Journal of Applied Data Sciences
Vol. 5, No. 4, December 2024, pp. 1715-1725

Stochastic Queuing System Model Design Based on Stakeholder Aspirations

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(Received: July 14, 2024; Revised: August 11, 2024; Accepted: September 20, 2024; Available online: October 15, 2024)

Abstract

A good queuing system will provide satisfaction and trust for consumers and operational cost efficiency for service providers. This study aims to obtain the optimal number of service facilities by considering the aspirations of stakeholders, namely customers and service providers. Using aspiration theory, this research contributes to obtaining a dynamic solution to the number of service facilities with reference to service operating costs that can be determined with certainty and waiting costs that vary based on customer profiles. The study began by designing sampling for arrival time and service time data based on simple random sampling. The probability distributions of arrival time and service time are determined based on the data collection results of the sampling design. Based on the queuing profile and distribution of the two data, a suitable queuing model is built. Poisson distribution-based multi-channel queue model is constructed ((M/M/c):(GD/∞/∞)), and an optimization analysis is carried out on the number of service facilities provided by considering the aspirations of the two stakeholders. The results showed that based on stakeholder aspirations, optimal conditions were achieved at the number of servers c = 2 if the waiting cost (C2): IDR 0/hour≤ C2 ≤ IDR 11,076/hour, and the number of servers c = 3 if the waiting cost (C2): IDR 11,076/hour ≤ C2 ≤ IDR 120,690/hour. Given that there are two conditional alternatives, the company can decide subjectively to take preventive and adaptive actions proactively according to the customer's appreciation of the waiting time in the company. Flexibility in opening service facilities will require the availability of workers and facilities to be provided. Multi-skilled workers will significantly help the flexibility of the system being built. Future research certainly needs to conduct a more in-depth study related to monthly fluctuations in arrival and service times within that period.

Keywords: Customer Behavior, Optimization Modelling, Queuing, Stochastic, Stakeholder Aspiration

1. Introduction

Queue management is considered not only to lessen customer waiting time but also to deal with strategic elements to minimize costs and increase productivity [1] and customer satisfaction [2]. Customer intensity, queue management strategies, and behavior influence the balance between service quality, speed, and customer satisfaction. Undoubtedly, customer intensity significantly affects the service balance, which directly affects price, service speed, demand, queue density, and service provider revenue [3]. Generally, service providers deliver different types of queues, such as regular and priority queues, to fit customer segmentation and preferences and to maximize revenue through self-selection [4]. Efficient queue management is essential in reducing customer waiting time and improving the service process, ultimately affecting customer satisfaction [4]. The utilization of proper technologies, such as online reservation applications or innovative queuing systems, can lead to more efficient service by accommodating customers' aspirations [5]. Research also investigated the impact of queuing disciplines, such as last-come-first-served (LCFS) and first-in-first-out (FIFO), on system performance and customer satisfaction [6]. The selection of queuing discipline will significantly influence the behavior and performance of the system. For instance, the join the shortest queue discipline has been studied to discover the stability and proper asymptotics, giving insight into its impact on network dynamics and resource allocation [7].

Queue management research has been conducted in services such as restaurant services [8], [9], hospital services [10], [11], [12], [13], [14], libraries [15], and supermarket/retail services [5], [16], [17], [18]. Like other industrial sectors, banks deal with the challenges of consumer behavior alteration [19], [20], and technological advances [21], [22] and are also contested to provide queuing decisions that maintain operational efficiency and customer satisfaction. This research aims to attain the optimal number of service facilities referring to the aspirations of stakeholders, namely

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DOI: https://doi.org/10.47738/jads.v5i4.314

customers and service providers. Aspiration theory will be used to bridge both stakeholders' requirements by comprehensively examining the dynamics affecting both parties in the queue system. The aspiration of stakeholders is employed to determine the number of service counters by considering the operational cost and the cost of waiting for consumers. Sensitivity analysis will be applied related to the range of waiting costs.

