QUEUE SYSTEM ANALYSIS IN IMPROVING SERVICE EFFICIENCY AT DISDUKCAPIL (CASE STUDY AT BALE MADUKARA PURWAKARTA)

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Abstract

The high demand for population administration services at the Bale Madukara Population and Civil Registration Office in Purwakarta Regency has resulted in long queues and waiting times, especially during peak hours. This study aims to analyze the implementation of the queuing system and evaluate service performance in improving the efficiency of population administration services using the Multi Channel–Multi Phase model. The research method used was descriptive qualitative with data collection techniques through observation, interviews, and documentation. The research population was the social situation of population administration services, with a sample consisting of key informants, including the head of the service section, counter officers, and queue system managers. The results of the study show that the queuing system has implemented the multi-channel–multi-phase model, but in some service phases there is still a backlog of applicants due to the high arrival rate and limited service capacity. Therefore, it is necessary to adjust the number of counters, reorganize service flows, and continuously evaluate the queuing system in order to improve the efficiency and quality of public services.

Keywords: Queue System, Service Efficiency, Multi Channel–Multi Phase, Waiting Time, Disdukcapil

INTRODUCTION

Public service is one of the main indicators for assessing the performance of government agencies. Good quality public service is characterized by a fast, accurate, and efficient service process. However, in practice, many public service agencies still face long queues and long waiting times, particularly in high-volume service agencies such as the Population and Civil Registration Office (Buana, 2021).

The Bale Madukara Population and Civil Registration Office (Disdukcapil) in Purwakarta Regency serves various population administration needs, such as the issuance of ID cards (KTP), Family Cards (Kartu Keluarga), and other civil registration documents. Bale Madukara is a Public Service Mall with various agencies actively involved in providing public services. These services are aimed at improving social needs (administrative services) within the community and have 37 agencies. This company is located in Purwakarta Regency and operates in the service sector to meet the needs of the community and is a venue for public service delivery activities for goods, services, administrative services, and services provided by state-owned enterprises (BUMN), regionally-owned enterprises (BUMD), and private companies, in order to provide fast, easy, affordable, safe, and convenient services. Public service efficiency is not only influenced by the number of service counters and service speed, but also by the organization's capability in managing internal resources and responding to environmental pressures(Ludiya, 2024)emphasize that organizational capability plays a critical role in transforming environmental challenges into improved performance through adaptive and structured process management. This perspective is relevant to population administration services, such as those at Disdukcapil, which are characterized by high service demand and multi-stage service processes that require strong coordination and operational capability.

However, several issues with the queuing system remain in civil service administration services, such as high numbers of people arriving during peak hours, long wait times, an imbalance between the number of counters and the number of visitors, and differences in service times between service types. Furthermore, limited staff and varying levels of service difficulty lead to queues that do not run smoothly at some service stages. Service efficiency is not only determined by the technical design of the queuing system but also by the organization's capability to manage internal resources and respond to environmental pressure.(Ludiya et al., 2026) emphasize that organizational capability plays a critical role in transforming environmental challenges into improved operational performance through adaptive and structured process management. This perspective is relevant to population administration services at Disdukcapil, which are characterized by high service demand and multi-stage service processes requiring strong coordination.

These issues indicate that the queuing system in use requires a comprehensive analysis. One approach to improving service efficiency and reducing applicant wait times is the Multi-Channel–Multi-Phase queuing system. This method focuses on a structured analysis of the number of arrivals, service levels, queue lengths, and applicant wait times at each service stage. Therefore, this study aims to evaluate the queuing system in civil service administration services at the Bale Madukara Civil Registration Office (Disdukcapil) in Purwakarta Regency.

Civil service administration services were chosen as the research object due to their complex characteristics, involving multiple service types, multiple service counters, and multiple process stages that applicants must go through. These characteristics have the potential to lead to long queues and high wait times if not managed with an effective and efficient queuing system.

Compared to other public service units, the Bale Madukara Population and Civil Registration Office (Disdukcapil) exhibits higher queue density, necessitating stricter and more structured queue management. Previous research using a queuing system approach to public services has shown that implementing a Multi-Channel–Multi-Phase model is effective in reducing waiting times and increasing service efficiency (Aseha, 2023). Appropriate queue management can reduce queue density, increase public satisfaction, and improve service performance through optimal capacity management. This is demonstrated by Pasquale De Marco in his book (Queueing Theory: A New Perspective, 2025).

In practice, population administration services involve various types of services with varying levels of complexity, such as the issuance of ID cards (KTP), Family Cards (Kartu Keluarga), and civil registration. These service processes consist of several stages that applicants must go through, from file verification and data input to document printing, thus requiring high coordination and precision at each stage of the service. One characteristic of the service at the Bale Madukara Population and Civil Registration Office (Disdukcapil) is the use of several service counters operating in parallel, resulting in a multi-channel and multi-phase queue system.

Therefore, the performance of a queuing system is highly dependent on the balance between applicant arrival rates and service capacity at each stage. The complexity of the service flow makes the queuing system more vulnerable to applicant backlogs, especially if there is an imbalance between the number of officers, counters, and variations in service times. This situation has the potential to increase applicant waiting times and reduce overall service efficiency. Research conducted by (Buana, 2021) shows that public services with multiple stages and varying service times tend to have longer wait times if not supported by effective queuing system management.

