

Analysis of Effectiveness and Education: Application of the FIFO Method in Managing O Bread Inventory in the Warehouse

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Abstract: This study aims to analyze the effectiveness of implementing the First In, First Out (FIFO) method in managing raw material inventory at Warehouse Roti O. Using a qualitative approach, data were collected through observation, interviews, and document analysis of warehouse records from 2022–2024. Verification of the reported 30% reduction in waste was conducted by comparing historical inventory data before and after FIFO implementation, supported by documentation from Quality Control reports and warehouse records. The results indicate that FIFO significantly minimized raw material waste, maintained product quality, and enhanced operational efficiency. Challenges such as limited storage space, recording errors, and insufficient staff understanding were identified, and improvements were achieved through regular training, digital record systems, and managerial supervision. The study highlights that the integration of FIFO with digital monitoring and quality assurance not only enhances operational effectiveness but also contributes to environmental sustainability and compliance with food safety standards. Unlike previous studies that focused only on FIFO's operational aspects, this research emphasizes its holistic integration with technological adaptation, staff training, and sustainability practices in the bread industry. Thus, the FIFO method proves to be an effective and sustainable strategy for food inventory management.

Keywords: FIFO, Inventory, Management, Operational Efficiency, Education

A. Introduction

Inventory management is a crucial aspect of maintaining smooth operations in the food industry, where raw materials have limited shelf life. Ineffective inventory management can lead to problems such as excess stock, expired raw materials, and increased operational costs due to suboptimal storage (Hilalia, 2024). Therefore, an appropriate method is needed to maintain product quality, reduce waste, and optimize storage efficiency (Taufik Maulana, 2024).

One commonly applied method in inventory management is First In, First Out (FIFO), which operates on the principle that materials entering the warehouse first must also be the first to be used (Roziqin & Kusuma, 2021). The FIFO system ensures that older materials are used before newer ones, helping to maintain freshness and minimize product deterioration. This approach is particularly relevant in the food industry, where raw materials such as flour, butter, or milk have expiration limits and require systematic rotation to prevent quality degradation.

In the case of Warehouse Roti O, the FIFO method serves as a key strategy to maintain production continuity and ensure that raw materials remain fresh and compliant with quality standards. Without proper FIFO implementation, the company risks increased waste and financial losses due to expired materials. Therefore, FIFO plays an essential role in reducing spoilage and enhancing warehouse operational efficiency (Taufik Maulana et al., 2024).

Although the FEFO (First Expired, First Out) method is often regarded as more precise for perishable goods, this study focuses on FIFO because the majority of Roti O's raw materials have uniform expiration ranges and rely more heavily on batch entry dates rather than individual expiry dates for stock rotation. FIFO also offers practical advantages such as easier tracking, simpler digital integration, and higher compatibility with Roti O's existing Warehouse Management System making it a more efficient approach for their operational context. The comparison highlights that while FEFO emphasizes expiration dates, FIFO remains effective for maintaining quality when raw materials are stored and used within consistent turnover periods.

Therefore, this study aims to analyze the effectiveness of FIFO implementation in managing raw material inventory at Roti O Warehouse based on knowledge and education, as well as its impact on reducing expired materials and operational inefficiencies. These findings are expected to provide insight into how FIFO can be optimized to balance practical efficiency and quality assurance in food production warehousing.

Additionally, the implementation of FIFO has educational value. It serves as a real-world case for students of management, accounting, and vocational education to understand how inventory management theories operate in practice (Munyaka & Yadavalli, 2022). The FIFO principle also cultivates values of discipline, precision, and responsibility qualities essential in both academic learning and professional performance (Nugraha & Suendri, 2024).

B. Methods

This study employs a qualitative descriptive approach, aiming to gain a comprehensive understanding of the implementation of the First In, First Out (FIFO) method in managing inventory at Warehouse Roti O. This approach was chosen because it allows for in-depth exploration of processes, behaviors, and managerial practices related to FIFO application, which cannot be captured adequately through quantitative measurement alone (Sugiyono, 2021).