Efficient queue management is an essential factor in increasing customer satisfaction and boosting operational productivity across various industries [1], [4]. The interaction between customer intensity, queuing strategies, and customer behavior significantly influences service quality and organizational performance. By addressing these factors through a strategic lens, the operations can be optimized by service operators and meet varied customer preferences, effectively. This approach is particularly proven in settings, in which customer preferences and behaviors are considered dynamic, necessitating adaptive and flexible queuing systems. The implementation of inventive technologies later supports this effort by providing tools that eventually simplify the service process and lessen waiting times, thus aligning with customer hopes for receiving efficient service delivery [5].

The research conducted in queuing disciplines, such as LCFS and FIFO, suggests valuable insights into how different strategies influence system performance and customer satisfaction [6]. These disciplines affect not only the operational efficiency of the service system but also the overall customer experience. For instance, the LCFS discipline may prioritize recent arrivals, and impact long-term waiting times, whereas the FIFO discipline ensures a first-come, first-served approach, potentially increasing customer satisfaction by maintaining perceived fairness. Additionally, the "join the shortest queue" discipline has been examined for its stability and resource allocation efficiency, highlighting its potential benefits in queuing systems [7].

Research in queuing management extends a wide-ranging spectrum of service industries, showing the universal applicability and urgency of effective queue strategies. For instance, in the banking sector, the dual challenges of evolving consumer behavior and rapid technological advancements necessitate innovative approaches to queue management. Banks must be able to navigate these changes while maintaining high levels of customer satisfaction and operational efficiency. Therefore, this study aims to address these challenges by developing a stochastic queuing system model incorporating stakeholder aspirations into the decision-making process. By considering the needs and preferences of both customers and service providers, the model tries to optimize the number of service facilities and improve overall delivery service.

The incorporation of aspiration theory into queuing system design provides a unique perspective on balancing operational costs and customer waiting costs. This approach allows for a comprehensive analysis of the factors influencing both service providers and consumers, ensuring that the queuing system aligns with their respective goals and aspirations. This model is also further developed using sensitivity analysis by examining how variations in waiting costs impact the system's performance and providing a robust framework for decision-making. Through this detailed analysis, the study aims to offer practical solutions for optimizing queuing systems in various service contexts, ultimately contributing to developed customer satisfaction and operational efficiency.

By focusing on the aspirations of stakeholders, this study bridges the gap between theoretical research and practical application in queuing system design. The insights from this research deliver information on future strategies and technologies in queue management, supporting the development of more efficient, customer-centric service systems. As industries continue to evolve, the importance of effective queuing strategies will remain an essential factor in meeting operational success and customer expectations.

2. Literature Review

2.1. Customer Behavior in Queue System

Customer behaviour management strategies are also essential for service providers to improve operational efficiency and customer satisfaction [23]. In situations where customers have no information about service parameters, their decision to join or reject a queue will be influenced by the trust gained from their experience [24]. Customers will often associate queuing problems caused by an organization's inability to handle queue management with the overall service experience [1]. Customers usually use queue length information to assess service quality and underline the importance of queue signals in primary care, especially when the quality of the service provider is unknown [25]. Service delays can substantially affect customers' overall service evaluation [26]. Thus, customer decisions and system performance can be affected by delayed notifications in queue dynamics [27].

2.2. Aspiration Theory

Aspiration theory in queuing can be understood as the pursuit of developing a comprehensive framework for performance analysis within queuing systems. While queuing theory traditionally focuses on mathematical formulations and the study of waiting lines to address random demands [28], aspiration theory aims to enhance this by delving deeper into the intricacies of performance evaluation. This aspiration involves creating models that consider various factors influencing queuing systems beyond mere mathematical abstractions, such as human decision-making processes [29]. By incorporating these elements, aspiration theory seeks to provide a more holistic understanding of queuing dynamics and improve the accuracy of performance predictions. Moreover, aspiration theory in queuing also emphasizes the need to address the limitations of existing queuing models. Aspiration theory in the context of customer and service provider interactions in queues has evolved to encompass a more comprehensive examination of the dynamics that influence both parties within the queuing system. To effectively address the needs of both customers and service providers in a queuing system, various strategies and models can be implemented based on recent research findings. One approach involves customer segmentation and fairness, where service providers offer regular and priority queues with additional fees, allowing customers to self-select into queues based on their preferences [30] Liu et al. This strategy not only maximizes revenue for service providers but also provides customers with options that align with their service expectations.

