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Designing a Storage System to Reduce the Damaged and Expired Products Using Class-based Storage and FIFO at a Local Supermarket

Angela Reschyta Putri[1], Fransiska Hernina Puspitasari[2]✉

[1, 2] Department of Industrial Engineering, Faculty of Industrial Technology, Universitas Atma Jaya Yogyakarta, Indonesia

✉ **Corresponding Author:** Fransiska Hernina Puspitasari (e-mail: fransiska.hernina@uajy.ac.id)

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ABSTRACT

Good product storage systems in the warehouse affect product quality. The Alfa Omega Twin supermarket has a problem with damaged and expired products in total 46 units, resulting in a total loss of Rp559,500.00. After observation, the cause was found to be the haphazard placement of products and the absence of storage procedures. Thus, the research aims to reduce the number of damaged and expired products, also total losses. Due to the large number of products, ABC classification was used to categorize them. This classification will be used as the basis for designing a layout using class-based storage. Once the layout created, a storage standards using FIFO equipped with Standard Operating Procedures (SOP) was made. Based on the implementation results, the number of damaged and expired products decreased to nine and the total loss was Rp80,900.00. Employing both strategies through the storage arrangement and procedure, which is the distinction from other research can effectively address the problems. Practical tips on storage system that have been focused on those two strategies will assist a retail manager to keep the warehouse neat dan more organized.

INTRODUCTION

The retail industry is a business sector selling a wide range of goods and services to end consumers (Kotler & Stigliano, 2024; Elguthb & Mansur, 2025). Convenience stores, department stores, specialty stores, off-price retailers, discount stores, and supermarkets are some examples of the retail industries. However, some of these retail industries are still considered traditional due to limited information, physical conditions of their environment, and their source of capital (Reardon & Hopkins, 2006).

Due to these limitations, some retailers are experiencing some problems. The problem of storing goods is one of them. When commodities are poorly stored, they deteriorate quickly (Perkumiene, et al., 2022), may expire undetected (Sari, 2022), take a long time to find (Freitas et al., 2019), and warehouse utility declines (Gianikas et al., 2017).

Alfa Omega Twin's supermarket is a supermarket selling daily necessities, such as rice, sugar, flour, snacks, cleaning materials, personal necessities, stationery, home furnishings, and so on. This supermarket is located on Jalan Raya Baturetno-Batuwarno km 1, Baturetno, Wonogiri, Jawa Tengah. This supermarket offers both retail and wholesale merchandise. This supermarket owns three warehouses. Snacks, drinks, cleaning supplies, and instant food are kept in the first warehouse. Sugar, flour, and rice goods are kept in kilogrammes at the second warehouse. Nappies and sanitary pads are kept in the third warehouse.

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Alfa Omega Twin's Supermarket faces issues with warehouse management, including the presence of damaged goods like mice eating them, leaking goods, and ripped packaging. The buildup of goods in the warehouse is one of the reasons for this damaged product. The difficulty of organising and retrieving goods from the warehouse is also impacted by this accumulation. Another problem experienced is that expired products are often found which is usually because new products are issued first. In addition, disorganized product placement makes it difficult for employes to find desired items. The damaged and expired products cause supermarkets to be unable to sell products back to consumers and cause financial losses. Based on the results of observations for one week, the financial loss amounted to Rp 559,500 for 11 types of products consisting of cleaning products, food, and beverages and totaled 43 units.

Similar issues related to damaged and expired products were also found in several other studies. Sari (2022) found issues with damaged and expired food and non-food products in a warehouse, which were then resolved by improving the FIFO-based storage system by checking the expiration dates on product packaging. The FIFO method for resolving damaged product issues was used by Pitoy et al. (2020) and Ibadussholih et al. (2025) using recording notes containing information on the entry and exit dates of goods. Here, FIFO is able to provide good performance in handling issues with damaged and expired products.

Additionally, improving the warehouse layout is another solution to address damaged and expired products. A mineral water company that produces gallon water, bottled water, and cups experienced product damage due to inventory accumulation, which was ultimately resolved by rearranging the warehouse layout based on class-based storage as proposed by Nursyanti et al. (2024) and Kusuma (2017). This was also done by Setyawan & Fauzi (2020) and Aiba et al. (2022), which can also help warehouse staff find products more easily and maximize warehouse utilization rates. Warehouses with a low variety and quantity of products can use dedicated storage in designing their layout (Alfathi et al., 2019). Himawan & Ernawati (2023), Zaky & Hidayatulloh (2023), Yunita (2021), and Jacobus & Sumarauw (2018) improved layout design using dedicated storage for a small number of products, approximately 9-15, to help warehouse staff increase warehouse utilization rates and make it easier for warehouse employes to find goods. However, one of the drawbacks of dedicated storage is that the warehouse requires a large space because each product needs its own storage space (Saleh & Abdelmaguid, 2025), resulting in a relatively low utilization rate (Alfathi et al., 2019).