Research Site and Subjects

The research was conducted at Warehouse Roti O, which serves as the main storage and distribution center for bread production materials. The subjects were selected using purposive sampling, focusing on individuals directly involved in inventory management activities. They include:

- a. Warehouse Manager Responsible for overseeing inventory systems and implementing FIFO policies.
- b. Warehouse Administrator Manages data entry, stock recording, and coordination of incoming and outgoing goods.

- c. Quality Control (QC) Staff Monitors and ensures that stored raw materials meet established quality standards.

These subjects were chosen because they possess firsthand experience and decision-making authority in the application and supervision of the FIFO system. Their roles are crucial in identifying both technical and managerial challenges in warehouse operations.

Data Collection Techniques

Data were collected through three main techniques: observation, interviews, and documentation. Observation was conducted for a total of two weeks (10 working days) to directly observe warehouse operations, including the receipt, storage, and distribution of raw materials following the FIFO principle. Observations focused on the physical layout of the warehouse, workflow consistency, and compliance with FIFO procedures.

Interviews were conducted in a semi-structured format to allow flexibility in exploring responses while maintaining consistency in key questions. The interviews lasted between 30 to 60 minutes per participant and were guided by a list of core themes such as inventory management, staff discipline, digital record usage, and problem-solving mechanisms. Follow-up questions were used to clarify specific issues that arose during observation.

Documentation involved the collection and review of warehouse standard operating procedures (SOPs), stock recording sheets, training materials, and internal reports. These documents provided secondary data to verify and support the information obtained from interviews and observations.

Data Analysis

The study uses an analytical descriptive method, which in this context refers to a narrative content analysis of qualitative data derived from interviews, observations, and documents. The analysis was carried out through several stages:

Data Reduction Organizing and categorizing information based on recurring themes such as implementation stages, challenges, and solutions in FIFO application. **Data Display** Presenting data in narrative form and supporting it with field notes and excerpts from interviews.

Conclusion Drawing and Verification Interpreting patterns and meanings from the data to understand how FIFO affects inventory efficiency, product quality, and sustainability outcomes. To ensure data validity, the study used triangulation techniques by comparing findings from interviews, observations, and documentation. This cross-verification strengthened the reliability of interpretations and minimized researcher bias.

C. Results and Discussion

The First In, First Out (FIFO) method is systematically applied at the O Bread Warehouse to maintain the freshness of raw materials and minimize damage to raw materials that have

been stored for too long. The results of the study show that there are three stages of the process, starting from the raw material reception stage, quality control, and stock taking.

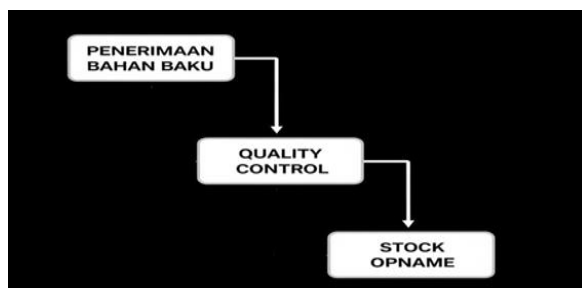


Figure 1. Product Flow

Source: author's interpretation (2025)

1. Raw Material Receiving Stage

The first process begins with the raw material receiving stage. The raw material receiving process at the Roti O warehouse is carried out very carefully to maintain the quality of the materials. This step is crucial because food ingredients must always be fresh and safe for use. The receiving process is also the first step in implementing the FIFO method, which ensures that ingredients arriving first are the first to be used.

When raw materials arrive, officers immediately inspect the delivery according to the company's standard procedures. One of the main checks includes verifying the temperature of the transport vehicle using a digital thermometer and downloading the temperature record from the data logger to ensure consistency during transit. If the temperature remains within standard limits, the materials are accepted; otherwise, they are rejected and reported to the supplier. Once verified, the materials are recorded in the warehouse system, including details such as arrival date, batch code, and expiration date, to ensure traceability.

In principle, materials that arrive earlier should be placed at the front or in an easily accessible position, while newer arrivals should be positioned at the back following the FIFO principle. However, based on field observations, this placement is not always perfectly implemented due to spatial constraints and high warehouse turnover. In certain situations, staff are forced to place new materials in front temporarily to optimize limited storage space. This inconsistency sometimes affects the ideal FIFO rotation, although corrective measures such as rearrangement during daily checks are routinely conducted.