At the Bale Madukara Population and Civil Registration Office (Disdukcapil) in Purwakarta Regency, service standards stipulate a certain tolerance limit for waiting times for applicants for population administration services. These provisions serve as a reference for officers in evaluating service performance, determining the need for adjustments to the number of counters or officers, and serve as the basis for decision-making regarding queuing system improvements to ensure services run more efficiently and meet public service standards. The following data shows the average number of service visits for each agency from June 2024 to May 2025.

Table 1.
Average number of service visits for each agency in the period June 2024-May 2025

Periode (Period)	Disdukcapil	Samsat	Disnakertrans	Immigration Office	DPMTSP
June	2,250	652	790	157	74
July	5,900	1,897	2,133	344	232

Periode (Period)	Disdukcapil	Samsat	Disnakertrans	Immigration Office	DPMTSP
August	5,984	2,464	2,040	389	329
September	3,932	2,127	1,539	353	1,067
October	5,388	2,120	1,485	394	728
November	5,397	2,281	1,323	383	533
December	5,922	2,655	1,273	334	970
January	5,745	1,745	836	5,745	524
February	6,173	1,797	452	1,797	679
March	5,379	2,322	452	269	242
April	5,115	2,266	244	244	245
May	5,480	2,257	3,135	260	240
Total	**62,665**	**24,583**	**15,702**	**10,699**	**5,863**

Source: (Data.purwakartakab.go.id, 2025)

The table above shows that the number of visits from June to May shows that the Civil Registration Office (Disdukcapil) had the highest number of queues compared to other agencies, recording 62,665 total queues over the course of the year. Therefore, the researchers chose Disdukcapil as the research object to examine the current service system and provide recommendations.

Based on these findings, it can be concluded that the agency needs to take several corrective steps to optimize the performance of the queuing system. First, it is necessary to evaluate and adjust the number of service counters to balance the number of applicants, especially during peak hours. Second, reorganizing the service flow at each stage is necessary to reduce queue congestion at certain phases. Furthermore, improving the competency of officers through regular service training is also necessary to minimize variations in service times that can lengthen applicant wait times.

The application of queueing system analysis using the Multi-Channel–Multi-Phase model significantly helps institutions identify service bottlenecks and formulate more targeted and sustainable improvement solutions. The implementation of queueing systems in public services has been proven effective in improving service efficiency, as demonstrated in research conducted in other public service institutions, where the application of queueing models significantly reduced waiting times and improved service performance (Aseha, 2023). In addition, the study confirms that the M/M/c queueing model or multi-counter system is highly relevant to population administration services because it can balance the rate of applicant arrivals with service capacity. However, most of these studies focus more on quantitative approaches and mathematical calculations of queueing systems, with a primary

focus on time efficiency and overall service performance. Based on this review, there is still a research gap, namely the limited number of studies analyzing the queueing system for population administration services at Disdukcapil by integrating the Multi Channel–Multi model approach. contextually through qualitative descriptive methods. Therefore, this research is important to fill the gap in studies by analyzing the empirical application of the queue system, identifying bottlenecks in each phase of service, and formulating recommendations for continuous improvement to increase the efficiency and quality of population administration services at the Bale Madukara Population and Civil Registration Office in Purwakarta Regency.

REVIEW OF LITERATURE

Operations Management in Public Services

Operations management focuses on designing, operating, and improving systems that create and deliver goods and services. In the public sector, effective operations management is essential to ensure efficiency, service quality, and optimal use of limited resources. According to Heizer and Render(Heizer & Render, 2022), operations management involves transforming inputs into outputs in the form of services that provide value to customers. In public service institutions such as Disdukcapil, operations management plays a strategic role in managing service processes, service capacity, and service flow to meet community needs efficiently.

Queuing System Theory

Queuing theory is a mathematical approach used to analyze waiting lines that occur when service demand exceeds service capacity. A queue consists of three main components: arrival process, service process, and queue discipline. Queues commonly arise in service organizations due to variability in arrival rates and service times. An effective queuing system helps organizations reduce waiting time, control congestion, and improve customer satisfaction. (Stevenson, 2022) Organizational capability is a key factor influencing service efficiency, particularly in organizations facing high demand and operational complexity. According to(Ludiya, 2024)organizational capability enables institutions to coordinate resources, manage service processes effectively, and maintain performance stability under environmental pressure. In the context of public services, strong organizational capability supports smoother service flow, reduces bottlenecks at critical service stages, and enhances the overall effectiveness of queuing system implementation. According to (Ludiya et al., 2026)a conducive environment strengthens internal capabilities, enabling organizations to manage service flows more effectively and maintain performance stability. In public service contexts, strong organizational capability helps reduce bottlenecks at critical service stages and supports the effective implementation of queuing systems.