The complaints experienced by warehouse employees regarding damaged and expired products, as well as the difficulty in finding the desired items, were resolved not only by improving the warehouse layout but also by revising the warehouse storage standards (FIFO procedures). The combination of these two things is important to address the issues comprehensively, which is also a unique value of this research. Furthermore, this supermarket has several product variations and a total of 379 products that need to be arranged in the warehouse, unlike some previous studies, which had little product variation and small quantities. Therefore, the objectives of this research are to determine the reduction in the number of damaged and expired products along with financial losses within the tolerance limit set by the owner of Swalayan Alfa Omega Twin's, which is Rp 100,000.

RESEARCH METHODS

The completion of damaged and expired products is completed using two steps shown in Figure 1. The first step is to design the warehouse layout using class-based storage. Before rearranging product placement using class-based storage rules, all products need to be categorized into fast-moving, medium-moving, and slow-moving products (class-based). This step was carried out using ABC classification. After that, since the number of product types reached 379, product separation was done, dividing them into two categories: food and beverage products and cleaning products. Next, the warehouse staff will rearrange the warehouse layout and make product labels based on the alphabet. This step aims to ensure that each product has a fixed placement, making it easier for warehouse employes to find and store goods. The second step is to design FIFO-based

storage standards. This aims to prevent stored products from spoiling or expiring. To make it easier and faster for warehouse employes to pick or store items, product labeling using colorful tape is done. This storage standard needs to be standardized, which can be done by creating standard operating procedures, the final step before implementation.

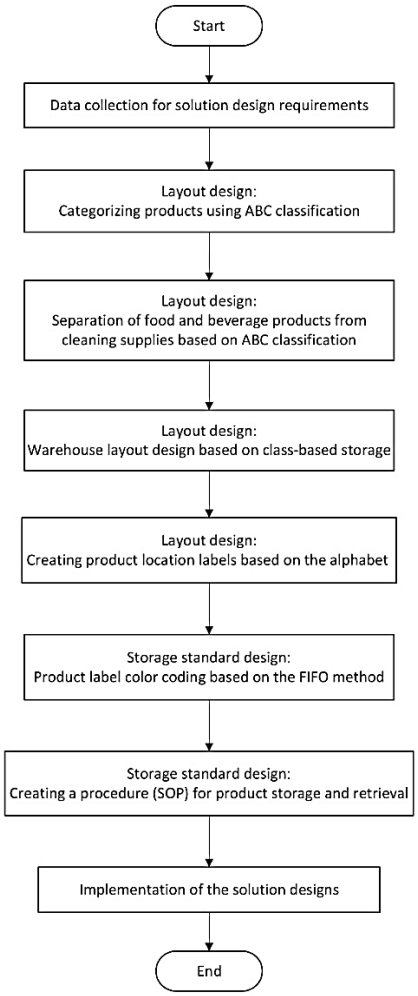


Figure 1. Steps of designing the solutions

ABC Classification

ABC classification is a determination of the type of product category that uses the principle of pareto law. As the name implies, this classification is divided into three product categories: Categories A, B, and C. Category A is a relatively small number of products with a high volume of revenue and has a percentage of 10-20% of the total inventory representing 60-80% of the revenue volume. Products that fall into this category are usually fast-moving products. Category B is a product having a percentage of 30% of the total inventory which represents 25-35% of the revenue volume and is called medium-moving products. Category C is a product having a percentage of 50-60% of the total inventory which represents 5-15% of the revenue volume and is called a slow-moving product (Reid & Sanders, 2013).

The ABC classification has several steps in the classification of goods (Reid & Sanders, 2013), namely:

1) Gather data on product type, number of product demands, and price or profit of each product.
2) Calculate the total revenue or profit of each product.
3) Calculate the percentage of revenue or profit of each product from the total revenue or profit.
4) Order products from the largest percentage to the smallest percentage.
5) Calculate the cumulative percentage of each product.
6) Classify products according to the percentage provisions of each product category group.