To minimize such issues, Roti O utilizes a digital inventory management system that automatically records the arrival and expiration dates of materials and provides alerts for those nearing expiration. This digital system supports warehouse staff in reorganizing stock to maintain FIFO consistency.

Overall, the receiving and inspection process at Roti O demonstrates a strong commitment to food safety and operational discipline. Nonetheless, alignment between the ideal SOP and its practical implementation still requires improvement to ensure the FIFO principle can function optimally within spatial and operational limitations.

2. Quality Control Process Stages

At the second stage, quality control (QC) is routinely carried out by the QC team to ensure that all raw materials stored in the Roti O warehouse remain suitable for production. Daily inspections focus on physical quality, storage temperature, and expiration dates. This process is essential to prevent spoilage and to ensure that the FIFO rotation runs effectively.

The QC team records each material's arrival and expiration date and collaborates closely with the warehouse and production departments. According to one QC staff member, "We check every batch daily. When a material is close to its expiration date, we immediately inform production so that it can be prioritized for use." However, as noted by the Warehouse Manager, "Sometimes coordination is less effective. Information from QC does not always reach the production team quickly, causing some materials to stay too long on the shelf." These statements indicate that while the monitoring system functions well, communication flow between QC and production still requires improvement.

In addition to date monitoring, QC staff also examine color, aroma, and texture changes, particularly in temperature-sensitive materials such as butter, milk, and eggs. They use thermometers and visual inspections to ensure that all items meet storage standards. If a product shows signs of deterioration, it is separated and labeled for evaluation. Each inspection result is documented in a daily report containing data on materials checked, findings, and recommendations for corrective action.

Collaboration with warehouse staff is essential to maintain FIFO compliance. Materials that arrive first are positioned at the front of the rack and given priority in production. QC also assists in training new warehouse employees, emphasizing the importance of discipline, cleanliness, and accuracy in implementing FIFO. "We remind the staff regularly to rotate stocks correctly. Simple mistakes like taking new items first can affect the whole system," explained one QC officer.

Overall, the QC process at Roti O has contributed to reducing waste and maintaining product consistency. However, the main challenge lies in ensuring continuous coordination between QC and production. Strengthening communication channels and scheduling more frequent joint evaluations are necessary steps to improve the overall effectiveness of FIFO implementation in the warehouse.

3. Stock Take Stages

The stocktaking process at the Roti O Warehouse is carried out periodically, generally at the end of each month or quarter, involving warehouse administration, storage officers, and the Quality Control team. During this process, warehouse operations are temporarily suspended to allow accurate physical verification of stock. Each raw material is counted manually and matched with system records following the company's Standard Operating Procedures (SOP). Every item counted is marked to prevent duplication, and any discrepancies are immediately recorded for analysis and correction.

Unlike routine quantity checks, stocktaking at Roti O also functions as an audit of FIFO/FEFO (First Expired, First Out) compliance. During physical verification, Quality Control staff check not only quantities but also batch codes and expiration dates to ensure that materials stored follow the FIFO principle. Items that appear out of sequence newer

batches placed ahead of older ones are flagged as FIFO non-compliance cases. Materials that have exceeded or are approaching expiration are documented, and the quantity of expired materials is compared against stock discrepancies to determine whether they result from FIFO failures (improper rotation) or human recording errors.

This approach allows management to trace discrepancies back to their root causes. For instance, a mismatch due to incorrect placement of new stock before older batches reflects a breakdown in FIFO discipline, while missing quantities with no physical trace are more likely caused by human error or unrecorded usage. Therefore, stocktaking serves as both a quantitative and qualitative assessment of inventory accuracy and FIFO performance.

The stocktake results are then entered into the Warehouse Management System (WMS), accompanied by corrective notes and recommendations. Patterns of expired or misplaced stock are reviewed in follow-up meetings to strengthen FIFO training, improve labeling visibility, and refine warehouse zoning. Through this integration, stocktaking not only reconciles physical and system data but also acts as a continuous audit mechanism for FIFO/FEFO implementation. By focusing on rotation compliance rather than distribution issues, Roti O ensures that the stocktaking process directly contributes to reducing material expiration, improving data accuracy, and supporting sustainable inventory management practices.