Multi Channel–Multi Phase Queuing Model

The Multi Channel–Multi Phase model is a queuing system that involves multiple service channels and multiple sequential service stages. This model is suitable for service systems where customers must pass through more than one stage and where each stage has more than one server. The application of this model enables organizations to analyze service performance at each stage, identify bottlenecks, and optimize resource allocation. In public service offices such as Disdukcapil, this model reflects real service conditions where

applicants go through several administrative stages handled by different service counters(Aseha, 2023)

Service Efficiency and Waiting Time

Service efficiency refers to the ability of a service system to deliver services with minimal waiting time, optimal resource utilization, and consistent service quality. Waiting time is a key indicator of service performance and efficiency. Long waiting times indicate imbalance between arrival rates and service capacity. Through queuing analysis, performance measures such as average number of customers in the system, average waiting time, and server utilization can be calculated to support managerial decision-making**.** According to (Ludiya et al., 2026)a conducive environment strengthens internal capabilities, enabling organizations to manage service flows more effectively and maintain performance stability. In public service contexts, strong organizational capability helps reduce bottlenecks at critical service stages and supports the effective implementation of queuing systems.

Planning, Implementation, and Evaluation of Queuing Systems

The effectiveness of a queuing system depends on proper planning, implementation, and evaluation. Planning involves determining service capacity, service layout, and service flow. Implementation refers to the execution of the planned queuing system according to established procedures. Evaluation is conducted to assess whether the system achieves service objectives such as fairness, efficiency, and customer satisfaction. Continuous evaluation allows organizations to identify weaknesses and implement improvements to maintain long-term service performance**.**

Previous Studies on Queuing Systems

Previous studies show that queuing system analysis has been widely applied in various sectors, including hospitals, banks, public service offices, and retail services. Most studies conclude that the application of appropriate queuing models can significantly reduce waiting time and improve service efficiency. However, differences in service characteristics, arrival patterns, and service capacity require context-specific analysis. This study differs from previous research by focusing on the qualitative and operational analysis of a Multi Channel–Multi Phase queuing system in a public population administration service.

Research Gap

Based on a review of previous studies, queuing system analysis has been widely applied in various service sectors such as hospitals, banking institutions, public service centers, and retail services. Most of these studies primarily focus on quantitative and mathematical approaches, emphasizing performance indicators such as arrival rates, service rates, waiting time, queue length, and server utilization.(Juwana, 2024)

However, several research gaps can be identified. First, previous studies largely concentrate on technical efficiency and numerical calculations, while managerial and operational aspects—including planning, implementation, evaluation, and continuous improvement of queuing systems—have received limited attention. In public service organizations, these managerial dimensions play a critical role in ensuring that queuing systems operate effectively in real service environments(Aseha, 2023)

Second, empirical studies examining queuing systems in population administration services, particularly in Civil Registration and Population Offices (Disdukcapil), remain scarce. This sector has distinctive characteristics, such as mandatory services, high and

fluctuating demand, and multi-stage service processes, which differentiate it from other service contexts and require specific analysis.(Akar & Doan, 2020)

Third, although the Multi Channel–Multi Phase queuing model has been applied in several studies, most research focuses solely on waiting time reduction and system efficiency, without comprehensively integrating organizational capability, coordination between service stages, and supporting facilities as factors influencing queuing system performance.

Therefore, this study addresses these gaps by analyzing the planning, implementation, evaluation, and improvement efforts of a Multi Channel–Multi Phase queuing system at the Disdukcapil of Bale Madukara, Purwakarta Regency. By combining operational analysis with a managerial perspective, this research contributes to a more comprehensive understanding of how queuing systems can enhance efficiency in public service delivery.(Mpp.purwakarta.go.id, 2020)

RESEARCH METHOD

A queuing system is a structured mechanism designed to regulate the process of arrival, waiting, and service delivery for service users in order to ensure that services are provided in an orderly, fair, and measurable manner. In the context of public services, a queuing system serves as an essential managerial tool to prevent service congestion, reduce applicant backlogs, and maintain fairness by prioritizing service based on the order of arrival rather than subjective considerations Without an effective queuing system, public service institutions are prone to inefficiencies such as disorderly queues, unequal access to services, and prolonged waiting times, which can ultimately reduce public trust in government performance.

Furthermore, a queuing system does not merely refer to the formation of physical lines within service facilities. It also encompasses the systematic management of waiting times, service capacity, arrival patterns, and service discipline applied by officers. The system integrates various operational elements, including the number of service counters, the speed of service delivery, and fluctuations in public demand across different time periods. By managing these components effectively, public agencies can create a more predictable service environment, reduce uncertainty for service users, and ensure service consistency across different service periods. Therefore, the implementation of an appropriate queuing system becomes a strategic effort to improve both service effectiveness and service reliability in public institutions.

Queuing system models are analytical tools used to evaluate service performance using mathematical and probabilistic approaches. These models analyze key variables such as arrival rates, service rates, number of service channels, and queue discipline to assess how efficiently a service system operates. One commonly applied model is the M/M/C model, which assumes a stochastic arrival process, exponential service times, and multiple service counters operating in parallel. This model is particularly suitable for public service organizations that serve a large number of applicants simultaneously through several counters or officers, such as population administration offices (Hariputra & Defit, n.d.)

