's insights can be used to identify the best staffing levels and service point configurations, streamlining operations and reducing client waiting times. The user-friendly design of ProModel makes it easy for Kluang Rail Coffee employees to utilise, allowing them to make data-driven decisions that improve service performance and customer satisfaction.

3. Research Methodology

3.1 Research Design

Simulation is a powerful method because it offers a formal and predictive way to analyse even the most complex systems. The thing that these applications have in common is they create a virtual environment to help people prepare for real-life situations, saving us time, money, and even lives (Ghosh *et al.* 2022). The researcher has decided to select this software because it is freely available, compatible with other modelling systems, and provides comprehensive guidance through its proper textbook, facilitating step-by-step model building. The comprehensive approach that will be taken in this study includes quantitative methods such as collecting the waiting time data and conducting time studies to ensure a thorough understanding of the waiting time at Kluang Rail Coffee. The ultimate goal is to develop practical recommendations that can be applied to improve customer experience and optimise the operations at the restaurant.

3.2 Research Process

The study for investigating waiting times at Kluang Rail Coffee starts with identifying the problem and forming a research topic. The researcher then looks for relevant information to understand customer wait time patterns. Next, develop clear research questions and review existing studies to find best practices. ProModel simulation software is chosen to model and analyse the restaurant's operations and customer waiting time. The researcher evaluates the restaurant's procedures and collects data on customer arrivals, service times, and wait lengths to build the simulation model. Finally, compile a report with simulation results and recommendations for reducing waiting times and improving customer satisfaction. This approach aims to enhance operational efficiency and customer experience at Kluang Rail Coffee.

3.3 Data Collection

This research study comprises two types of data which are primary and secondary. For primary data, a digital stopwatch is used to record the duration of the service process in Kluang Rail Coffee. A table of time study was prepared to streamline data collection. The rationale for requiring a minimum of 30 samples is that this sample size is necessary for valid analysis based on the normal distribution, such as the z-test (Huang, 2022). The researcher collected data on 11 to 13 October 2024 (Friday to Sunday), focusing on busier days. Observations were made daily from 8:00 a.m. to around 12:00 p.m., averaging 5 hours per day. For the secondary data, the researcher will refer to written resources by various scholars to complete the study.

3.4 The Flow Chart of the Service Process

Data collection process involves observing customers from the moment they join the queue at the entrance until they finish their transaction. By capturing detailed information on customer flow and service times, the study aims to identify the inefficiencies and areas for improvement in the service process and waiting time. Fig. 3 shows the model and layout of service conditions at Kluang Rail Coffee.

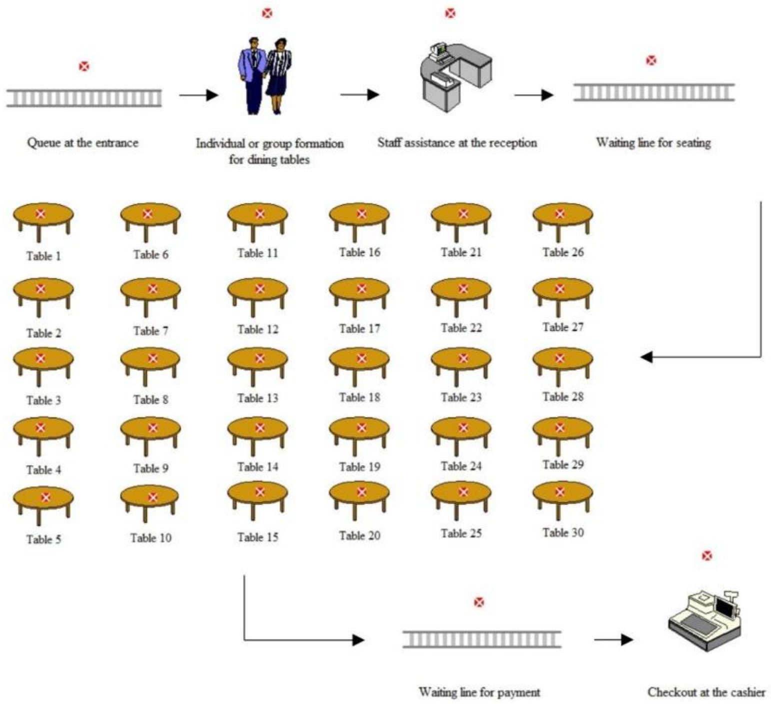

Fig. 3 *The model and layout of service conditions at Kluang Rail Coffee*

3.5 Simulation Procedure

The data collected at Kluang Rail Coffee includes customer waiting and queuing times, as well as service times by restaurant staff until the customer completes the transaction. According to Ghosh *et al.* (2022), while there are no rigid requirements for carrying out a simulation project, the following methods are commonly recommended.