Class-based Storage

One use of the goods storage policy is class-based storage. The goods storage policy is an activity of arranging goods for each SKU by paying attention to the place that has been provided. The length of time employees must spend retrieving and looking for items is a result of the policy of storing goods (Gianikas et al., 2017). The storage size depends on the required storage area and storage policies. Goods storage policies are divided into four: dedicated storage, randomized storage, class-based storage, and shared storage (Francis & White, 1992).

Class-based storage is a storage policy that groups SKUs into specific categories. SKUs that are in the same category will be placed in the same storage area. The storage method uses the principle of dedicated storage because in one storage area it can only be used to store SKUs of the same category. SKUs of different categories may not be stored in that storage area even if this storage area is empty. However, SKUs stored in the storage area will be stored using the principle of randomized storage or SKU arrangement can be done randomly with the same SKUs close to each other.

Products that are classified as fast-moving products are in the front class or placed close to the product entry and exit routes from the warehouse. Products that are classified as slow-moving products are in the back class or placed far from the product entry and exit routes from the warehouse.

Goods Storage Standards

The method of storing items must be determined before establishing the standards for their storage. The method involves moving goods into and out of the warehouse. It is divided into three, namely First in First out (FIFO), Last in First out (LIFO), and First expired First out (FEFO) (Dobos, 2015).

The principle of the First in First out (FIFO) method is to use products that are purchased first to be used or carried out in the production process (Dobos, 2015). When there is a demand that must be met, then the demand can be fulfilled from the rest of the stock that enters the storage first. If the demand has not been met, then the incoming product can meet the demand. The FIFO storage method's goal is to avoid keeping goods in the warehouse for long stretches of time, which could result in damage and a decline in quality (Sembiring et al., 2018). Bread, restaurant ingredients, and food and drinks in minimarkets are examples of products with a limited shelf life that can be used with the FIFO system (Mendez et al., 2020). FIFO performs better when it comes to perishables (Ching et al., 2019).

This FIFO storage method will later be made a storage procedure, or called a standard operating procedure (SOP). SOP is a written document that contains a clearer description of guidelines or procedures in carrying out work activities set by a company. SOPs are designed to reduce mistakes in an activity that could affect the company's standards. Every document should specify the tasks and responsibilities of the person in charge, along with a clear title, nature, and purpose (Yuliana et al., 2023).

RESULTS AND DISCUSSIONS

The Initial Warehouse Condition

Alfa Omega Twin's supermarket warehouse is divided into two floors, namely the first and second floor warehouses. The warehouse layout of the first floor of the Alfa Omega Twin's supermarket has several storage areas and other supermarket areas such as the area of bulk food products, kitchen, bathroom, and laundry area. Some of these storage areas include snack food storage areas, packaged food, beverages, packaged seasoning ingredients, and cleaning supplies. When observations were made, there were some parts of the aisle that were too narrow to pass. In fact, there are some areas that do not have aisles so that products are difficult to reach. Figure 2 is the overall layout of Alfa Omega Twin's Supermarket warehouse.

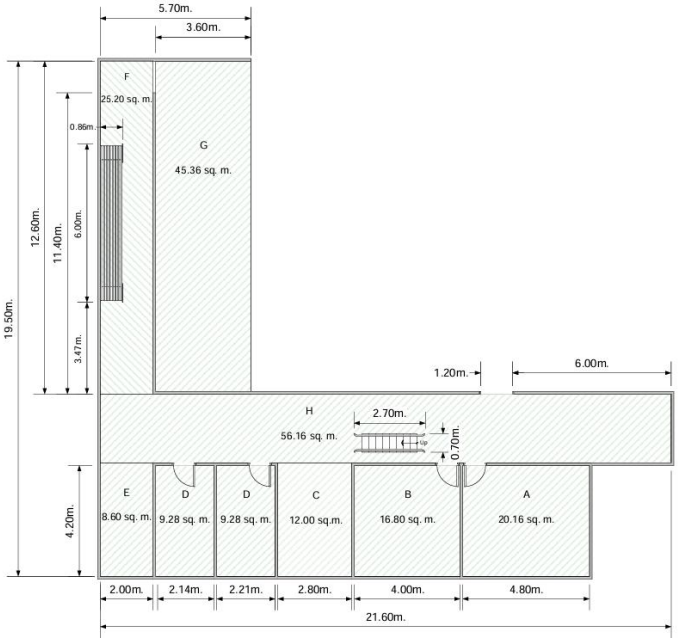


Figure 2. The warehouse layout

Notes:
A: Cleaning supplies storage area
B: Bulk food storage and package area
C: Employee kitchen
D: Bathroom
E: Laundry area
F: Cleaning supplies storage area
G: Instant food, beverage, and seasoning storage area
H: Cleaning supplies, snacks, and sachet beverage storage area