Selecting an appropriate queuing system model is a critical step in service analysis, as each model reflects different service characteristics and operational conditions. An accurate model provides a realistic representation of actual service processes, enabling

decision-makers to identify bottlenecks, evaluate service capacity, and simulate potential improvements. Through proper model selection, public agencies can determine the optimal number of service officers and counters required to handle applicant demand efficiently, thereby minimizing waiting times and preventing excessive queue accumulation (Ibrahim et al., 2025). Consequently, queuing models function not only as analytical instruments but also as decision-support tools for service planning and optimization.

Service efficiency refers to an organization's ability to deliver services in a timely, accurate, and resource-efficient manner while maintaining service quality. Efficient service is commonly characterized by short waiting times, streamlined service procedures, and minimal redundancy in service processes (Mirza, M., Fadli, A., & Rachman, 2025)In the context of population administration services, efficiency is a critical performance indicator because these services involve high demand, standardized procedures, and direct interaction with the public. Inefficient service delivery in such institutions can quickly lead to public dissatisfaction and operational overload.

A well-managed queuing system has been empirically proven to significantly improve service efficiency by balancing applicant arrival rates with service capacity and ensuring a smooth service flow. By reducing unnecessary waiting times and optimizing the use of available resources, queuing systems contribute to improved operational performance and higher levels of public satisfaction. (Hariputra & Defit, n.d.)emphasize that public agencies implementing structured and data-driven queuing systems are better positioned to deliver consistent, efficient, and transparent services. Thus, queuing system management is not only a technical necessity but also a fundamental component of effective public service governance.

Service effectiveness emphasizes the extent to which public service objectives are achieved in accordance with predetermined standards and targets. A service is considered effective when it is capable of fulfilling public needs accurately, consistently, and within the expected time frame (Kirana, A. P., & Isbandono, 2025)Effectiveness is not merely measured by the completion of services but also by the conformity of service outcomes with procedural rules and community expectations. In this context, the implementation of a modern queuing system plays a strategic role in enhancing service effectiveness by ensuring that each service user is processed in an orderly, systematic, and transparent manner without discrimination (Viana & Nurhidayat, 2019). A well-designed queuing system minimizes service delays, prevents overlapping queues, and ensures that service flows operate according to established standards.

The quality of public services reflects society's perception of the performance and reliability of government institutions. Service quality is generally assessed through several dimensions, including reliability, responsiveness, assurance, empathy, and tangible aspects of service delivery (Kirana, A. P., & Isbandono, 2025)As a provider of essential population administration services, the Population and Civil Registration Agency (Disdukcapil) is required to consistently maintain high service quality. An integrated queuing system serves as a critical instrument in sustaining this quality by organizing service flows, reducing uncertainty, and improving coordination among service officers (Mirza, M., Fadli, A., & Rachman, 2025)Through systematic queue management, Disdukcapil can ensure that services are delivered fairly, efficiently, and in accordance with service standards.

Public satisfaction emerges when the services received meet or exceed user expectations. Long waiting times, unclear service procedures, and uncertainty regarding queue progression are among the most common sources of dissatisfaction in public service delivery (Mirza, M., Fadli, A., & Rachman, 2025)The presence of a transparent and measurable queuing system allows service users to predict service times more accurately, reducing anxiety and increasing comfort during the service process. Consequently, public trust and satisfaction toward Disdukcapil services can be significantly improved (Salsabila et al., 2023).

The adoption of a web-based queuing system enables service users to register online without the need to be physically present at the service location. This technological innovation has been shown to reduce congestion in waiting rooms, optimize service capacity, and improve overall service efficiency (Dzaki, M. F., Rahman, A., & Nugroho, n.d.)In addition, web-based systems support transparency by providing real-time access to queue information, allowing users to monitor service progress and plan their visits more effectively (Siahaan & Syahputra, 2024).

The development of a digital queuing system at Disdukcapil aims to improve service quality through the application of information technology. Digital systems facilitate efficient queue data management, simplify reporting processes, and enable supervisors to monitor officer performance more accurately (Hasmadi et al., 2023). Moreover, the implementation of digital queuing systems supports bureaucratic transformation toward more adaptive, responsive, and community-oriented public services (Dzaki, M. F., Rahman, A., & Nugroho, n.d.)

User interface (UI) design is a crucial factor in determining the success of technology-based queuing systems. A simple, intuitive, and user-friendly interface ensures that people from diverse educational and technological backgrounds can easily access services (Alifia et al., 2023). Good UI design reduces system usage errors, increases user confidence, and enhances the level of technology adoption among the public, thereby maximizing the benefits of digital service innovations (Alifia et al., 2023).

Service innovation at Disdukcapil includes the implementation of electronic systems such as e-queue services, Automated Document Machines (ADM), and online service applications. These innovations aim to streamline bureaucratic procedures, reduce administrative layers, and accelerate population administration processes (Lesmana, 2024). Through such innovations, Disdukcapil is better equipped to address challenges related to high service demand and limited human resources (Maskhuroh, 2024).