(a) Define objective and scope
The objective of a simulation defines the purpose or rationale behind conducting the simulation study. It should be both realistic and achievable, considering the time and resource constraints of the study. The objectives help to define the questions that the simulation aims to answer. The scope of work can be defined to accomplish the stated objective (Ghosh *et al.*, 2022).

(b) Collect and analyse system data
This process involves identifying, obtaining, and analysing data to define the system to be simulated. This process generates a conceptual model and a data document that every group involved may agree on (Ghosh *et al.*, 2022). For this research, data will be collected from direct observations at the restaurant. The collected raw data will be analysed, and probability distributions will be selected to serve as input and model parameters. Every data analysis process is conducted using Stat:Fit, a distribution fitting package in ProModel software, which helps match sample data to an appropriate theoretical distribution.

(c) Build model
The designed model must be translated into a computer program. In this case study, the simulation software used to construct the model is the ProModel Professional Version 10.14.350, licensed under ProModel Professional by BigBear.AI. The simulation model is based on some key concepts including locations, entities, arrivals, and processing. These components interact with each other in simulating the flow of activities in the restaurant to represent the actual conditions observed during the study.

i. Locations
Locations are fixed points in the system where entities are sent for processing, delaying, storing, making decisions, or performing other tasks (Ghosh *et al.*, 2022). In this study, a total of 36 locations are defined in the model. The capacity of each 30 tables was set to reflect the actual restaurant.

ii. Entities
Entities refer to the items or individuals that are processed within a system, which can include products, customers, or documents. Each entity may exhibit distinct characteristics, including cost, shape, priority, quality, or condition (Ghosh *et al.*, 2022). In relation to Kluang Rail Coffee, the researcher identified two principal entities in the model: individual customer and group of customers. The inclusion of these two entities is important for accurately determining the waiting times for both individual customer and groups. While group customers often occupy larger tables, individual customer can also use these tables, depending on availability.

iii. Arrivals
The process of determining how entities enter the system is referred to as arrivals (Ghosh *et al.*, 2022). For Kluang Rail Coffee, the researcher determined two classes of arrivals: individual customer and group of customer arrivals. Both classes of arrivals are important to the model in that they represent different patterns of customer behaviour that appreciably impact the system dynamics. While group customers usually require bigger tables and may exhibit shared dining preferences, individual customer can also use the same resources, so it is vital to account for both types of arrivals in the system.

iv. Processing
Processing encompasses the activities conducted at a location, including the duration an entity remains there, the resources required for completion, and any other tasks performed, such as determining the entity's subsequent destination (Ghosh *et al.*, 2022). In processing, the configuration of 36 locations was entered into ProModel, and the waiting times collected during data collection were used so the model could generate outputs based on the data.

(d) Verify and validate the model
During this stage, it is crucial to carefully check the model for any mistakes to make sure it accurately reflects the real system. This involves looking for errors or differences that could affect how trustworthy the model is. Moreover, it is important to verify and validate the model thoroughly to ensure that its behaviour closely matches what happens in the actual system (Ghosh *et al.*, 2022).

i. Verification
The first verification technique involved reviewing the model code to check for errors and inconsistencies, with the researcher's supervisor providing feedback to ensure accuracy and alignment with the restaurant's operations. The second technique focused on checking for reasonable outputs, such as selecting the correct 'queue' option instead of 'conveyor' to avoid inaccurate results. The researcher also reviewed printed outputs to identify any discrepancies or unusual values.

ii. Validation
The researcher validated the model using two techniques. First, the simulation model was tested with different configurations of waiting times and operational methods. Abnormal output led to refinements, with the IF-THEN-ELSE statement providing realistic and consistent results by differentiating operations for individual and group customers. Second, ProModel's animation feature helped identify issues in customer flow between locations, such as transitions from the entrance to seating areas, prompting adjustments to improve accuracy.

