

Raw Material Management Information System at D'Fans Coffee Using Web-Based Buffer Stock and FEFO Methods

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ABSTRACT

Efficient management of stock and raw materials is crucial to maintaining smooth operations in the beverage industry. D'Fans Coffee, a Micro, Small, and Medium Enterprise (MSME) in Medan, still relies on manual recording systems that often lead to stock discrepancies and operational inefficiencies. This study aims to develop a web-based inventory information system that integrates the Buffer Stock, First Expired First Out (FEFO), and Reorder Point (ROP) methods to optimize stock control and minimize waste. The system was developed using the Waterfall model through several stages: requirements analysis, system design, implementation, and testing. Data were collected through interviews and direct observations at D'Fans Coffee to understand current stock management practices. The results show that the implementation of the Buffer Stock and FEFO methods can ensure raw material availability, reduce the risk of expired products, and improve overall operational efficiency. The developed system also provides real-time stock monitoring, expiration date tracking, and automatic reorder notifications, significantly reducing human error. In conclusion, the integrated system successfully enhances stock accuracy, reduces material waste, and supports better decision-making in inventory management at D'Fans Coffee.

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1. INTRODUCTION

Proper stock management and key components affect the operational running of businesses in the beverage industry. If stock is not managed properly, it can result in raw material shortages, waste, and high operational costs. To avoid this, the buffer stock method is used by storing additional stock reserves so that the business continues to run smoothly even if there are changes in supply or demand [1]. Buffer Stock is a method used to monitor and ensure stock availability in anticipation of the risk of shortages due to fluctuations in supply and demand [2]. With the availability of raw materials maintained, the production process can run smoothly, so that the quality and consistency of production are guaranteed. Also, being able to make good planning in raw material management also helps avoid waste, especially for materials that have a limited shelf life.

FEFO (First Expired First Out) is a stock management that prioritizes the use of goods with the closest expiration date to reduce the risk of loss due to expired products [3]. If not managed properly, raw materials that accumulate for too long are at risk of experiencing quality degradation or even expiration, which can ultimately increase operational costs, therefore a material quality monitoring strategy such as First Expired First Out (FEFO) is needed. The use of information technology encourages MSMEs to use digital systems to manage inventory in real-time, analyze data accurately, and support efficient decision-making so that operations remain smooth without stock constraints.

D'Fans Coffee is a Micro, Small, and Medium Enterprise (MSME) located in Medan city. This business is engaged in the beverage sector, which is located at Jalan Bajak 2-H Harjosari II, Medan District, Medan City, North Sumatra 20148. D'Fans Coffee still runs operations that use manual recording such as making raw materials, making incoming goods reports, making outgoing goods reports, ordering raw materials, and making goods reports. Recording is done after working hours have ended, namely at night. In addition, the absence of a system that provides notifications when stock reaches a minimum amount often causes delays in reordering raw materials. This condition puts D'Fans Coffee at risk of experiencing stock shortages when customer demand is high, especially during peak hours. This will cause errors that contribute to waste in raw materials, so manual recording in managing raw material stock increases the risk of errors in recording the amount of incoming and outgoing materials, especially when the transaction volume is high, input errors in updating stock records can cause differences between data and conditions on materials in the warehouse.

Previous research has discussed the design of a raw material control system. This design still focuses on accounting such as payment or selling prices and purchase prices and their impact on the smooth production process in coffee shops [4]. Previous research was also conducted on how the FIFO method works in bakeries, the FIFO method applied in the pressing and taking of raw materials, so that the first in will be the first out in the goods data, and employees still manage FIFO in the warehouse [5]. This research aims to build a website-based information system that combines the Buffer Stock and FEFO methods to manage inventory at D'Fans Coffee. This system is designed to provide live stock data, streamline the procurement process, facilitate monitoring of expiration dates, and improve overall operational efficiency. With more organized and transparent inventory management, it is hoped that management can make more accurate decisions in the planning and procurement of raw materials.

2. METHOD

This research uses qualitative methods. Through interviews and observations, qualitative methods enable researchers to understand the social and cultural contexts that influence individuals [6]. Qualitative research is a method used to gain a deeper understanding of how people think, behave, or feel, usually based on the direct experiences of the informants, through the analysis of non-numerical data. Researchers prioritize individual meanings, experiences, and perspectives over numerical or statistical data.