The e-queue system allows service users to obtain a queue number online prior to visiting the service location. This system has been empirically proven to shorten waiting times, reduce overcrowding, and improve applicant comfort (Lesmana, 2024). Additionally, e-queue implementation assists service officers in distributing workloads more proportionally, thereby preventing service bottlenecks and improving service consistency (Salsabila et al., 2023).

Service transparency refers to the openness and accessibility of information related to service procedures, timelines, and service flows. Digital queuing systems enhance transparency by openly displaying queue positions, estimated service times, and service requirements (Annisah et al., 2025). Improved transparency strengthens public trust in Disdukcapil's performance and accountability (Annisah et al., 2025).

Furthermore, an integrated population information system plays a vital role in supporting the smooth execution of administrative services by providing accurate and real-time data. Integration between the queuing system and population information systems accelerates service delivery and minimizes delays caused by data verification processes (Annisah et al., 2025). Effective data management also reduces administrative errors, prevents service duplication, and enhances the overall reliability of public service delivery (Widiyantoro & Kartini, 2024).

Automated Document Machines (ADM) represent a form of self-service innovation designed to allow the public to independently print population administration documents without having to go through conventional service counters. Through ADM, service users can access documents such as identity cards and family cards in a faster and more flexible manner. The implementation of ADM has been empirically proven to accelerate service delivery and significantly reduce manual queues at service counters, particularly during peak service hours (Maskhuroh, 2024). In addition to improving service speed, ADM contributes to increased officer efficiency by transferring routine and repetitive services to an automated system, thereby allowing officers to focus on more complex administrative tasks that require direct interaction and verification (Maskhuroh, 2024).

Digital transformation has become a key strategic approach in enhancing the quality and responsiveness of public services. The digitization of queuing systems constitutes an integral part of technology-based bureaucratic reform aimed at improving service effectiveness, transparency, and accountability(Dzaki, M. F., Rahman, A., & Nugroho, n.d.)Through digital queuing systems, public service agencies can manage service flows more systematically and predict service demand more accurately. However, the success of digital transformation is highly dependent on the availability of adequate infrastructure and the readiness of human resources to operate and manage the system optimally. Without sufficient technical capacity and digital competence among officers, the benefits of digital queuing systems cannot be fully realized (Juwana, 2024)

Waiting time management is a critical indicator in evaluating the efficiency of a queuing system. Well-controlled waiting times contribute to positive public perceptions of service quality and institutional performance (Hariputra & Defit, 2022). Excessive waiting times often indicate an imbalance between service demand and service capacity. Therefore, an effective queuing system must be capable of aligning the number of applicants with available service resources to ensure a smooth and predictable service process (Viana & Nurhidayat, 2019). The ability to manage waiting times accurately also reflects the organization's capacity for operational planning and service optimization.

The management of a queuing system has a direct impact on staff workload distribution. An unbalanced workload can lead to officer fatigue, reduced productivity, and declining service quality. Conversely, a balanced distribution of tasks enables officers to work more efficiently and deliver services more consistently (Ibrahim et al., 2025). Digital queuing systems provide management with real-time data on service volume, processing times, and officer performance, enabling data-driven decisions related to staffing adjustments and service scheduling (Hasmadi et al., 2023).

The provision of Disdukcapil services within Public Service Malls requires an integrated and efficient queuing system due to the presence of multiple service providers operating within a single service environment. The complexity of multi-agency service

delivery necessitates effective queue coordination to prevent congestion and service overlap (Mirza et al., 2025). An effective queuing system not only supports the smooth flow of services but also enhances the overall service experience for the public, ultimately leading to higher levels of public satisfaction in Public Service Malls (Mirza et al., 2025).

Despite its benefits, the implementation of a digital queuing system faces several challenges, including limited infrastructure availability, varying levels of public digital literacy, and organizational resistance to change (Siahaan, 2024)These challenges can hinder system adoption and reduce service effectiveness if not properly addressed. Therefore, continuous socialization, user guidance, and mentoring are essential to ensure public acceptance and optimal system utilization. Capacity-building programs for officers are equally important to support sustainable system implementation (Siahaan, 2024)

Based on the literature review, it can be concluded that queuing systems play a strategic role in improving the efficiency, effectiveness, and overall quality of Disdukcapil services. This research is particularly relevant in assessing the implementation of the queuing system at Bale Madukara Purwakarta as an effort to enhance public service performance. The findings of this study are expected to contribute both theoretically and practically to the development of population administration services that are efficient, effective, and oriented toward public satisfaction.

RESULTS AND DISCUSSION

The planning of the civil service queuing system at the Bale Madukara Population and Civil Registration Office (Disdukcapil) is designed as a strategic effort to ensure that the service process operates in accordance with established service standards and principles of good governance. This planning stage emphasizes the alignment between service demand and service capacity through structured arrangements of service counters, staff scheduling, service flow design, and the allocation of specific service types to each counter. By carefully determining the number of active counters and assigning officers based on service complexity, the planning process seeks to reduce inefficiencies that commonly arise in public service delivery. Effective planning is expected to prevent excessive queue buildup, shorten applicant waiting times, and improve the overall orderliness and predictability of population administration services.