(e) Conduct simulation experiments
Simulate each of the scenarios to be investigated and analyse the outcomes. It is important to run the simulation several times to confirm the accuracy of the results. This iterative procedure helps to verify that the findings appropriately reflect the real-world structure of the system being studied (Ghosh *et al.*, 2022).

(f) Present the results
Before providing recommendations, the simulation experiment results should be thoroughly presented. This entails providing a thorough examination of the data gathered during simulation runs. The presentation should include critical metrics like average wait times and other relevant performance indicators.

(g) Recommendation for improvement
After running the simulation using ProModel and reviewing the data, the findings provide useful information for

improving waiting times in restaurants. These ideas are intended to improve the efficiency and efficacy of restaurant services with a high volume of customers, allowing for a smoother and more streamlined operation.

3.7 Model Replication

In conducting a simulation experiment, one run of the simulation constitutes one replication of the experiment (Ghosh *et al.*, 2022). Each replication provides one sample. Hence, to get a sample size of n, the simulation must be run independently for n times. Based on Table 1, the following is an initial summary of the performance of two types of customers: individual customers and customer groups, based on one replication of the system. It will be used to determine the sample size required for further analysis, ensuring more reliable and accurate results. Below is the sample size formula:

$$\text{Required Sample Size} = n = \left(\frac{zs}{hx}\right)^2$$

For individual customers, the required sample size (n) is 15.3664. Similarly, the required sample size for group customers is also 15.3664, the same as for individual customers. Therefore, to meet the calculated requirement, the number of replications used in the simulation is 16. Given the parameters are,

n = The required sample size.
z = The number of standard deviations required for the desired confidence level (For 95% confidence, z = 1.96).
s = The standard deviation (Estimate s as 10% of $\bar{x}$).
h = The desired accuracy level (acceptable error margin) is expressed as a percentage, which should be converted to a decimal (e.g., 5% = 0.05).
$\bar{x}$ = Mean. In this case, it represents the average time in the system.

Table 1 *Initial Entity Summary (single replication)*

Name	Total Exits (Customer)	Current Quantity In System (Customer)	Average Time In System (Min)	Average Time In Move Logic (Min)	Average Time Waiting (Min)	Average Time In Operation (Min)	Average Time Blocked (Min)
Individual customer	83.00	18.00	45.74	0.00	2.93	40.10	2.71
Group of customers	123.00	22.00	46.69	0.00	3.11	40.97	2.61

4. Results and Discussion

The ProModel output viewer provides various summaries and detailed statistics, which are essential for assessing key performance indicators. The results from 16 replications are analysed to identify areas for improvement and optimise the system's efficiency.

4.1 Results

(i) Location summary based on average replications

The Location Summary, presented in Table 2, shows the performance issues related to long waiting times and high utilisation across various locations in the system. For instance, the dining tables (Dining tables 1 to 30) exhibit extremely high utilisation rates, ranging from 90.87% to 93.88%, indicating that seating capacity is stretched to its limit throughout the simulation. This heavy usage, while ensuring service efficiency, also points to a potential issue with overcapacity, leading to long waiting times. Additionally, the reception area, with a staff utilisation of only 33.12%, suggests that resources are not being fully utilised to manage customer flow effectively, resulting in an average customer wait time of 2 minutes, which could increase during peak periods. The checkout process at the cashier, with a high utilisation of 70.94%, also signals potential delays, as customers spend an average of 1.04 minutes completing their transactions. While the payment line shows low utilisation (1.37%), the overall system performance reflects significant concerns with overburdened resources and extended waiting times, which could negatively impact customer satisfaction.

(ii) Entity summary based on average

The Entity Summary, presented in Table 3, shows significant waiting times and high occupancy within the system for both individual customers and groups. Individual customers had an average of 81.75 exits, with 17.31 still in the system at any given time. On average, they spent 47.87 minutes in the system, with 40.67 minutes spent in operational stages, but also experiencing 4.57 minutes of waiting and 2.64 minutes in blocked conditions. Similarly, groups of customers had 122.13 exits and 26.94 customers in the system, spending an average of 48.39 minutes. While most of this time was spent in operational stages (41.12 minutes), they also faced 4.46 minutes of waiting and 2.81 minutes of blocked time. These metrics emphasised the high demand for the restaurant's resources, with long waiting times and a busy environment that suggests the need for improvements to streamline processes and reduce delays.