Discussion

The implementation of the First In, First Out (FIFO) method at the Roti O Warehouse has been carried out through structured stages, yet field observations reveal a gap between planned procedures and actual practices. Although the FIFO system theoretically ensures the rotation of raw materials based on their arrival order, several operational inconsistencies still occur. These discrepancies are mainly caused by limited storage space, weak interdepartmental coordination, and inadequate system integration.

At the raw material receiving stage, inspection procedures including temperature verification, data logger review, and digital recording are already well established. However, observations show that physical stock placement sometimes deviates from the FIFO principle due to space limitations and high activity levels. This indicates a gap between the ideal standard operating procedure (SOP) and actual field implementation.

The findings indicate that the FIFO method has been systematically implemented at Roti O Warehouse, but several weaknesses still affect its overall effectiveness. The three main stages raw material reception, quality control, and stock-taking have been carried out according to procedure. However, inconsistencies in staff discipline and interdepartmental coordination remain major obstacles in maintaining smooth FIFO rotation.

At the quality control stage, the QC team's monitoring system works well in recording and reporting expiration dates. Nevertheless, qualitative data from interviews reveal coordination gaps between QC and production. As stated by the Warehouse Manager, "Sometimes coordination is less effective. Information from QC does not always reach the production team quickly, causing some materials to stay too long on the shelf." This finding highlights the need for more structured communication mechanisms between departments to ensure timely utilization of older materials.

From a theoretical standpoint, this aligns with Veni's (2022) argument on record-keeping compliance in FIFO-based warehouse systems, which emphasizes that accuracy and timeliness of recording are critical to maintaining inventory reliability and preventing rotation failures. In Roti O's case, while documentation systems have been established, discrepancies still occur due to delays in information flow and human error. Therefore, integrating digital tracking systems and real-time notifications between QC and production could strengthen record accuracy and improve FIFO consistency.

Furthermore, observations during the stock-taking stage also revealed discrepancies between physical and system data. These issues are often caused by space constraints and manual recording errors. Continuous training and digitalization are essential to reduce these discrepancies and enhance operational transparency. The improvement of human resource competence and managerial supervision plays a vital role in ensuring compliance with FIFO procedures.

The overall implementation of FIFO has had a positive impact on operational efficiency, including a 30% reduction in raw material waste and smoother production flow. However, achieving sustainability requires consistent monitoring, periodic evaluation, and technological integration. In the long term, a well-implemented FIFO system contributes not only to operational efficiency but also to environmental sustainability and the fulfillment of food safety standards. Thus, the discussion underscores that the success of FIFO implementation depends on three interconnected factors: accurate record-keeping (Veni, 2022), effective interdepartmental coordination, and strong managerial commitment. Strengthening these aspects will ensure that Roti O's warehouse system becomes more reliable, transparent, and sustainable in the future.

A deeper analysis further shows that storage space limitations are not merely physical constraints but result from inefficient warehouse layout and misaligned procurement planning. In some cases, excessive ordering by the Purchasing division without adjusting to actual production capacity and stock turnover leads to overstocking. This condition disrupts FIFO rotation because older materials are often placed behind newer stock due to space limitations. Therefore, improving warehouse efficiency requires not only expanding physical space but also optimizing layout design through warehouse mapping, digital slotting systems, or ABC classification, ensuring that high-rotation materials are stored in more accessible zones.

Meanwhile, coordination and discipline issues are not simply caused by worker negligence but by the lack of cross-departmental data integration. The warehouse, production, and purchasing divisions still operate in semi-manual silos, leading to delays in sharing critical information such as expiration alerts or stock aging data. To address this, Roti O could adopt a real-time integrated Warehouse Management System (WMS) connected to the production and purchasing units, enabling automated reminders, digital labeling, and barcode tracking to maintain FIFO accuracy and minimize human error.

In addition, employee understanding and discipline can be enhanced through more contextual and data-driven approaches. Instead of relying solely on general training, the company can introduce performance dashboards that display real-time FIFO compliance metrics and conduct root-cause analysis workshops to identify recurring errors. This

method not only promotes accountability but also fosters a culture of continuous improvement aligned with Lean Warehouse principles.