In addition to counter and staff allocation, the planning of the queuing system also considers temporal service patterns, such as daily and weekly fluctuations in applicant arrivals. Certain periods, particularly at the beginning of the week or during the processing of mandatory population documents, tend to experience higher service demand. Therefore, the planning process includes anticipatory measures, such as flexible staffing arrangements and service prioritization mechanisms, to ensure that service delivery remains stable despite fluctuating demand. Through this comprehensive planning approach, the queuing system is positioned as an operational tool that supports efficiency, fairness, and service continuity. The findings indicate that although the Multi Channel–Multi Phase queuing system has been implemented, congestion still occurs at certain service stages, The persistence of congestion at certain service stages indicates that service efficiency is not determined solely by queuing system design and service capacity. Organizational competence, commitment, and the effective use of information technology also play a crucial role in improving service quality.

(Nugraha et al., 2022)demonstrate that information technology competence, employee competence, and organizational commitment significantly influence service quality and operational performance. In the context of Disdukcapil services, strengthening officers' competence and commitment, supported by appropriate information technology, is essential to stabilize service flow and reduce bottlenecks across multiple service phases.particularly during peak service periods. The persistence of congestion at certain service stages indicates that queuing system performance is not solely influenced by technical capacity or system design. Organizational factors also play a crucial role in determining service effectiveness.(Romi et al., 2021) emphasize that organizational commitment and organizational citizenship behavior contribute significantly to improving operational performance through better coordination, proactive work behavior, and responsiveness in service delivery. In the context of Disdukcapil services, the ability of officers to demonstrate commitment and cooperative behavior is essential in managing service flow dynamics, particularly during peak periods, and in minimizing bottlenecks across multiple service phases.

This condition suggests that queuing system performance is not solely determined by service capacity, but is also influenced by the organization's ability to manage operational complexity. (Ludiya et al., 2026)emphasize that a conducive environment strengthens internal capabilities, enabling organizations to coordinate processes effectively and maintain performance stability. In the context of Disdukcapil services, organizational capability plays a crucial role in managing service flow dynamics and minimizing bottlenecks across multiple service phases.

The implementation of the queuing system at the Bale Madukara Disdukcapil is carried out continuously across all stages of the service process. The service flow begins when applicants take a queue number, either manually or through a designated system, which establishes the order of service objectively and transparently. Applicants then wait in the designated service area until their queue number is called for the appropriate service counter. This structured process ensures that services are delivered sequentially and fairly, minimizing confusion and potential conflict among applicants.

Services at the Bale Madukara Disdukcapil are delivered through several service counters operating simultaneously, following a Multi-Channel–Multi-Phase queuing model. This model allows multiple applicants to be served at the same time while still requiring them to pass through several service phases, such as registration, document verification, data processing, and document printing. The application of this model is particularly relevant given the diverse types of population administration services handled by Disdukcapil, each of which has different service durations and procedural requirements. By implementing parallel service channels, the office aims to increase service throughput and reduce congestion in the waiting area. The findings indicate that although the Multi Channel–Multi Phase queuing system has been implemented, congestion still occurs at certain service stages. This condition suggests that queuing system optimization requires adequate organizational capability to manage service processes effectively. In line with (Ludiya, 2024)organizational capability is a crucial factor in improving operational performance through adaptive and

structured process management, particularly in service systems with fluctuating demand and limited capacity.

Supervision of the queuing system implementation focuses primarily on service stages with high arrival rates and significant variability in service time, such as file verification and document printing. These stages often become bottlenecks due to the complexity of document requirements and the technical processes involved. Service officers actively monitor applicant movement between service stages to ensure that the service flow remains orderly and that no stage experiences excessive accumulation of applicants. Continuous supervision also enables officers to respond quickly to disruptions, such as system downtime or sudden increases in applicant volume, thereby maintaining service continuity.

The evaluation of the queuing system at the Bale Madukara Population and Civil Registration Office (Disdukcapil) is conducted through direct observation of service operations, focusing on indicators such as the number of applicants, waiting times, service durations, and the overall flow of services during specific observation periods. The evaluation process aims to assess the effectiveness of the queuing system in managing service demand and maintaining acceptable service performance levels. Observational data reveal that queue density tends to increase significantly during periods of high public visitation, particularly when the number of available officers is relatively limited.

Evaluation results indicate that queue length and waiting times are not solely determined by the volume of applicants but are also influenced by service capacity, staff allocation, and the effectiveness of queuing system management. On certain days, even a moderate number of applicants resulted in long waiting times due to uneven distribution of officers across service counters or prolonged service durations at specific stages. This finding highlights the importance of dynamic system management rather than relying solely on static service capacity assumptions.

Further insights obtained from interviews with service officers and direct observations reveal several key issues affecting the performance of the queuing system. One of the primary findings is the imbalance between the number of service counters and the volume of applicants during peak service periods. Additionally, significant variations in service duration across different service types contribute to uneven queue movement and localized congestion. These variations are often influenced by document completeness, applicant preparedness, and technical system performance. Increased staff workload during peak periods further exacerbates these challenges, leading to reduced service speed and longer applicant waiting times.