Storage area A stores cleaning products from various brands, such as Daia, Soklin, Boom, Ekonomi, Sunlight Superpell, Rinso, Vixal, Jaz1, and others. Storage area A itself is divided into five product placement areas: A1, A2, A3, A4, and A5. There is no special division in its storage. This resulted in some of the same products being placed in other product placement areas. For example, in product placement area A1, there is Soklin laundry detergent, and the same is true for area A5. There is also Ekonomi laundry detergent in area A2 and in area A5. Additionally, some cleaning products that do not fit in storage area A will be stored in storage area F.

Storage area G stores instant food products, instant seasonings, and bottled drinks. This area has four storage areas for these products: G1, G2, G3, and G4. Area G1 stores instant seasoning products, such as Bango, Indofood Fried Chicken, Indofood Sweet Soy Sauce, ABC Soy Sauce, and Mazzoni Seasoning Powder. However, this area also contains some bottled drinks, such as Cimory UHT, Cimory Yoghurt, Freiss Squash, Clevo UHT, Good Day Botol, Club Gelas, and Larutan Cap Badak. Area G2 has a relatively small room size, so it is only used to store bottled drinks, specifically mineral water, such as Aqua, Le Minerale, and Vit. Area G3 stores a large number of instant food products, including Indomie, Pop Mie, Sarimi, Mie Sedap, Sukses Mie, and Supermi. Additionally, a small amount of mineral water products are stored in this area, namely Aqua and Ow Air Mineral. Some instant seasoning products and bottled drinks that did not fit in the G1 area were stored in the G4 area.

Storage area H holds several types of cleaning supplies, snacks, and sachet drinks. Storage area H is divided into several product placement areas, namely H1, H2, H3, H4, H5, and H6. There is no specific product division in each of these areas, so some products are the same as in other product placement areas or other storage areas. In this area, there are several types of cleaning products stored in the same area as snacks and sachet drinks. For example, in the A5 snack placement area, snacks like Beng-beng, Blaster candies, Kis, Kopiko, Mentoz, and Yupi are stored together with cleaning products such as Giv soap, Lifebuoy, Lux, Nuvo, and Rejoice shampoo. Oreo products can be found in both the H1 and H3 areas. Nabati wafer products are

also found in both the H1 and H4 areas. Roma biscuit products are also found in both the H1 and G1 areas.

The warehouse layout on the second floor has storage area J, which is used to store sachet drink products, snacks, and instant food. Storage area J is divided into four product placement areas: J1, J2, J3, and J4. These four areas do not have any special divisions in their arrangement. In area J1, Energen sachet drink products are stored; the same products are found in area H5. Sachet coffee products are also found in areas J2, J3, J4, and H6 (first-floor warehouse). Figure 3 and Figure 4 are two examples of initial layout drawings for storage areas A and G.

