

New Selection Algorithm on Priority Service for Certification Queue Service Information System in BARISTRAND

Rizky Dwi Nugroho¹, Anjik Sukmaaji^{2*}, Endra Rahmawati³, Arifin Pujiwidodo⁴, Teguh Sutanto⁵

Department of Information System, Dinamika University, Indonesia

¹ridzki.mail@gmail.com, ³rahmawati@dinamika.ac.id ,

⁴arifin@dinamika.ac.id, ⁵teguh@dinamika.ac.id

²*corr_author: anjik@dinamika.ac.id

Abstract - Queue management for product certification of perishable goods is a major problem faced by the Surabaya Industrial Standardization and Research Institute (BARISTAND). The purpose of this study is to combine the use of the First in first out (FIFO), First Expired First Out (FEFO) and Least Shelf Life First Out (LSFO) methods into an automatic queuing system that can ensure effective service performance in queue management. This research was conducted using qualitative methods with observations to collect data and processes about how the product certification queue process flow at the Surabaya Industrial Standardization and Research Institute (BARISTRAN). The results show that the service only requires an average service completion time of 0.14 products per minute, meaning that every hour it can serve approximately 8.4 products. The conclusion of the research system has succeeded in determining the queue based on the use of the First in first out (FIFO), First Expired First Out (FEFO) and Least Shelf Life First Out (LSFO) methods, and customers can perform the tracking process to find out the certification process for the registered products.

Keywords: queue, priority service, product certification management

I. INTRODUCTION

In our daily life, we often wait in line, especially when we go to the public service office. In this life we have spent a lot of time queuing, the time we spend queuing depends on several factors, including the number of people queuing in front of us, the number of people serving, and how the performance of the serving officers. These factors affect the waiting time of the queue, not to mention there are other factors that also affect the waiting time of the queue.

Queue management system in a public service institution is an important component for any service-oriented business. First in first out (FIFO) and last in first out (LIFO) are two standard methods for queue

management in valuing business inventory. The queuing system as part of the selected inventory management can greatly affect the performance of the business being run. In observations made at the Surabaya Industrial Standardization and Research Institute (BARISTAND), which certifies food, beverages, and household products that require Indonesian National Standards (SNI) have not implemented an effective system in the product certification service process.

SNI is one of the processes for product quality control and supervision programs by establishing product quality norms and rules which are determined together with the aim of producing products with quality that can be described and measured by obtaining uniform product quality. SNI or Indonesian National Standard is a standard made by BSN or the National Standardization Agency applicable in Indonesia as a standard for doing work or making a product. SNI covers many fields, including in the field of building construction. The standardization is made so that development is not carried out arbitrarily and the product or result of the development is safe from various hazards. Certification of a product must not be influenced by the existence of authority or interest, meaning that there must be independence and proper [1]. Every product that will be circulated and marketed in the community in accordance with Indonesian government regulations through the process of inauguration of trademarks, patents, certifications and associations must refer to the rules and regulations of the Department of Industry and Trade (DISPERINDAG) to obtain the Indonesian National Standard (SNI) [2]. Every product marketed by following and obtaining SNI guarantees more public trust, this will indirectly increase the added value or value of products circulating in the market [3-4]. The process of granting SNI is through a qualification process that must be carried out correctly in accordance with the provisions of each type and type of product. The

process of granting SNI is carried out by guaranteeing product quality with a product certification mechanism.

This product certification mechanism means the process of providing certification for products that meet the requirements. The product control and verification process need to be carried out carefully for each product. This condition will certainly require a queue at each flow of the certification process. Problems will arise when a product has an expiration date, especially food, beverage, drug and cosmetic products. A priority determination mechanism is needed in product certification services. The First In First Out (FIFO) method is a queuing method that is generally used in setting process queues [5-7]. Queuing arrangements using the first come first in process or FIFO method will not be appropriate for every item because each item cannot be treated the same. The diversity of types and types of products in the storage warehouse requires a process of determining the order that does not have to comply with FIFO provisions, because the condition of certain types of goods depends on the age limit or Expired date which can be overcome by the First Expired First Out (FEFO) method [8]. However, customer dissatisfaction will occur if within a certain period the products that come for certification are dominant products with types that have an age limit. The handling of goods in the warehouse related to the certification process is possible due to outside conditions, for example the accumulation of goods in certain types of goods rooms, while there are vacancies for goods products in other storage rooms. In the condition of the shelter gap, the Least Shelf Life First Out (LSFO) queue method can be used. [8]. To deal with queuing problems in the provision of product certification, it is not appropriate to use the Last In First Out (LIFO) queue method because of the urgency of service and on the basis of product certification customer satisfaction [9].