Table 2 *Location summary (average)*

Name	Scheduled Time (Hr)	Capacity	Total Entries	Average time per entry	Average Contents	Max Contents	Current Contents	Utilisation (%)
Queue at the entrance	5.00	999999.00	248.13	0.17	0.14	2.00	0.00	0.00
Individual or group formation for dining tables	5.00	999999.00	248.13	0.00	0.00	1.00	0.00	0.00
Staff assistance at the reception	5.00	5.00	248.13	2.00	1.66	4.00	1.75	33.12
Waiting line for seating	5.00	999999.00	246.38	6.39	5.29	14.00	10.00	0.00
Table 1	5.00	1.00	7.81	36.05	0.93	1.00	1.00	92.97
Table 2	5.00	1.00	8.13	34.42	0.93	1.00	0.94	92.73
Table 3	5.00	1.00	7.94	34.95	0.92	1.00	1.00	92.02
Table 4	5.00	1.00	7.94	35.30	0.93	1.00	1.00	92.82
Table 5	5.00	1.00	8.06	34.67	0.93	1.00	1.00	92.60
Table 6	5.00	1.00	7.88	35.94	0.93	1.00	1.00	92.83
Table 7	5.00	1.00	7.81	35.23	0.91	1.00	1.00	91.40
Table 8	5.00	1.00	7.69	35.92	0.92	1.00	1.00	91.71
Table 9	5.00	1.00	7.75	35.95	0.92	1.00	0.94	92.31
Table 10	5.00	1.00	7.75	36.29	0.93	1.00	0.94	93.30
Table 11	5.00	1.00	7.88	35.87	0.93	1.00	1.00	93.15
Table 12	5.00	1.00	7.44	37.17	0.92	1.00	1.00	91.67
Table 13	5.00	1.00	7.81	35.13	0.91	1.00	1.00	91.07
Table 14	5.00	1.00	8.13	34.20	0.92	1.00	1.00	92.03
Table 15	5.00	1.00	7.94	34.89	0.92	1.00	1.00	91.59
Table 16	5.00	1.00	7.94	34.89	0.91	1.00	1.00	91.47
Table 17	5.00	1.00	8.06	34.60	0.92	1.00	1.00	92.17
Table 18	5.00	1.00	7.75	36.24	0.93	1.00	1.00	93.17
Table 19	5.00	1.00	7.69	36.66	0.93	1.00	1.00	92.97
Table 20	5.00	1.00	8.13	34.87	0.94	1.00	1.00	93.88
Table 21	5.00	1.00	7.94	35.02	0.92	1.00	1.00	92.09
Table 22	5.00	1.00	7.69	36.25	0.92	1.00	1.00	92.10
Table 23	5.00	1.00	8.06	34.65	0.93	1.00	1.00	92.72
Table 24	5.00	1.00	7.69	35.97	0.92	1.00	1.00	91.74
Table 25	5.00	1.00	8.06	34.95	0.93	1.00	1.00	92.99
Table 26	5.00	1.00	7.75	36.03	0.93	1.00	1.00	92.74
Table 27	5.00	1.00	7.81	35.67	0.92	1.00	1.00	91.65
Table 28	5.00	1.00	7.88	35.39	0.93	1.00	1.00	92.52
Table 29	5.00	1.00	8.00	34.27	0.91	1.00	1.00	90.87
Table 30	5.00	1.00	8.00	34.26	0.91	1.00	1.00	91.08
Waiting line for payment	5.00	999999.00	206.56	1.99	1.37	7.75	1.81	0.00
Checkout at the cashier	5.00	1.00	204.75	1.04	0.71	1.00	0.88	70.94

Table 3 *Entity summary (average)*

Name	Total Exits (Customer)	Current Quantity in System (Customer)	Average Time in System (Min)	Average Time in Move Logic (Min)	Average Time Waiting (Min)	Average Time in Operation (Min)	Average Time Blocked (Min)
Individual customer	81.75	17.31	47.87	0.00	4.57	40.67	2.64
Group of customers	122.13	26.94	48.39	0.00	4.46	41.12	2.81

4.2 Discussion

According to the results presented in the previous section, this discussion aims to achieve the research objectives through the analysis of the findings. The analysis focuses on evaluating customer flow, service process utilisation, and waiting times in the restaurant, followed by proposing practical recommendations to address the identified issues.