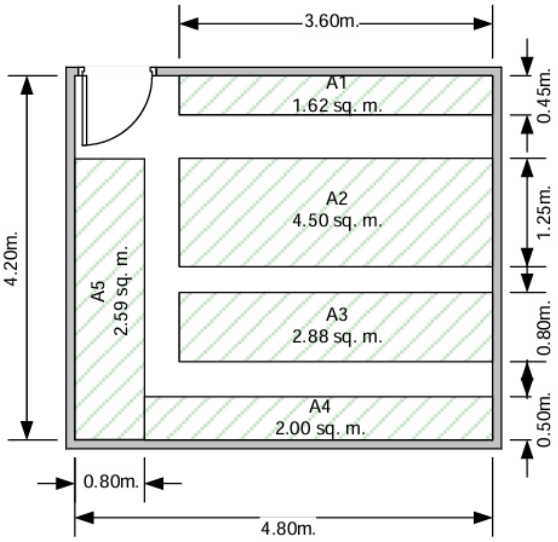


Figure 3. Initial Layout of Storage Area A

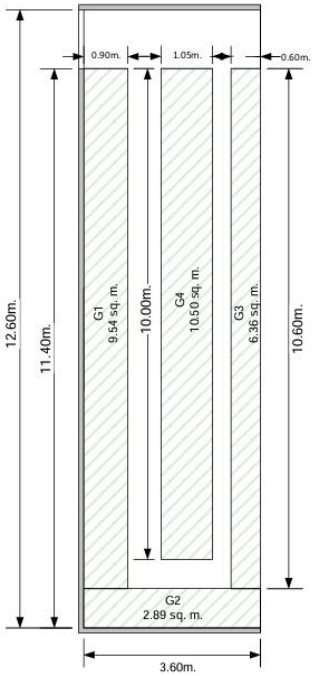


Figure 4. Initial Layout of Storage Area G

Layout Improvement Using Class-based Storage

Redesigning the warehouse arrangement is the answer to Alfa Omega Twin's supermarket issue with damaged and expired goods. The class-based storage approach was used to construct this architecture. Each product SKU is grouped into a particular category using the class-based

storage approach. According to the supermarket owner's interviews, the warehouse layout design can make it simpler for staff to organise and retrieve goods in the warehouse, particularly for items with a high turnover rate.

ABC classification was chosen as the product classification method for layout design in this supermarket. This classification uses product sales data and selling prices to group all product SKUs. Regarding the permits from the supermarket, sales and selling price data use historical data from January to March which was obtained from the author's observation. ABC classification was determined using the cumulative revenue absorption percentage to group products into categories A (fast-moving), B (medium-moving), and C (slow-moving).

Product Category Grouping

Alfa Omega Twin's supermarket sells a wide variety of product categories, including food, beverages, toiletries, laundry soap, floor cleaners, and much more. Those products are stored in a warehouse. There are approximately over three hundred products stored in that warehouse. The products will be classified using ABC analysis based on the revenue volume earned by Alfa Omega Twin's supermarket. This revenue is calculated from the selling price per product. Additionally, product sales data is used in product classification using ABC analysis.

After collecting unit selling price data and product sales data, the next step is to classify the products using ABC analysis. The percentage comparison for products in category A (fast-moving products) is 10-20% of the total number of products, representing a revenue absorption of 60-80%. Category B (medium-moving product) uses a percentage comparison of 30% of the total product quantity, representing a revenue absorption of 25-35%. Meanwhile, the percentage comparison for category C products is 50-60% of the total number of products, representing a revenue absorption of 5-15% (Rein & Sanders, 2013). Out of the 379 products, 67 belong to the fast-moving product category, also known as category A, according to the calculation results. There are 114 items in the category B, or medium-moving product category. Lastly, there are 198 products in category C, which is the slow-moving product category.

Based on the Head Regulation BPOM RI No. HK.031.23.12.11.10569 used for layout design and storage, non-food ingredients need to be stored separately (https://e-sertifikasi.pom.go.id/assets/uploads/peraturan). After previously categorising product types into three categories based on the percentage of revenue absorption, the next step is to separate the product types. The product types were divided into two categories: food and beverages, and non-food products (cleaning supplies, pesticides, and other materials). The results of separating food and beverage products consisted of 282 items, while non-food products comprised 97 items.

Warehouse Layout Design

All products stored in the supermarket warehouse are packaged using cardboard boxes. The product cardboard dimension data is used to determine the storage area requirements for each product in the supermarket warehouse, while the maximum stack data is used to determine the stacking limit for product arrangement.

The proposed layout design was adjusted to fit the area and size of the warehouse currently in use. In addition, product placement is also adjusted to the closest distance to the warehouse entrance and exit, meaning category A products will be closer to the product entrance and exit doors compared to category B and C products. Meanwhile, category B products will be closer to the product entrance and exit doors compared to category C products (Tompkins, 2010). In creating the proposed warehouse layout, products were also sorted alphabetically, as requested by the supermarket owner, to make it easier for employees to find products. The storage allocation for each product in each area cannot be changed. For example, area A will continue to be used for storing cleaning products; the same goes for other storage areas.

The first layout design result is for the warehouse on the first floor. Cleaning products in categories A, B, and C are stored in area A and sorted alphabetically by category. Previously, some

scattered cleaning products were stored in area F. Table 1 shows a list of products stored in area A, already sorted alphabetically.