The solution for handling the queue of goods served earlier is known as the FIFO method, handling the queue of goods service by paying attention to the expiration date can be done with the FEFO method approach, and the problem of product service queues related to the condition of the storage space can be done with LSFO. However, by using several methods of handling the queue, it is necessary to pay attention to policy or more considerations in order to provide satisfaction with the services provided. The use of these methods needs to be applied in a program that can process automatically and intelligently so as not to add new queue problems. In this paper, a selection algorithm is presented that can accommodate the problems that occur if you only pay attention to one method selection. The purpose of

research on the product certification queuing system is to combine the use of FIFO, FEFO and LSFO methods into an automatic queuing system that can guarantee service performance inventory management. The implementation of the queuing method based on the type of product used in the system that is built can: (1) add value to the management of the product to be certified by determining the quota for the certification process every week; (2) Can classify types of certification products and determine product priority levels according to the urgency for certification first; (3) Can monitor the product certification process so that customers can find out the tracking of product certification processes; (4) Can inform customers to register product types before submitting the product to be tested for certification; (5) Can help improve the control performance and operational management of the Research and Standardization Center.

To be able to provide these benefits to an agency, the application of the FIFO, FEFO and LSFO queue methods in a computerized system must be supported by the priority service method in accordance with the determination of the priority level for each type of product to be certified [10-11]. The use of the service priority method in computer programs is made in a computer algorithm model that can accommodate queuing methods such as FIFO, FEFO and LSFO. Service priority is given to customers who have a higher priority compared to customers who have a lower priority, although those who first arrive at the waiting line may be the last to arrive. This may be caused by several things, for example in medical services, a person who has a more severe illness than others in a doctor's office, kinship waiters and potential customers will be served first. The types of priority services that can be adopted in the queuing system that is built include: single channel – single phase, single channel – multi phase, multi-channel – single phase and multi-channel – multi phase [12-13].

II. METHOD

In the research conducted, the stage of collecting research data was carried out using field research. Research is carried out by going directly to the place that is the object of research. The field research was conducted by conducting observations and interviews about how the flow of the product certification queue process at the Surabaya Industrial Standardization and Research Institute (BARISTRAN) and what obstacles existed. Several key business users are involved here considering the role of their key informants in the use of the system as a source of data mining carried out in the

interview process. The results of the analysis carried out from the data collected through the observation and interview stages can identify three queuing variables that must be considered, namely: (1) queues for low-risk general products, namely non-food or beverage products; (2) queues for products with a high risk of damage, namely food and beverage products; (3) queues for products that must be prioritized due to economic considerations which are categorized as moderate. In addition to the three queuing variables, the queue priority must be determined according to field conditions, namely the agency that will apply the queuing method to the system being built. From the observations made, the appropriate queuing priority model is to apply a multi-phase - multi-channel model [12-13]. The multi-channel multi-phase queuing model is based on the nature of the service process in the channel (channel) and the phase (phase), the channel shows the number of paths or places to enter the service system which also shows the number of service places where the waiters must serve before the service is declared complete. Fig. 1 illustrates the Multi-Channel Multi Phase (MCMP) priority service process.