2.1 Data Collection Method

This method requires information to be collected in the research. The following data collection methods were used by the author in this study:

- a. Observation: Data collection by directly observing a phenomenon in its natural environment, which can produce detailed and in-depth information, although it requires considerable time and expense [7]. The researcher conducted the observation at D'Fans Coffee on Jl. Bajak 2-H Harjosari II, Medan District, Medan City, North Sumatra 20148.
- b. An interview is an event between two parties who exchange information through questions and answers for the purpose of generating meaning on a specific topic [8]. The author conducted interviews with the owner of D'Fans Coffee and the program coordinator at the cafe.
- c. Literature Review: Studying previous findings by collecting and studying previous discussions relevant to this research to strengthen the material discussed by the author.

2.2 System Algorithm Method

- a. Buffer Stock: Buffer Stock is a strategy used to anticipate shortages of goods, by storing reserve inventory to address situations where demand or usage of goods exceeds initial estimates [9]. Buffer stock is a method used to protect against the risk of shortages of goods due to greater than expected usage. This method helps maintain the availability of goods in sufficient quantities to meet unexpected demand. With buffer stock, companies can cope with sudden fluctuations in demand without having to worry about running out of stock.
- b. First Expired First Out (FEFO): By using the FEFO method, companies can improve operational efficiency and reduce costs arising from unsold products before they expire. Implementing this method also helps in better stock management, reducing waste, and ensuring that older products are not simply thrown away, but are used first before others. In this way, companies can maintain the quality of the products sold and reduce losses caused by expired goods [10].
- c. Reorder Point (ROP): Reorder Point helps simplify problem solving, so a sales information and stock monitoring system is created using the safety stock and reorder point methods [11].

2.3 System Development Methods

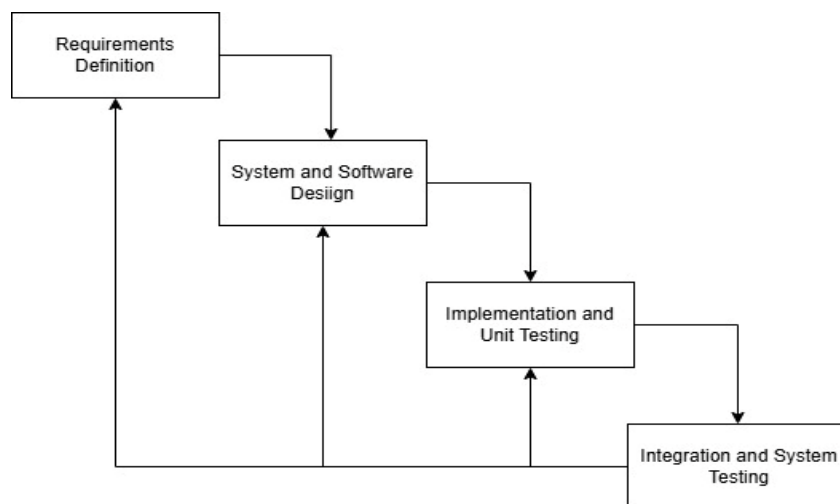


Figure 1. Waterfall Method

The Waterfall model is a commonly used SDLC method in information systems and software development [12]. This model offers the advantage of easy project management and comprehensive documentation [13]. Like a waterfall, each phase in this model is implemented sequentially from top to bottom. The stages of the process can be seen in Figure 1, which illustrates the systematic flow of the Waterfall model, starting from requirement definition to system testing. Each stage is interrelated and must be completed before moving to the next, ensuring a structured and controlled development process [14]. The explanation of the method in the image above is as follows:

1. Requirement Definition: The process of gathering and recording software requirements using techniques such as interviews, prototyping, and JAD to accurately understand user desires [15].
2. System and Software Design: This stage is the process of organizing system components to separate primary functions and additional features, so that the system becomes more structured and easier to develop [16].
3. Implementation and Unit Testing: Once the software design is complete and meets the system's requirements and scope, the next stage is implementation and unit testing [17].
4. Integration and System Testing: Software testing is a critical stage to ensure the application functions as intended [18]. After unit testing, the components are combined and the system as a whole is tested to identify errors and failures.

3. RESULTS AND DISCUSSION

3.1 Data Collection

Data collection is a core process in this research because it affects the validity and quality of the results. This study collected data on the raw materials used by D'Fans Coffee for one month, from December 1 to 31, 2024. In addition to raw material data, the study also required lead time information for each material used in operations.