Moreover, the analysis of queueing models with priority scheduling by supplementary variable methods can help in handling customers with different service requirements in the system [31]. By considering the diverse needs of customers and providing tailored services, service providers can better accommodate the aspirations of customers seeking specific service levels. Incorporating differentiated pricing decisions based on word-of-mouth rating information can also be beneficial in addressing information heterogeneity in queueing service systems [32]. By allowing customers to make informed decisions based on service value assessments, service providers can enhance customer satisfaction and optimize service offerings to meet individual aspirations. Additionally, optimizing service prices for high-priority and low-priority customers through algorithms like Particle Swarm Optimization can help maximize service provider revenue while catering to the needs and preferences of different customer segments [33]. This approach ensures that service providers can adapt their pricing strategies dynamically to accommodate varying customer demands and aspirations.

3. Methodology

3.1. Research Object

The research focuses on a bank, which operates in the service sector and requires facilities such as tellers and supporting infrastructure to effectively serve its customers and meet the needs of all stakeholders. The bank is selected as the research object because it represents a dynamic environment where queuing management is critical for maintaining operational efficiency and customer satisfaction. The queuing facilities and processes within the bank provide a rich context for studying how service delivery can be optimized to balance stakeholder aspirations, including the efficiency of service and cost management.

3.2. Research Flow

The research involves four main stages, namely preparation, data collection, data processing, and data analysis and discussion. Preparation involves research planning, including observing the existing queuing facilities and the discipline that is used in managing queues. Data are collected systematically over a specified period, ensuring a representative sample of customer arrivals and service times. Data processing is to identify patterns, determine the appropriate queuing model, and assess its effectiveness. The final stage includes data analysis and discussions on findings, focusing on how the model can optimize the number of tellers and meet stakeholder needs. Each stage is designed to systematically explore the queuing system at the bank, starting from initial observations to the model development that aligns with stakeholder aspirations

 ISSN 2723-6471

3.3. Research Preparation

The preparation phase is focused on observing the queuing facilities at the bank, including understanding the queuing discipline. Queuing discipline refers to the rules and policies that dictate the order in which customers are served, ensuring fairness and efficiency in the system. The study was conducted in two months, in which data were collected over 328 hours. This period is considered representative of the bank's annual operations, assuming homogeneous behavior throughout the year. Moreover, the preparation also involved calculating the minimum sample size using the Solvin formula, to ensure statistical accuracy. With an accuracy level of 7.5%, it was identified the minimum sample size of 116. Yet, 128 samples of arrival and service data were randomly selected to provide a robust dataset. The sampling method was initiated by generating random numbers using Excel software, which determined the specific hours for data collection, as detailed in table 1 and table 2.

Table 1. Arrival Data Collection Design

Schedule		Day					
		1	**2**	**3**	**4**	**...**	**41**
hour	08-09	1	9	17	25	...	321
	09-10	2	10	18	26	...	322
	10-11	3	11	19	27	...	323
	11-12	4	12	20	28	...	324
	12-13	5	13	21	29	...	325
	13-14	6	14	22	30	...	326
	14-15	7	15	13	31	...	327
	15-16	8	16	24	32	...	328

Table 2. Service Data Collection Design

Schedule		Day					
		1	**2**	**3**	**4**	**...**	**41**
hour	08-09	1	9	17	25	...	321
	09-10	2	10	18	26	...	322
	10-11	3	11	19	27	...	323
	11-12	4	12	20	28	...	324
	12-13	5	13	21	29	...	325
	13-14	6	14	22	30	...	326
	14-15	7	15	13	31	...	327
	15-16	8	16	24	32	...	328

3.4. Data Collection

The process of data collection includes systematic observation of the number of customer arrivals and the services provided at specific hours each day, as specified in the research design. This approach enables the data to demonstrate typical patterns of customer behavior and service delivery within the bank. The marked times in the schedule represent the moments when data was recorded, offering a comprehensive view of the queuing system's operation.