Peak service periods also have a direct impact on the effectiveness of the queuing system. During these times, officers are required to handle higher workloads within limited time frames, which may affect service accuracy and consistency. Consequently, the evaluation results indicate that although the queuing system functions adequately under normal conditions, it still requires strengthening at critical service stages to ensure consistent performance during periods of high demand.

Based on the evaluation and analysis of queuing system issues, improvement efforts are directed toward controlling critical factors within the service process. One key improvement strategy involves adjusting the number of active service counters during peak hours to better match service demand. This adjustment is supported by more flexible staff

scheduling and temporary task redistribution to ensure that high-demand service stages receive sufficient attention. Additionally, service flow reorganization is implemented to eliminate redundant steps and streamline service transitions between stages.

Improvement efforts also emphasize strengthening coordination among officers at each service stage. Effective communication and coordination are essential to prevent service delays caused by misaligned processes or information gaps. Managing officer workload through equitable task distribution and providing opportunities for skill enhancement are also integral components of queuing system development. These measures aim to improve service responsiveness while maintaining service quality and officer well-being.

Efforts to improve and develop the queuing system for population administration services at the Bale Madukara Population and Civil Registration Office (Disdukcapil) in Purwakarta Regency are conducted based on the results of a systematic queuing system analysis using the Multi-Channel–Multi-Phase model. This analytical approach enables the identification of key service bottlenecks, evaluation of queuing performance indicators, and formulation of evidence-based recommendations. By using this model, the institution can assess the interaction between service channels and service phases comprehensively.

The development of the queuing system is oriented toward sustainable improvement by integrating analytical findings into policy and operational decision-making. Recommendations derived from the analysis include optimizing counter allocation, enhancing staff competency, improving service flow integration, and strengthening monitoring mechanisms. Through continuous evaluation and adaptive system development, the queuing system at Bale Madukara Disdukcapil is expected to support the delivery of efficient, orderly, and citizen-centered population administration services.

1. Probability of no customers in the system

The probability of no customers in the system is a measure indicating the likelihood that all service facilities are idle, or that there are no applicants waiting or being served. This probability is denoted by P_0 and is used to determine the level of slack in service capacity in a queuing system. In the population administration service queuing system at the Bale Madukara Population and Civil Registration Service (Disdukcapil), the probability value of no customers in the system is calculated based on the applicant arrival rate (λ), the level of officer service (μ), and the number of service counters available. A small P_0 value indicates that the service system is rarely empty and most of the time is used to serve applicants. The calculation is as follows:

$$\boldsymbol{\rho 0 = 0,045}$$

Based on the results, the probability of a counter being empty is only 4.5%. The analysis shows that the probability of no customers in the system at the Bale Madukara Population and Civil Registration Office (Disdukcapil) is relatively low. This condition indicates that the service facility is almost always actively serving applicants. The low P_0 value is consistent with the high utility value of the queuing system, indicating that the applicant arrival rate is close to the available service capacity. A low P_0 value implies that

the queuing system is at risk of applicant overcrowding, especially during periods with high arrival rates.

2. Average Number of Customers in Queue (Ls)

The average number of customers in queue is a measure of the number of applicants waiting in line for service. This indicator, denoted by Ls, is used to determine the level of queue congestion within the service system.

In the population administration service queuing system at the Bale Madukara Population and Civil Registration Office (Disdukcapil), the Ls value is calculated based on the applicant arrival rate, the service capacity of the officers, and the number of available service counters. A high Ls value indicates that many applicants must wait before receiving service, reflecting an imbalance between the arrival rate and service capacity.

The analysis shows that the average number of customers in the queue (Ls) at the Bale Madukara Civil Registration Office remains relatively high during certain periods, particularly during peak service hours. This condition indicates that the queuing system is not yet fully optimized and that applicants continue to accumulate at some service stages.

A high Ls value directly increases applicant waiting times and potentially reduces public satisfaction with the service provided. Therefore, the average number of customers in a queue is an important basis for evaluating the effectiveness of a queuing system and determining the need for improvements, such as increasing the number of counters, rearranging service flows, and adjusting staff schedules to reduce queue congestion.

$$\boldsymbol{Ls = 0.45\left(\frac{20}{8}\right)3(0,83)}$$

$$\boldsymbol{3!\,(1-0,83)2 = 3{,}5\ orang}$$

Based on the calculations above, an average of 3 to 4 people are queuing at the counter. The analysis shows that the average number of customers in the queue (Ls) at the Bale Madukara Population and Civil Registration Office (Disdukcapil) remains relatively high during certain periods, particularly during peak service hours. This condition indicates that the queuing system is not yet fully optimized and that applicants still experience backlogs at several service stages. A high Ls value directly impacts applicant waiting times and potentially reduces public satisfaction with the service provided.

3. Average Number of Customers in the System

The average number of customers in the system is an indicator that shows the number of applicants in the service system, both those waiting in line and those being served by officers. This indicator is symbolized by L and is used to describe the overall congestion level of the queuing system. In the population administration service queuing system at the Bale Madukara Population and Civil Registration Office (Disdukcapil) in Purwakarta Regency, the L value is influenced by the number of applicant arrivals, the speed of officer service, and the number of service counters available. The larger the L value, the more applicants are in the system, which indicates a high service workload.

$$\boldsymbol{Ls = 3,5 + (20 \div 8) = 6\ orang}$$

Based on the calculation results above, there were a total of 6 people in the service area (being served and queuing). The analysis shows that the average number of customers in the system (L) remains relatively high during certain periods, particularly during peak

service hours. This condition indicates that the service system is not yet optimal in managing the flow of incoming applicants, resulting in congestion in both the waiting area and the service counters.