3.1.1 Lead Time

Lead time is the duration from ordering raw materials to receiving them and their readiness for use. Each material has a different lead time depending on availability, shipping distance, and the supplier's process for fulfilling D'Fans Coffee's demand. This is explained in Table 1 below:

Table 1. Lead Time for D'Fans Coffee Raw Materials

No.	Raw Material	Lead Time	Unit
1	Gayo Arabica Coffee Beans	3	Day
2	Ulee Kareng Coffee	2	Day
3	Capuccino	2	Day
4	The Bendera	2	Day
5	Soda Water	3	Day
...	...	...	...
19	Strawberry Fruit	3	Day

3.1.2 Data Collection

Raw material usage is the process of utilizing primary raw materials in production to produce finished products. These raw materials are processed into goods ready for use or sale. Data on D'Fans Coffee's raw material usage over a 30-day period is shown in the following table:

Table 2. Raw material usage over a 30-day period at D'Fans Coffee

No.	Raw Material	Amount	Max/Day	Average /Day	Unit
1	Gayo Arabica Coffee Beans	49	4	2	Kg
2	Ulee Kareng Coffee	174	25	13	Packaging
3	Capuccino	130	15	9	Packaging
4	The Bendera	64	3	2	Box
5	Soda Water	30	4	2	Bottle
...	...	...	...	...	...
19	Strawberry Fruit	7	2	1	Kg

As shown in Table 2, Ulee Kareng Coffee and Cappuccino Powder are the most frequently used raw materials, indicating their critical role in daily operations. These findings highlight the need for accurate buffer stock and reorder point calculations to prevent shortages. Meanwhile, materials with lower usage but shorter shelf life, such as fruits, require careful FEFO-based monitoring to avoid waste. The usage data also serve as input for safety stock and reorder point determination in the developed system.

3.2 Data Calculation

3.2.1 Buffer Stock Calculation

The buffer stock value will be used to calculate the safety stock. Safety stock is obtained by using a raw material, such as Ulee Kareng Coffee. Within one month, Ulee Kareng Coffee had the highest daily sales value of 25 packages and an average sales value of 13 packages, with a lead time of 2 days. Therefore, the safety stock value is:

$$SS = (\text{Maximum Usage} \times LT) - (\text{Average Usage} \times LT)$$

$$SS = (25 \times 2) - (13 \times 2)$$

$$SS = 50 - 26$$

$$SS = 24 \text{ Packages}$$

Table 3. D'Fans Coffee Raw Material Safety Stock

No.	Bahan Baku	Safety Stock	Unit
1	Gayo Arabica Coffee Beans	4	Kg
2	Ulee Kareng Coffee	24	Packaging
3	Capuccino	12	Packaging
4	The Bendera	2	Box
5	Soda Water	6	Bottle
...	...	...	...
19	Strawberry Fruit	2	Kg

3.2.2 ROP Calculation

In calculating the ROP, the researcher used a sample of Ulee Kareng Coffee raw material, which is known to have an average usage value of 13 packages over 30 days and a safety stock value of 26 packages with a shelf life of 2 days. Therefore, the ROP value for Ulee Kareng Coffee can be concluded as:

$$ROP = \text{Lead Time} + \text{Safety Stock}$$

$$ROP = 26 + 2$$

$$ROP = 28 \text{ Packages}$$

The ROP results for D'Fans Coffee ingredients can be seen in Table 4 as follows:

Table 4. ROP for D'Fans Coffee Raw Materials

No.	Bahan Baku	ROP	Unit
1	Gayo Arabica Coffee Beans	7	Kg
2	Ulee Kareng Coffee	28	Packaging
3	Capuccino	14	Packaging
4	The Bendera	4	Box
5	Soda Water	9	Bottle
...	...	...	...
19	Strawberry Fruit	5	Kg

3.3 System Design

This system design aims to improve management efficiency using web technology that enables real-time information access. The system is designed to provide easy and fast information access, facilitating project monitoring and decision-making [19].