3.5. Data Processing

Several key calculations were presented after data were collected. Testing the distribution of arrivals and services were done to analyze the collected data to understand the distribution patterns that were crucial for selecting the proper queuing model. Based on the data distribution, the research identified the queuing model that best fits with the bank's operational environment. The last calculation was determining the proper queuing decision model. This involved selecting a decision-making framework in line with the stakeholders' aspirations, balancing operational efficiency and customer satisfaction.

3.6. Data Analysis

Data analysis, as the final stage of the methodology, involves discussions on research findings in the context of optimizing the number of tellers at the bank. This analysis contemplates the aspirations of both customers and service providers, to balance reducing waiting times and managing operational costs. The analysis also includes a sensitivity analysis to explore how different scenarios, such as changes in customer arrival rates or service times, might affect the queuing system's performance. The analysis aims to provide actionable insights that can be used to refine the queuing model, ensuring it meets the preferences of all stakeholders involved.

4. Results and Discussion

4.1. Service System Observations

Based on the observations of the bank's service system, the service discipline followed is First Come, First Served (FCFS). This queuing method ensures that customers are served in the order they arrive, promoting fairness. The service room is spacious, allowing for a high number of customers to be present at any given time, which indicates that the system's capacity is virtually unlimited. A customer survey revealed that while customers prefer swift service, they are generally willing to tolerate an average wait time of up to 10 minutes. On the bank's side, an idle time for tellers of up to 25% is acceptable. The cost associated with each additional teller, which includes their salary and the cost of adding facilities, is approximately IDR 5,880,000 per month or IDR 35,000 per hour.

4.2. Arrival and Service Distribution Data

The data collection for arrivals and services was conducted according to the predetermined sampling design. Arrival data was collected by observing the number of customers arriving every hour (λ). The results, as shown in table 3 indicate variability in the frequency of customer arrivals. Similarly, service data was gathered by recording the number of customers served each hour (μ), with the results presented in table 4 These tables provide a detailed frequency distribution, helping to understand the patterns and peaks in both customer arrivals and service rates.

Table 3. Frequency Distribution of Customer Arrivals

No	λ	Freq	No	λ	Freq
1	8	6	10	17	7
2	9	6	11	18	7
3	10	7	12	19	6
4	11	8	13	20	5
5	12	9	14	21	5
6	13	12	15	22	4
7	14	13	16	23	4
8	15	13	17	24	3
9	16	11	18	25	2

Table 4. Frequency Distribution of Number of Customers Served

No	μi	Freq (Fi)	No	μ	Freq (Fi)
1	5	7	7	11	10
2	6	13	8	12	6
3	7	14	9	13	6
4	8	18	10	14	5
5	9	24	11	15	3
6	10	20	12	16	2

 ISSN 2723-6471

4.2.1. Data Processing

The data were managed to classify the queuing model using Kendall's Notation, which follows the format (a / b / c): (d / e / f). Later, 'a' represents the arrival distribution, 'b' the service distribution, 'c' the number of parallel service facilities, 'd' the service discipline, 'e' represents the maximum number of customers allowed in the system, and 'f' denotes the size of the calling source.

4.2.2. Arrival Distribution

The average number of customer arrivals per hour was calculated to be 15.18. To identify the distribution pattern of the arrival data, a goodness-of-fit test was performed. The test statistic (X^2 cal) was computed and compared against the critical value (X^2). The result showed that the arrival data follows a Poisson distribution ($X^2_{\ cal} = 18.44 < \chi^2_{\ (0.05;15)} = 25.00$), as depicted in figure 1.

$$X^2_{cal} = \sum_{i=1}^{n} \frac{(F_i - E_i)^2}{E_i} \tag{1}$$

$$= \frac{(6-2.2874)^2}{2.2874} + \frac{(6-3.8580)^2}{3.8580} + \cdots + \frac{(2-0.7173)^2}{0.7173} = 18.44$$