Table 1. A product list stored in area A

No	Products	Category
1	Daia 800 gr Softener	A
2	Downy Sunrise Fresh 14 ml renteng	A
3	Head & Shoulders saset Menthol renteng 12	A
4	Jaz1 1.6 kg Semerbak Cinta	A
5	Jaz1 1.6 kg Semerbak Segar	A
...	...	...
18	Sunsilk Shampoo saset renteng 24 Black Shine	B
19	Clear Shampoo renteng 12 Ice Cool Menthol	B
20	Daia 1.8 kg Floral Blossom	B
21	Daia 1.8 kg Fresh Lemon	B
22	Daia 1.8 kg Clean & Fresh	B
...	...	...
55	Zinc Shampoo saset Rontok renteng	B
56	Baygon Jumbo Lavender	C
57	Boom 350 gr Jeruk Nipis	C
58	Boom 350 gr Merah	C
59	Boom 350 gr Putih	C
...	...	...
97	Zen Shiso Soap 80 ml Sulphur	C

The second layout design is storage area G, which consists of food products, ingredients, and beverages from categories A, B, and some products from category C. Some category C products stored in this area are those starting with the letters A through G. The total number of products stored in area G is 154. Storage room F, which holds food items, ingredients, and drinks from category C, is the third layout design outcome. Some products in this category stored in this area are those starting with the letters H through K, totalling 30 products. Category C products with letters L through T are stored in storage area H. The number of these products is 91. The next layout design result is the second-floor warehouse, specifically storage area J, which consists of category C products with letters U through Y, totalling 7 products. Figure 5 and Figure 6 are images showing the warehouse layout of areas A and G.

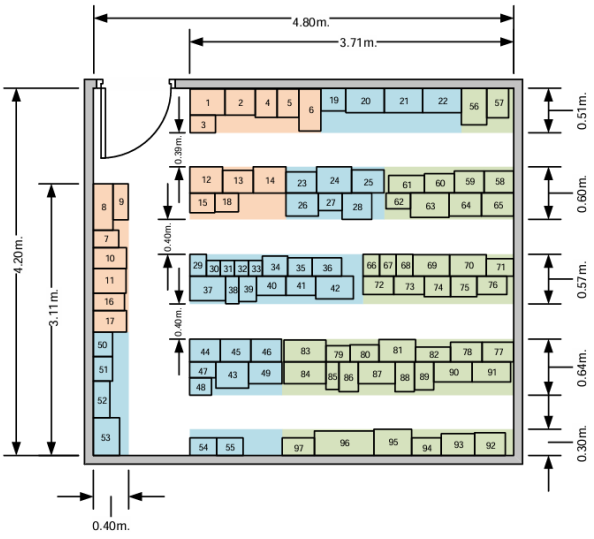


Figure 5. The layout improvement for area A

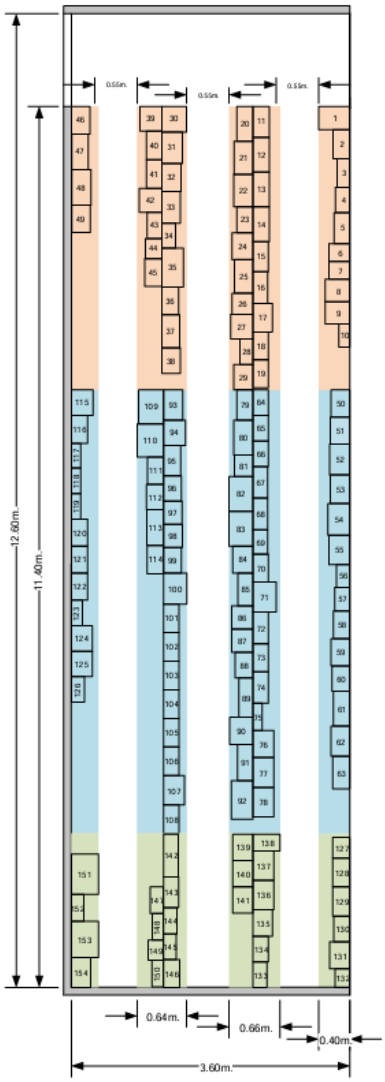


Figure 6. The layout improvement for area B

Creating Product Location Information Label

Next, the product location information labels are created. The creation of product location labels is used to provide information for each product category area and the location of products alphabetically, making it easier for employees to organise and find products. Each product category has a different colour for the label paper, as shown in Figure 7.

Figure 7. Information label for non-food products (cleaning products)

Each product category is labeled with product descriptions placed in that area, arranged alphabetically according to each product, as shown in Figure 8.