3.3.1 Use Case Diagram

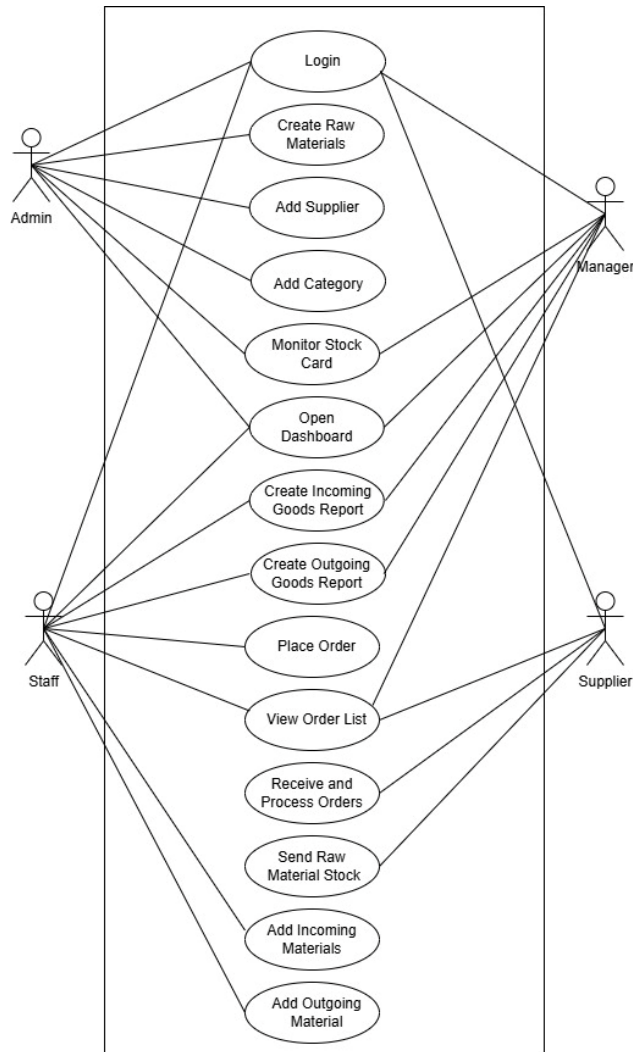


Figure 2. Use Case Diagram

The image above shows a use case diagram of D'Fans Coffee's raw material inventory management system. There are three main actors: Admin, Staff, and Manager, who have different but interrelated access rights to control, manage, and monitor raw material inventory activities.

3.4 Implementation

3.4.1 Raw Materials Page

No	Nama Bahan	Jenis	Stok	Satuan	Lead Time	Safety Stock	ROP	Aksi
1	Air Aqua Botol	Kemasan	9	Kotak	2 hari	2	4	[Edit] [Delete]
2	Biji Kopi Arabica Goya	Biji Kopi	49	Kg	3 hari	4	7	[Edit] [Delete]
3	Biji Selasi	Bahan Makanan	20	Bungkus	1 hari	2	3	[Edit] [Delete]
4	Buah Lemon	Bahan Makanan	5	Kg	2 hari	2	4	[Edit] [Delete]
5	Buah Strawberry	Bahan Makanan	7	Kg	3 hari	2	5	[Edit] [Delete]
6	Bubuk Cokelat	Pemanis	56	Bungkus	3 hari	6	9	[Edit] [Delete]
7	Cappuccino	Kemasan	176	Bungkus	2 hari	12	14	[Edit] [Delete]
8	Es Batu	Kemasan	22	Kg	2 hari	2	4	[Edit] [Delete]
9	Gula	Pemanis	15	Kg	1 hari	2	3	[Edit] [Delete]
10	Kopi Ulee Kareng	Biji Kopi	35	Kg	2 hari	26	28	[Edit] [Delete]
11	Pemanis	Pemanis	34	Botol	2 hari	2	4	[Edit] [Delete]
12	Sirup Blue Curacao	Bahan Makanan	20	Kg	3 hari	6	9	[Edit] [Delete]
13	Sirup Mint	Pemanis	15	Botol	3 hari	1	4	[Edit] [Delete]

Figure 3. Raw Materials Page

The raw materials page serves as a central data management center for materials, allowing users to monitor the name, type, stock, and unit of stock, as well as edit or delete raw material data in the system.

3.4.2 Incoming Goods Page

No	Tanggal	No Faktur	Qty	Harga	Input Oleh	Aksi
1	01 Jun 2025	12345	10	1.500	Administrator	[Label FEFO]
2	01 Jun 2025	12345	10	1.500	Administrator	[Label FEFO]
3	01 Jun 2025	12345	60	1.500	Administrator	[Label FEFO]
4	27 May 2025	0102	100	15.000	Administrator	[Label FEFO]

Figure 4. Incoming Goods Page

The image below shows the Incoming Goods page on the D'Fans Coffee Inventory Management website, where the system records goods received from suppliers after an order is placed.

3.4.3 Print FEFO Label

Kembali

Cetak Label

D'FANS COFFE - LABEL FEFO

Bahan: Soda Water

No Faktur: 0

Supplier: PT MAKMUR JAYA

Tanggal Masuk: 09/06/2025

Tanggal Expired: 09/07/2025

Qty: 20

Gunakan sebelum tanggal expired - Sistem FEFO

Figure 5. FEFO label

The image above illustrates the FEFO label, which can be printed from the incoming goods form. This label is used to display the expiration date on incoming goods.