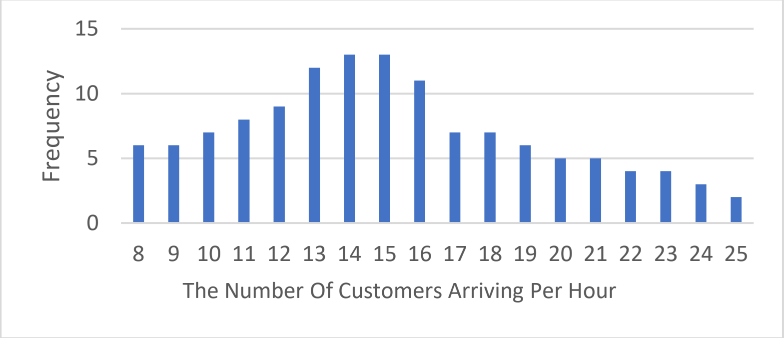

Figure 1. Customer Arrival Distribution

4.2.3. Service Distribution

Similarly, the service data that showed an average service rate (μ) of 9.20 customers per hour, were verified for its distribution. The goodness-of-fit test confirmed that the service data also follow a Poisson distribution ($X^2_{\ cal} = 7.45 < \chi 2\ (0.05;9) = 16.92$), as shown in figure 2.

Figure 2. Distribution of Customer Service

4.3. Queue Model Formulation and Calculation

Given the Poisson distribution for both arrival and service times, and assuming the system capacity is infinite, the queuing model can be defined as (M/M/c): (GD/∞/∞). Using standard queuing formulas, various parameters such as the probability of zero customers (P0), the average number of customers in the queue (Lq), the average number of customers in the system (Ls), the average waiting time in the queue (Wq), and the average time in the system (Ws) were calculated for different numbers of service facilities (c). With the following formula:

$$P_n = \begin{cases} \left(\frac{p^n}{n!}\right) P_o, 0 \le n \le c \\ \left(\frac{p^n}{c^{n-c} c!}\right) P_o, n > c \end{cases} \quad (2)$$

$$P_o = \left\{ \sum_{n=0}^{c-1} \frac{\rho^n}{n!} + \frac{\rho^c}{c!\,(1 - \frac{\rho}{c})} \right\}^{-1} \quad (3)$$

$$L_q = \frac{\rho^{c+1}}{(c-1)!\,(c-\rho)^2} P_o = \left[\frac{c\rho}{(c-\rho)^2}\right] P_c \quad (4)$$

$$\rho = \lambda/\mu\,; \quad (5)$$

$$L_s = L_q + \rho \quad (6)$$

$$W_q = \frac{Lq}{\lambda} \quad (7)$$

$$W_s = W_q + \frac{1}{\mu} \quad (8)$$

Based on some values calculated before, namely

λ = 15.18 customers/hour,

μ = 9.20 customers/ hour,

C_1 = Rp 35,000/hour,

Value P_0, L_q, L_s, W_q, W_s, and X will be calculated.

$\rho = \lambda/\ \mu = 15.18/\ 9.20 = 1.65$

For c = 1;

$\lambda > c\ \mu$, so that Po = 0, Lq = ∞, Ls = ∞,

Wq = ∞, Ws = ∞, X = 0%

For c = 2;

Po =$\{1.65^0/0! + 1.65^1/1! + 1.65^2/(2!(1 – 1.65/2))\}^{-1}$ = 0.0959

Lq = $(1.65^3/((2 – 1)!\ (2 – 1.65)^2)) \times 0.0959$ = 3.5163

Ls = 3.5163 + 1.65 = 5.1663

Wq = 3.5163/15.18 = 0.2316 hours = 13.8986 minutes

Ws = 0.2316 + 1/9,2 = 0.3403 hours = 20.42 minutes

X = 100 % (1 – 15.18/(2 × 9.2) = 17.5%

For c = 3;

Po =$\{1.65^0/0! + 1,65^1/1! + 1,65^2/2! + 1,65^3/(3!(1 – 1,65/3))\}^{-1}$ = 0,1781