Figure 8. Alphabet information label for non-food products (cleaning products)

Improvement of Storage Standards

The problem of damaged and expired products in the first warehouse of Alfa Omega Twin's Supermarket is divided into two solutions: layout design and storage standard improvement. The standard storage improvement method uses FIFO by attaching different colour labels for each week. The implementation of the standard storage improvement is also done by creating standard operating procedures (SOPs) to provide written explanations to employees (Akyar, 2012; Raghuram & Arjunan, 2022). The SOPs created relate to the procedures for storing and retrieving products at the Alfa Omega Twin's Supermarket warehouse, so that the FIFO method can run smoothly.

1. Product Label Colour

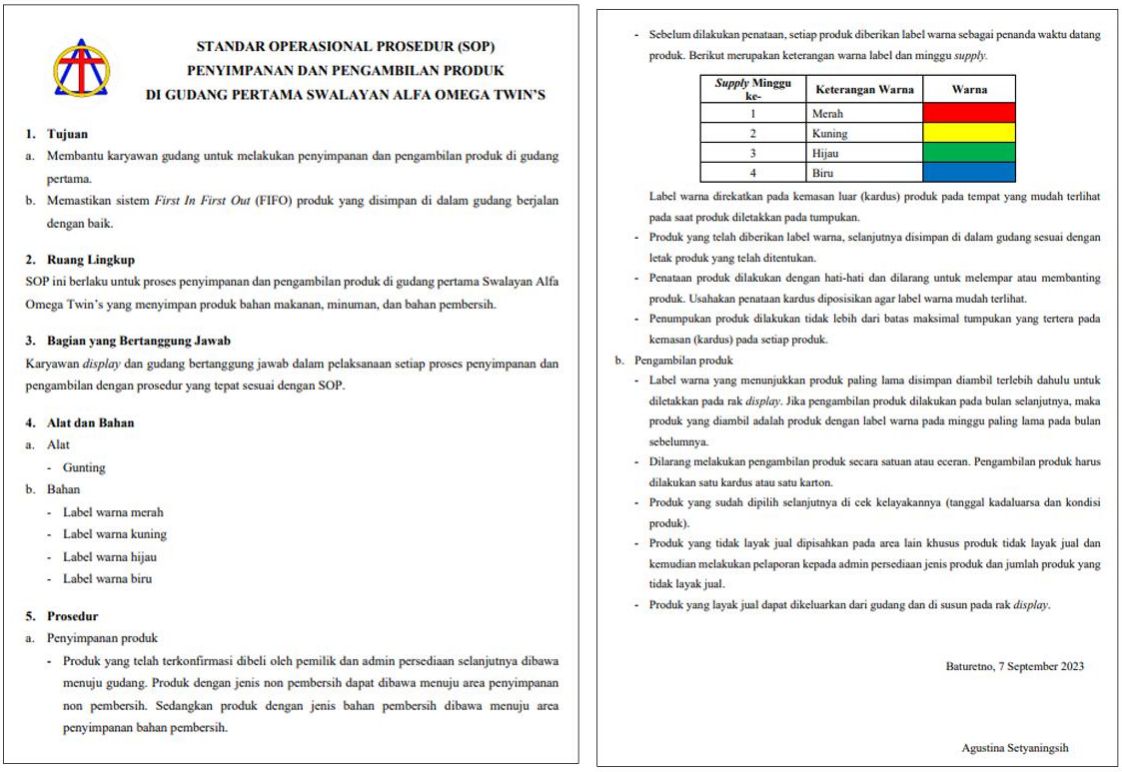
The colour labels will be affixed to the packaging or boxes of each product. The difference in colour of the labels affixed can make it easier for employees when retrieving products, helping them identify which product to pick first.

The product labelling process is done when the product arrives or before the product is stored in the warehouse. Additionally, product labelling needs to be adjusted based on the week the product arrives. Each week, four new colour codes are utilised as differentiators. The red colour code is used for products supplied in the first week; the yellow colour code is used for supplies in the second week; the green colour code is used for product supplies in the third week; the blue colour code is used for product supplies in the fourth week.

The colour labels are also used to determine which products will be taken first, so employees need to look at the colour labels on the product packaging. Products with colour labels indicating the longest storage time will be taken first and placed on the display shelves. If product retrieval is done in the following month, the products taken will be those with the colour label from the oldest week in the previous month. The procedures for product labelling, warehouse arrangement, and product retrieval will be outlined in the SOP.