In the multi-channel multi-phase model, customers who will carry out certification queue at a constant rate λ and customers can be served with c for service facilities simultaneously. The rate of each service is also constant, which is equal to μ . If it is described in the queue characteristics formula with a multi-channel multi-phase model as follows (1-6) [12]:

$$\rho = \frac{\lambda}{\mu}; \tag{1}$$

$$P_0 = \frac{1}{\sum_{n=0}^{c-1} \frac{(\lambda/\mu)^n}{n!} + \frac{(\lambda/\mu)^c}{c!(1-\lambda/c\mu)}}; \tag{2}$$

$$L_q = \left[\frac{(\lambda/\mu)^c \lambda/c\mu}{c!(1-\lambda/c\mu)^2} \right] P_0; \tag{3}$$

$$L_s = L_q + \frac{\lambda}{\mu}; \tag{4}$$

$$W_q = \frac{L_q}{\lambda}; \tag{5}$$

$$W_s = W_q + \frac{1}{\mu}; \tag{6}$$

Formula 1 is used to calculate the level of usability of service facilities, with the variable ρ . Formula 2 is used to calculate the probability if no customers come, with the variable P_0 . Formula 3, a formula that can be used to calculate the average customer in the queue, with the variable L_q . Formula 4, the formula used to calculate the average customer in the system denoted by L_s . Formula 5, the formula used to determine the waiting time in the queue symbolized by W_q . The 6th formula, the formula that can be used to calculate the average waiting time in the process that occurs in the system is symbolized by W_s . By using this formula, a calculation simulation can be done if there are several customers queuing on the multi-channel multi-phase priority service model. In the logic of the program that is built, considering the number of stages or phases that exist in the BARISTRAN agency, it is determined based on the stage of the product certification workflow. While the number of channels is determined based on the inventory used to accommodate products of the same type, such as food channels, beverage channels, household appliances channels, and so on.

The stages of determining product certification at BARISTRAN consist of four stages with each consisting of 4 services or channels. The first stage is the process of registration and product submission, the second stage is chemical and environmental laboratory testing which can be a determinant of the priority selection process, the third stage is quality determination or quality testing, and the final stage is information about whether the product is certified or not.

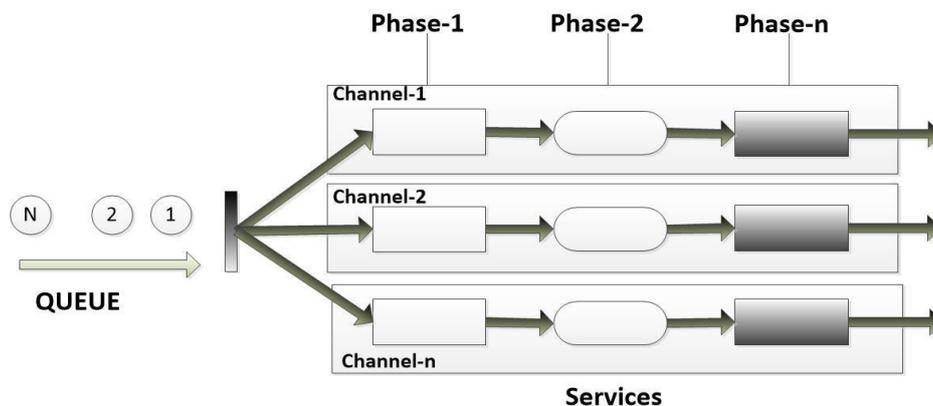


Fig. 1 multi-phase multi-channel service model

The algorithm for determining product priority through chemical and environmental lab tests in the second stage is carried out using an algorithm as shown in Figure 2. In this second stage, the type of product is determined to be in the high priority category, medium priority or low priority or ordinary product. The algorithm for determining the queue category is based on Fig. 2, which can determine the processing date according to the entry date on the item. From that date and known product types, the priority type of queue can be determined. The type of product is the key in determining the priority of the queue in the system to be built, if there are several similar types, it must be optimized in determining the type that is in accordance with the condition of the goods. Determining the type of product with almost the same type, must be supported by other documents related to the characteristics or details of the product so that priority determination can be more optimal [14-15].

In the product certification service and management system that has been created, to find out the effectiveness of using the product certification management and administration application to obtain SNI, which is carried out in an agency that performs standardization such as BARISTRAN, it must be evaluated using formulas that are in accordance with the evaluation carried out. For example, knowing the average waiting time in the queue and knowing the service time can be calculated using formula 5 and formula 6. Measurement

or evaluation of service performance provided in the certification process can be used as a reference for evaluating all components related to the service, if the average time which can be seen in the time span of the monitoring process in accordance with the simulation carried out, it can be said that the performance of the system provided has an impact on the services provided.