Lq = $(1.65^4/((3 – 1)!\ (3 – 1.65)^2\ ))\times 0.1781$= 0.3621

Ls = 0.3621 + 1.65 = 2.0121

Wq = 0.3621/15.18 = 0.0239 hours = 1.43 minutes

Ws = 0.0239 + 1/9.2 = 0.1326 hours = 7.95 minutes

X = 100 % (1 – 15.18/(3 × 9.2) = 45.00%

For c = 4;

$Po = \{1.65^0/0! + 1.65^1/1! + 1.65^2/2! + 1.65^3/3! + 1.65^4/(4!(1 - 1.65/4))\}^{-1} = 0.1892$

$Lq = (1.65^5/((4 - 1)!\,(4 - 1.65)^2)) \times 0.1892 = 0.0698$

$Ls = 0.0698 + 1.65 = 1.7198$

$Wq = 0.0698/15.18 = 0.0046$ hours $= 0.2760$ minutes

$Ws = 0.0046 + 1/9.2 = 0.1133$ hours $= 6.7977$ minutes

$X = 100\ \% \ (1 - 15.18/(4 \times 9.2) = 58.75\%$

The calculations are summarized in table 5, which highlights the optimal conditions for different values of c.

Table 5. Optimal Condition Determination

c	1	2	3	4
Po (%)	0,00	9,59	17,81	18,92
Lq (#customer)	∞	3,52	0,36	0,07
Ls (#customer)	∞	5,17	2,01	1,72
Wq(minutes)	∞	13,90	1,43	0,28
Ws (minutes)	∞	20,42	**7,95**	6,80
X (%)	0	**17,50**	45,00	58,75

4.4. Queue Decision Based on Stakeholder Aspirations

An aspiration level model that reflects customer and company (teller) aspirations is used, as shown in figure 3.

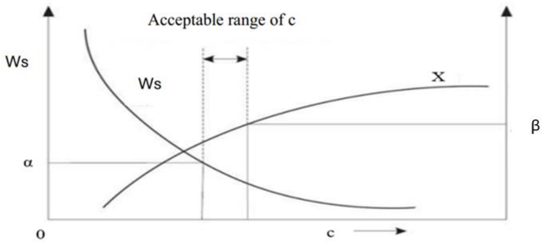

Figure 3. Aspiration Level Model

Queuing decisions are made by fulfilling the aspirations of consumers ($Ws \leq \alpha$) and banks ($X \leq \beta$), with $X = 100(1- \lambda / c\ \mu)$.

Based on α and β, it is possible to determine the acceptable range of c that satisfies both aspirations. If both aspiration levels cannot be met simultaneously, then one or both constraints need to be relaxed before a decision is made. To constrain specific decision-making, the cost parameter C2 (cost of waiting/hour) resulting from the selection of c for a given aspiration level can be calculated. This is because it is generally more challenging to estimate the cost of waiting than to estimate the costs associated with adding new facilities/services. Based on the formulas in the cost model, the value of C2 is in the range of:

$$\frac{C1}{Ls(c-1) - Ls(c)} \leq C2 \leq \frac{C1}{Ls(c) - Ls(c+1)} \quad (9)$$

The customer survey found that the maximum waiting time in the system was 10 minutes ($Ws \leq \alpha$), and The bank tolerates an average percentage of idle tell-ers of 25% ($X \leq 25\%$). Based on table 5, when c = 2, it is able to meet the Bank's aspirations ($X = 17.50\% \leq 25\%$) but has not been able to meet customer aspirations ($Ws = 20.42$ minutes ≥ 10 minutes). Conversely, when c = 3, it is able to meet customer aspirations ($Ws = 7.95$ minutes ≤ 10 minutes) but has not been able to meet the aspirations of the Bank ($X = 45\% \geq 25\%$). Based on formula (8), It can be concluded that the optimum number of employees (c) is:

c = 2 if the cost of waiting/hour is:

IDR 0/hour ≤ C2 ≤ IDR 11,076/ hour

c = 3, if the cost of waiting/hour is:

IDR 11,076/hour ≤ C2 ≤ IDR 120,690/hour

Based on stakeholder aspirations, the sensitivity of providing service facilities was carried out. Two alternatives were obtained, namely, 2 or 3 facilities. The number of facilities provided is two if the cost of waiting is at most IDR 11,076 / hour, and three if the cost of waiting is between IDR 11,076/hour and IDR 120,690/hour.