Research Objective 1: To determine the total customer exits, service process utilisation, and average time in the system to evaluate the waiting times in the restaurant

(a) Total customer exits

The total customer exits highlight the high demand experienced at Kluang Rail Coffee, with an average of 81.75 individual customer exits and 122.13 group customer exits during the simulation. These figures indicate a substantial flow of customers, particularly during busy hours, and align with queuing theory, which explains that a high volume of arrivals combined with limited-service capacity leads to system congestion and queues (Adan *et al.*, 2019). The current quantities of customers are still in the system, 17.31 for individuals and 26.94 for groups, further reflect a busy environment where queues are prevalent. This is consistent with Heizer, Render, and Munson's (2017) depiction of common queuing scenarios, where arrivals must wait for service due to capacity constraints. Such congestion has implications for customer satisfaction. Prolonged service entry waits, identified by Dube-Rioux, Schmitt, and Leclerc (1989) as critical to customer satisfaction, may lead to increased frustration, especially during peak times. This is particularly relevant given Tasar *et al.*'s (2020) findings that longer service entry waits have a more pronounced impact on customer perceptions than in-service delays. Addressing these bottlenecks is essential to prevent diminished satisfaction and to maintain a positive reputation.

(b) Service process utilization

The service process utilisation data reveals critical inefficiencies and resource challenges. Dining tables exhibit utilisation rates consistently exceeding 90%, with some reaching 93.88%. These figures demonstrate that the seating capacity is nearly fully occupied during peak periods, leaving minimal room for flexibility. This supports Khajeh's (2020) argument that overutilised facilities create bottlenecks, prolonging service entry and in-service waits. Additionally, Benevento *et al.* (2023) highlighted that high utilisation rates often lead to extended service times, increasing the risk of customer dissatisfaction. At the cashier, a utilisation rate of 70.94% indicates significant pressure during the checkout process, which aligns with Munichor and Cooke's (2022) observation that prolonged waits at critical service points can lead to frustration and negative perceptions of service quality. Conversely, the reception area's utilisation rate of only 33.12% suggests underutilisation of staff resources, which could otherwise be deployed to alleviate bottlenecks elsewhere in the system. Harrell, Ghosh, and Bowden (2012) emphasised that simulation models, unlike traditional queuing theory, allow for detailed insights into such imbalances, enabling targeted resource optimization.

(c) Average time in the system

The average time customers spend in the system provides a comprehensive view of the restaurant's operational challenges. Individual customers spend an average of 47.87 minutes, while groups spend slightly longer at 48.39 minutes. Of this, approximately 40 minutes are dedicated to operational activities, but waiting times of 4.57 minutes for individuals and 4.46 minutes for groups highlight significant delays. These findings are consistent with Li, Yuan, and Zhao's (2024) assertion that waiting periods occur at multiple stages of the service delivery process, negatively impacting the customer satisfaction. Moreover, the blocked times 2.64 minutes for individuals and 2.81 minutes for groups further emphasise inefficiencies in resource allocation and customer flow. According to Namkung and Jang (2010), delays during critical service stages, such as order-taking or seating, disrupt the overall flow and prolong the total time spent in the system. This is supported by Özkul, Bilgili, and Koç's (2020) findings that waiting times are a crucial determinant of perceived service quality and customer satisfaction. The data also aligns with the queuing theory framework outlined by Nielsen *et al.* (2012), where inefficiencies at any stage of the queueing process exacerbate delays throughout the system. These delays not only frustrate customers but also impact on the restaurant's ability to handle peak demand effectively. Addressing these issues requires a focus on reducing waiting times and optimising resource allocation to enhance the overall customer experience.

Research Objective 2: To propose practical recommendations for reducing waiting time and enhancing customer satisfaction at Kluang Rail Coffee

In this study, the researcher aims to propose practical recommendations for outlets facing long queues and waiting times, such as Kluang Rail Coffee. The following recommendations, approved by the operation manager of Kluang Rail Coffee, Mr Rizal bin Sukardi, seeks to address long customer waiting times, lengthy queues, and overall customer satisfaction while considering cost-effective solutions.