III. RESULTS AND DISCUSSION

Input Process Output Diagram is a chart that explains in general the description of the application of input, namely the data needed, the process that is how the data is carried out, and the output produced according to the needs of the application and the user. Input Process Output shown in Fig. 3.

Context diagrams are the highest level in the Data Flow Diagram (DFD) which describes the process of the data used in the overall system development. Therefore, for the process on the contexts the diagram has only one main process and has represented all the processes of the entire system. Where in the process already involves external data and the flow. Data flow in the context diagram is data that flows between the main process and external entity. Context Diagram shown in Fig. 4. The following are the results and discussion of the Design of the Certification Queue Service Information System Using Priority Service Method in BARISTAND.

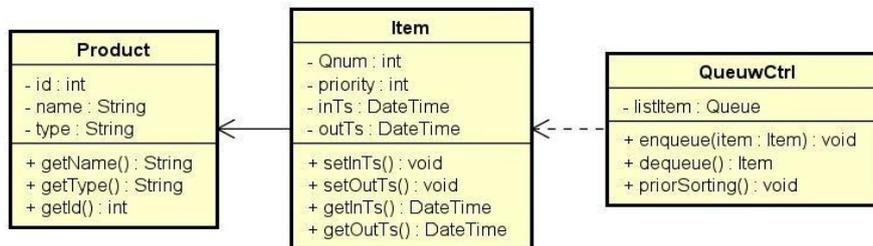


Fig. 2 Algorithm of product selection to be certified



Fig. 3 Input process output application diagram block for BARISTRAND service information system

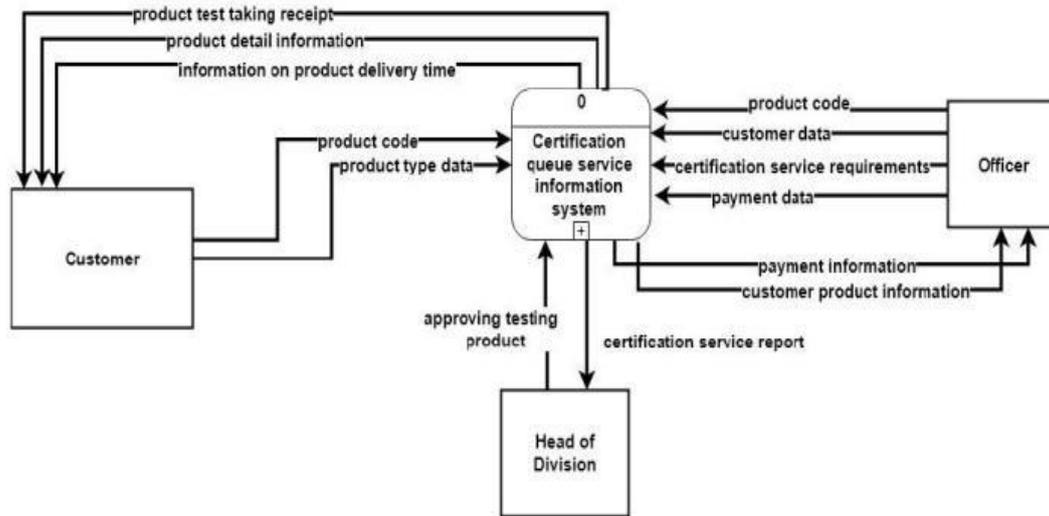


Fig. 4 Context diagram on priority service for certification queue service information system

A. Product Registration

On the product registration page, visitors must enter product data, product name, product type, as well as company origin as a condition in registering visitor products to be certified at BARISTAND. After completing product certification in accordance with the rules, the system will work to calculate the number of priorities of the product and the results that will be issued by the system is the date and the username of the customer. Customer's username is useful for entering the customer's page. where the page serves to monitor product certification for customers.