3.4.4 Outgoing Goods Page

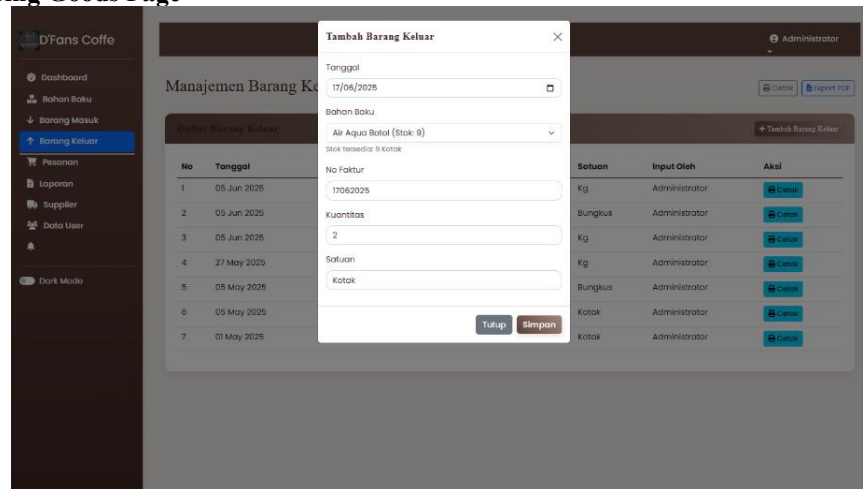


Figure 6. Outgoing Goods Page

The image below shows the outgoing goods page on the D'Fans Coffee inventory management website. This page records outgoing stock, including the date, ingredient name, quantity, and transaction user. This feature helps staff and management monitor and organize inventory efficiently by updating item data after use.

3.4.5 Report Page

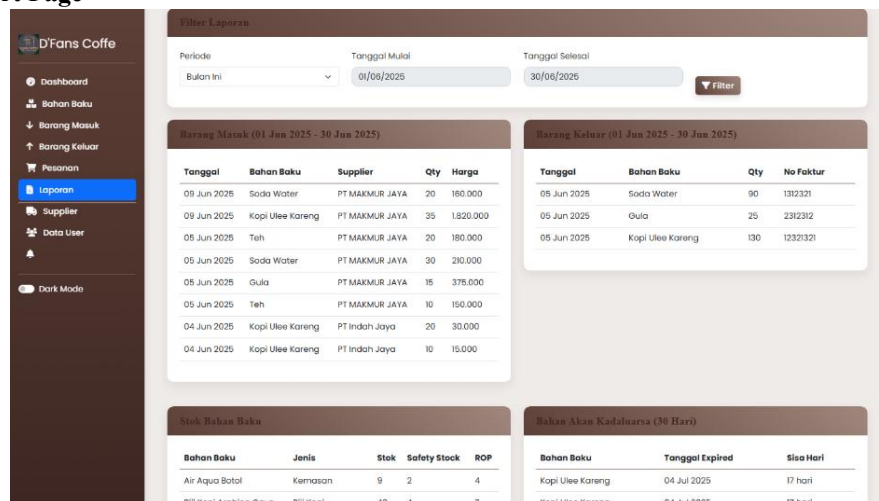


Figure 7. Monthly Report Page

The image below shows the monthly report page for incoming, outgoing, and 30-day-expired goods at D'Fans Coffee. This report helps the owner monitor inventory movements in the café. This report page contains data on incoming and outgoing goods, raw material stock, and items that will expire within 30 days. This report helps employees monitor usage to prevent errors or the use of expired goods, thus ensuring D'Fans Coffee's efficiency and organization.

4. CONCLUSION

Highly efficient inventory and raw material management is crucial to ensuring smooth operations, especially in the beverage industry. Implementing a buffer stock method and a First Expired First Out (FEFO) strategy can help maintain a smooth production process, avoid raw material shortages, minimize waste, and maintain product quality. With the advancement of information technology, MSMEs like D'Fans Coffee now have the opportunity to manage inventory more accurately and efficiently through digital systems. However, D'Fans Coffee's continued use of manual record keeping leads to potential errors in inventory management, which can negatively impact operations and costs. Therefore, implementing an inventory information system

that combines the FEFO and Reorder Point (ROP) methods is essential to increase efficiency, reduce waste, and ensure the quality of raw materials is maintained. With an improved system, D'Fans Coffee can optimize its operations and remain more competitive in the market.

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