*(a) **Reducing waiting time***

(i) Implementing the 5S System -The 5S methodology (Sort, Set in order, Shine, Standardise, Sustain) is a workplace organisation technique designed to enhance productivity and efficiency. By streamlining processes and ensuring a clutter-free environment, the time taken for employees to complete tasks can be reduced. For example, organising tools and equipment near workstations will minimise unnecessary movement, enabling faster service delivery. This systematic approach not only reduces customer waiting times but also improves the overall workflow of the restaurant.

(ii) Distributing menus in the queue - Providing customers with menus while they are waiting in line allows them to decide on their orders in advance. This reduces the time taken at the ordering counter, thereby accelerating the service process. By enabling customers to place their orders quickly upon reaching the counter, this strategy minimises waiting time and ensures a smoother customer flow during peak hours.

(iii) Optimising staff schedules - Reallocating staff during peak hours to high-demand areas, such as the cashier or dining service, can significantly reduce waiting times without increasing costs. This involves analysing peak periods and ensuring that more employees are available during these times to manage the increased customer flow. By shifting staff resources dynamically, the restaurant can improve service speed without hiring additional personnel.

*(b) **Enhancing Customer Satisfaction***

(i) Fostering a Customer-Friendly Staff Culture - Ensuring that employees are well-trained in customer service is essential. Friendly and approachable staff can significantly enhance the dining experience, even during busy hours. Training programmes focusing on effective communication, problem-solving, and maintaining a positive attitude can create a welcoming environment that leaves customers satisfied despite minor delays.

(ii) Improving Premises and Facilities - Upgrading the restaurant's facilities to enhance customer comfort is equally important. For instance, providing ample seating in waiting areas, offering beverages or snacks during longer waits, and maintaining a clean, pleasant atmosphere can improve the perceived waiting experience. A comfortable environment can reduce the negative impact of delays, as customers are less likely to feel frustrated if they are at ease while waiting.

(iii) Creating a Self-Service Station - Setting up a self-service station for beverages, condiments, or small snacks can help reduce the load on staff and improve service speed. Customers can serve themselves while waiting, which not only saves time but also keeps them engaged, reducing the perception of waiting. This cost-effective solution requires minimal investment and enhances the overall customer experience.

5. Conclusion

In conclusion, this study aimed to address the problem of long waiting times faced by customers at Kluang Rail Coffee, located in Pusat Perniagaan Tasik. Through the utilisation of time study and simulation methodologies, the total customer exits, service process utilisation, and average time in the system were determined, and practical recommendations were proposed for reducing wait times. This study focused on the issue of long waiting times at Kluang Rail Coffee, using simulation techniques to identify and address operational inefficiencies. The analysis showed that dining tables were over 90% utilised, causing bottlenecks, while other areas, like the reception, were underutilised. Customers spent an average of 48 minutes in the system, with significant delays due to waiting and blocked stages. To solve these issues, several steps are recommended. Organising the workspace using the 5S system can streamline operations and reduce service time. Providing menus to customers while they wait can speed up ordering. Adjusting staff schedules during busy periods can help manage customer flow better. Enhancing the waiting area with comfortable seating or snacks can improve the overall experience, while self-service stations for beverages and condiments can reduce staff workload and keep customers engaged. By drawing on previous research on waiting time simulation in the food and beverage industry, the study identified factors contributing to high wait times and simulated scenarios to find improvement solutions. The findings underscore the importance of operational efficiency in enhancing customer satisfaction. Moving forward, further research could explore additional strategies for reducing wait times and improving service quality in Malaysian restaurants, ultimately contributing to the overall growth and success of the food service industry. Lastly, the study emphasises the significance of embracing technology, such as simulation software, to analyse complex systems and support evidence-based decision-making in the restaurant sector. These implications underscore the potential for similar restaurants to adopt simulation methodologies to address operational challenges and achieve better performance outcomes.

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Conflict of Interest

Authors declare that there is no conflict of interests regarding the publication of the paper.

Author Contribution

The authors confirm contribution to the paper as follows: ***study conception and design:*** *Tan Ee Qi, Siti Anisah Atan;* ***data collection:*** *Tan Ee Qi;* ***analysis and interpretation of results:*** *Tan Ee Qi, Siti Anisah Atan;* ***draft manuscript preparation:*** *Tan Ee Qi, Siti Anisah Atan. All authors reviewed the results and approved the final version of the manuscript.*

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