B. Monitoring Page

This page view of the certification process monitoring used to see the extent to which the product certification process from the company takes place. In addition, there is also information related to visitor data and data on products that are certified. Customers can see the certification process on their respective pages according to the username and password previously given. This monitoring data is taken from the database and updated regularly when the process of certified products continues to run in BARISTAND. This page is only accessible to customers. Monitoring and detail report product certification pages shown in Fig. 5-6.



Fig. 5 Monitoring step for certification queue service information system

ID Pendaftaran	Asal Perusahaan	Nama Pengunjung	Nama Produk	Jenis Sertifikasi	Tindakan
0z11RgQYFX	PT.ABC	devi	CIKI	Layanan Sertifikasi Makanan/Minuman	Update Delete
7NS28vdXTU	PT Nyoblos Lagi AJA	Mas Rizky	Jajancoklat	Layanan Sertifikasi Makanan/Minuman	Update Delete
gmFhJc2i0N	PT Nyemil Terus	Om Rizky	Ciki Tos	Layanan Sertifikasi Makanan/Minuman	Update Delete

Fig. 6 Detail report product certification queue service information system

C. Detail Report Page

The Product Certification Report Page Display is a page that displays the certification data that has been carried out by visitors. Data can be exported and printed according to the needs of the section head. data can be adjusted according to the desired period. then inside the page has several functions that are useful for deleting or changing data from that customer. Detail Report Page shown in Fig. 6. In the figure below is data that has been downloaded by period and can be printed to be used as a report that data can only be printed by the head of the department. The data displayed is data on company data

that has finished certification. The data can be used for decision making or other purposes like on Fig 7.

The results of the analysis and evaluation process that have been carried out based on the use of applications that have been tested for all queuing services on each of the existing services produce conclusions as shown in Table I. Based on Table I, in service number 2 the service provided is better than other services, which only requires an average service completion time of 0.14 products per minute, meaning that every one hour it can serve approximately 8.4 products. However, it is possible that conditions that require longer services will affect the completion of the certification process for these services.

ID Pendaftaran	Asal Perusahaan	Nama Produk	Jenis Produk	Jenis Sertifikasi	Masa Expired	Prioritas	Status Sertifikasi	Sta Agg
VF2K5hM2xk	PT AVOSEYO	SNACK MOCHI ACE	Makanan/Minuman	Layanan Sertifikasi Makanan/Minuman	35 hari	Low Priority	Tahap 1	Wa
VZ6QWZ9B	PT KENCANA ADI WUJAYA	BISKUIT NAGITA	Makanan/Minuman	Layanan Sertifikasi Makanan/Minuman	30 hari	Medium Priority	Tahap 1	Wa

Fig. 7 Details of the certification report

TABLE I
RESULTS OF SERVICE QUEUE DATA ANALYSIS

Queue Characteristic	phase			
	1	2	3	4
Average arrival rate of new product applicants (product/hour) (λ)	20	15	14	7
Average service for new product applicants (product/hour) (μ)	16	13	8	3
Usability of service facilities (ρ)	1.25	1.15	1.75	2.33
The probability that there are no new product (P_0)	0.5	0.433	0.33	0.24
Average number of new product applicants in queue (L_q)	12.5	0.93	0.98	0.98
Average number of new product applicants in the system (L_s)	13.75	2.1	2.73	3.3
Average time for new product applicants in queue (product/min)(W_q)	0.63	0.06	0.07	0.14
Average new product requester time in the system (product/min) (W_s)	0.69	0.14	0.195	0.47

IV. CONCLUSION

In this article, we present the BARISTAND certification service queuing system that applies the multi-channel, multi-phase priority queuing method based on the FIFO, FEFO, and LSFO models performed using a selection algorithm. This certification service queue system integrates the product certification administration process from various services and stages. In this service system, customers can carry out the tracking process to find out the product certification process is taking place. Application performance makes a high contribution to the performance of BARISTRAN agencies. Information related to service performance evaluation every period, can be accessed at any time. Based on the current results, the BARISTAND certification service queuing system provides effective results, however, it should be improved with other relevant factors in improving the service.

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