4.5. Implications for Service Providers

These findings provide significant implications for service providers. Significant preparations must be made to adjust the number of service facilities based on the cost of waiting and the importance of the customers. For high-value customers, additional service facilities must be available. The flexibility in managing service facilities can be increased by employing multi-skilled workers and improving the coziness of waiting areas. Moreover, information technology utilization can streamline queue management and reduce perceived waiting times. Future research should consider customer arrivals monthly variations and service times that lead to a more dynamic queuing model.

Based on observations of the service system in banks, the service discipline was FCFS. The service room is large enough that the number of customers allowed to enter the system is quite large; in other words, the capacity of the system is not limited. The customer survey indicated that customers wanted fast service but still tolerated an average time in the system of 10 minutes. The bank tolerates an average percentage of idle tellers of 25%. The cost of each additional facility (teller), which includes teller costs and the cost of adding facilities on average, is IDR 5,880.000/month = IDR 35,000/hour.

5. Conclusions

The conclusion of this study offers significant insights into the optimal design of a queuing system, particularly in the context of bank services where customer satisfaction and operational efficiency are critical. The research identifies two optimal scenarios based on the cost of waiting per hour (C2), allowing for a strategic decision regarding the number of service facilities (servers) to be provided. The first scenario, where the number of servers (c) is set to 2, is deemed optimal if the waiting cost per hour falls within the range of IDR 0 to IDR 11,076. This configuration is suitable for situations where the cost of waiting is relatively low, and customers are more tolerant of longer waiting times. It reflects a balance between operational costs and service quality, aligning with stakeholder aspirations while maintaining efficiency. In the second scenario, the number of servers (c) is increased to 3 when the waiting cost per hour ranges from IDR 11,076 to IDR 120,690. This configuration is ideal when customers have a lower tolerance for waiting, necessitating quicker service to maintain satisfaction. The higher number of servers ensures that waiting times are minimized, directly addressing customer expectations and enhancing the overall service experience.

The study also emphasizes the importance of flexibility in service provision. The two alternatives presented offer companies the ability to make proactive decisions based on real-time customer feedback and appreciation of waiting times. By adapting the number of servers according to the specific cost and customer preferences, companies can better manage resources while ensuring customer satisfaction. These findings highlight the critical need for adaptable and flexible service facilities in modern banking environments. Companies that can swiftly adjust their service offerings in response to customer needs will be better positioned to maintain a competitive edge, reduce complaints, and improve overall service quality. This flexibility, coupled with the strategic use of information technology, can significantly enhance the customer experience, especially in high-stakes or priority situations.

6. Declarations

6.1. Author Contributions

Conceptualization: I.D.W., A.P., and Q.; Methodology: A.P. and Q.; Software: I.D.W.; Validation: I.D.W., A.P., and Q.; Formal Analysis: I.D.W., A.P., and Q.; Investigation: I.D.W.; Resources: A.P.; Data Curation: A.P. and Q.; Writing

ISSN 2723-6471

Original Draft Preparation: I.D.W., A.P., and Q.; Writing Review and Editing: A.P., Q., and I.D.W.; Visualization: I.D.W.; All authors have read and agreed to the published version of the manuscript.

6.2. Data Availability Statement

The data presented in this study are available on request from the corresponding author.

6.3. Funding

The authors received financial support for the research and publication of this article from the Department of Industrial Engineering, Faculty of Industrial Technology, Universitas Islam Indonesia, Yogyakarta, Indonesia.

6.4. Institutional Review Board Statement

Not applicable.

6.5. Informed Consent Statement

Not applicable.

6.6. Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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