4. Average Time Spent in Queue (Wq)

The average time customers spend in queue is a performance indicator of the queuing system, indicating the length of time applicants wait from arrival to the start of service. This indicator, denoted by Wq, is used to assess the level of service efficiency from the perspective of service users. In the queuing system for population administration services at the Bale Madukara Population and Civil Registration Office (Disdukcapil) in Purwakarta Regency, the Wq value is calculated based on the number of applicant arrivals and the speed of service provided by officers at each counter. A high Wq value indicates that applicants have to wait a relatively long time before being served, which reflects an imbalance between the number of applicants arriving and the available service capacity.

$$Wq = \frac{3{,}5}{20} = 0{,}175\ jam = 10{,}5\ menit$$

The calculation results above show that the average waiting time for customers before being served is 10.5 minutes. The analysis shows that the average waiting time in the queue (Wq) remains relatively long during certain periods, particularly during peak service hours. This is due to the high number of customers arriving simultaneously and the limited number of staff at several service stages. Long waiting times have the potential to reduce customer satisfaction and create a perception of ineffective service. Therefore, the Wq indicator is an important parameter in evaluating the quality of the queuing system. A high Wq value indicates the need for service system improvements, such as increasing the number of active counters, reorganizing the service flow, and utilizing a technology-based queuing system to speed up the service process and reduce customer waiting times.

5. Average Time Spent in the System

The average time customers spend in the system is an indicator that shows the length of time a customer spends from the time they first arrive at the service location until the entire service process is completed. This indicator is symbolized by W and reflects the overall performance of the service system. In the population administration service queue system at the Population and Civil Registration Service (Disdukcapil) Bale Madukara, Purwakarta Regency, the W value is influenced by the average waiting time in the queue (Wq) and the service time provided by officers. A high W value indicates that applicants have to spend a relatively long time in the service system, both waiting and being served. The calculation is as follows:

$$\boldsymbol{Ws = \frac{6}{20} = 0{,}3\ jam = 18\ menit}$$

Based on the calculation results above, the total time required for applicants from arrival to completion was 18 minutes. The analysis shows that the average time applicants spent in the system (W) was still relatively long during certain periods, particularly during peak service hours. This condition was influenced by the high number of applicant arrivals not matched by adequate service capacity, as well as the presence of service stages that

required relatively long times. Time spent in the system is an important indicator in assessing the level of public service efficiency.

6. Queue System Utility

Queue System Utility is a measure of the level of activity of a service facility in serving applicants. Utility describes the proportion of time that officers or service counters are in service compared to the total service time. In a queuing system, utility is symbolized by ρ (rho) and is used to assess whether service capacity is balanced with the number of applicant arrivals. In the population administration service queuing system at the Bale Madukara Population and Civil Registration Office (Disdukcapil), the queuing system utility is calculated based on the ratio of the applicant arrival rate (λ) to the officer's service capacity (μ), taking into account the number of available service counters. A high utility value indicates that service personnel are busy most of the time, while a low utility value indicates that service capacity is still sufficient to serve applicants. The calculation is as follows:

$$\boldsymbol{p = \frac{20}{3x8} = \frac{20}{24} = 0,83}$$

The calculation results above show that the counter utilization rate is 83%. This figure indicates that officers are working very actively (efficiently), but there is a risk of queues if there is a sudden surge. The results of the queue system utility analysis indicate that the service utility value at the Bale Madukara Population and Civil Registration Office is close to one. This condition indicates that the number of applicant arrivals is almost proportional to the available service capacity, so that service officers are in a very busy condition. This high utility value has the potential to cause an increase in queue lengths and applicant waiting times, especially during peak service hours. A utility value close to one also indicates that the queue system is not yet in optimal condition. If no adjustments to service capacity are made, such as adding counters or rescheduling officer schedules, the risk of queue buildup will increase.

CONCLUSION

The results of this study indicate that the implementation of the Multi-Channel–Multi-Phase queueing system at the Bale Madukara Civil Registry Office has not been optimal in several service phases due to the high number of applicants and limited service capacity. These findings indicate the need to strengthen queue management operations in order to continuously improve the efficiency and quality of public services. This study emphasizes the importance of adjusting the number of counters and staff distribution during busy service hours, reorganizing service flows to reduce bottlenecks, and improving coordination between service phases. Recommendations include conducting periodic evaluations of the queue system, utilizing queue data as a basis for managerial decision-making, and developing a technology-based queue system to support more efficient and responsive services to the needs of the community. Therefore, improving service efficiency at Disdukcapil is not only dependent on technical queuing system design but also on strengthening organizational capability. This finding supports argue that organizational capability is essential in sustaining performance and managing operational challenges in high-demand service environments(Ludiya, 2024)

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