From a strategic perspective, the implementation of FIFO should also be positioned within a broader inventory governance framework. This framework includes measurable indicators such as stock turnover ratios, shelf-life utilization rates, and waste percentages to evaluate FIFO performance objectively. Periodic audits and cross-functional coordination meetings can further ensure system consistency and alignment with the company's sustainability goals.

In summary, the gap between FIFO theory and field execution at Roti O Warehouse lies in structural (layout), systemic (data integration), and behavioral (discipline) dimensions. By addressing these root causes through layout optimization, digital integration, and performance-based training, the company can achieve a more consistent, efficient, and sustainable implementation of FIFO moving beyond procedural compliance toward strategic inventory excellence.

While some challenges identified in this study such as mismatched delivery schedules or fluctuating demand from production units are partly related to demand management and logistics distribution, these external issues are not the primary focus of FIFO implementation. Instead, the FIFO system functions as a mitigating mechanism that minimizes the operational losses caused by such external fluctuations. By ensuring accurate tracking and rotation of materials within the warehouse, FIFO reduces the risk of overstocking and spoilage even when upstream or downstream inconsistencies occur. Thus, FIFO contributes indirectly to stabilizing the overall supply chain by enhancing the reliability of internal inventory processes.

D. Conclusions

From the results of the study, it can be concluded that the application of the First In, First Out (FIFO) method at Warehouse Roti O plays an important role in maintaining the quality of raw materials, reducing the risk of expired materials, and increasing operational efficiency. Systematically, the FIFO method is applied through three main stages, namely raw material reception, quality control, and stock taking.

However, in practice, there are still a number of obstacles, such as limited storage space, recording errors, and a lack of understanding of the FIFO system among some staff. These obstacles have resulted in stock discrepancies, delays in the use of materials, and potential losses due to materials not being used immediately. Nevertheless, these obstacles can be overcome through training, improved discipline among warehouse staff, and managerial support in conducting regular evaluations. More broadly, the implementation of FIFO not only supports effective inventory management but also contributes to environmental sustainability by reducing food waste. This also strengthens the company's compliance with food safety standards and increases consumer confidence in product quality.

Thus, the FIFO method has proven to be an important strategy in inventory management in the food industry. To achieve greater effectiveness, Warehouse Roti O needs to continue improving aspects of implementation consistency, digital system integration, and storage

space management so that the FIFO principle can be implemented in a disciplined and sustainable manner, providing maximum benefits for the company.

Technology-based recording systems and structured warehouse organization have proven to support optimal FIFO implementation. Despite facing challenges such as space limitations and employee understanding, regular training and managerial commitment have successfully overcome these obstacles. FIFO not only impacts internal efficiency but also contributes to customer satisfaction, environmental sustainability, and the achievement of food industry standards. Therefore, the FIFO method should be adopted as a standard in inventory management for other food industries facing similar challenges.

The Role and Educational Contribution of Research Findings

The findings of this study not only enrich the field of food industry inventory management but also provide important insights for the education sector. The application of the FIFO (First-In, First-Out) method can be directly integrated into teaching materials in business, management, accounting, and vocational education programs. By using the real-life application of FIFO at Gudang Roti O as a contextual case study, students can develop a practical understanding of theoretical concepts, particularly in Supply Chain Management and Cost Accounting courses.

In addition to technical competency, the FIFO principle instills the values of discipline, accuracy, and responsibility, which are essential values in character education. For vocational education, this research serves as a valuable reference in designing practical training modules (PBL) related to warehouse management and logistics systems. This integration not only enhances students' technical competency but also prepares them for real-world operational challenges.

Furthermore, the sustainable impact of this study has strong educational significance. The 30% reduction in raw material waste is concrete data that can be used as learning material in the Green Economy and Sustainable Management theme. This figure reflects not only cost efficiency but also measurable savings in landfill disposal and carbon emission reductions. This case encourages students to develop critical thinking in sustainable management and recognize the importance of green operations. By adopting industry best practices such as FIFO into the university curriculum, the link and match between educational institutions and industry needs will be strengthened, producing graduates who are more competent, adaptable, and ready to contribute to responsible professional practice.

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