2. Forming Standard Operating Procedure (SOP)

The first SOP is the procedure for storing and retrieving products, as shown in Figure 9. The purpose of this SOP is to assist employees, especially those in the display and warehouse departments, in storing and retrieving products. Additionally, this SOP is expected to ensure the FIFO system functions properly, supporting the layout design that has been implemented. The second SOP is a procedure that regulates the placement of products according to the layout design that has been created. The purpose is to assist employees in performing and ensuring that product placement is in accordance with the layout design that has been prepared.



STANDAR OPERASIONAL PROSEDUR (SOP)
PENYIMPANAN DAN PENGAMBILAN PRODUK
DI GUDANG PERTAMA SWALAYAN ALFA OMEGA TWIN'S

1. Tujuan

a. Membantu karyawan gudang untuk melakukan penyimpanan dan pengambilan produk di gudang pertama.
b. Memastikan sistem *First In First Out* (FIFO) produk yang disimpan di dalam gudang berjalan dengan baik.

2. Ruang Lingkup

SOP ini berlaku untuk proses penyimpanan dan pengambilan produk di gudang pertama Swalayan Alfa Omega Twin's yang menyimpan produk bahan makanan, minuman, dan bahan pembersih.

3. Bagian yang Bertanggung Jawab

Karyawan *display* dan gudang bertanggung jawab dalam pelaksanaan setiap proses penyimpanan dan pengambilan dengan prosedur yang tepat sesuai dengan SOP.

4. Alat dan Bahan

a. Alat
- Gunting

b. Bahan
- Label warna merah
- Label warna kuning
- Label warna hijau
- Label warna biru

5. Prosedur

a. Penyimpanan produk
- Produk yang telah terkonfirmasi dibeli oleh pemilik dan admin persediaan selanjutnya dibawa menuju gudang. Produk dengan jenis non pembersih dapat dibawa menuju area penyimpanan non pembersih. Sedangkan produk dengan jenis bahan pembersih dibawa menuju area penyimpanan bahan pembersih.
- Sebelum dilakukan penataan, setiap produk diberikan label warna sebagai penanda waktu datang produk. Berikut merupakan keterangan warna label dan minggu *supply*.

Supply Minggu ke-	Keterangan Warna	Warna
1	Merah	
2	Kuning	
3	Hijau	
4	Biru	

Label warna direkatkan pada kemasan luar (kardus) produk pada tempat yang mudah terlihat pada saat produk diletakkan pada tumpukan.
- Produk yang telah diberikan label warna, selanjutnya disimpan di dalam gudang sesuai dengan letak produk yang telah ditentukan.
- Penataan produk dilakukan dengan hati-hati dan dilarang untuk melempar atau membanting produk. Usahakan penataan kardus diposisikan agar label warna mudah terlihat.
- Penumpukan produk dilakukan tidak lebih dari batas maksimal tumpukan yang tertera pada kemasan (kardus) pada setiap produk.

b. Pengambilan produk
- Label warna yang menunjukkan produk paling lama disimpan diambil terlebih dahulu untuk diletakkan pada rak *display*. Jika pengambilan produk dilakukan pada bulan selanjutnya, maka produk yang diambil adalah produk dengan label warna pada minggu paling lama pada bulan sebelumnya.
- Dilarang melakukan pengambilan produk secara satuan atau eceran. Pengambilan produk harus dilakukan satu kardus atau satu karton.
- Produk yang sudah dipilih selanjutnya di cek kelayakannya (tanggal kadaluarsa dan kondisi produk).
- Produk yang tidak layak jual dipisahkan pada area lain khusus produk tidak layak jual dan kemudian melakukan pelaporan kepada admin persediaan jenis produk dan jumlah produk yang tidak layak jual.
- Produk yang layak jual dapat dikeluarkan dari gudang dan di susun pada rak *display*.

Baturetno, 7 September 2023

Agustina Setyaningsih

Figure 9. SOP for product storage and retrieval

Implementation

The layout design implementation and storage standard improvement were carried out over a week. After implementation, there was a decrease in the number of damaged and expired products found in the Omega Twin's Supermarket warehouse.

Compared to the initial conditions before implementation (Table 2), there was a decrease in the number of damaged and expired products, from 46 units to 9 units in one week. Additionally, the losses incurred from damaged and expired products decreased to below the supermarket owner's loss tolerance limit of Rp100,000. The owner's response also stated that the warehouse conditions looked neat, clean, and comfortable to see after implementation. Display and warehouse employees find it easier to locate products because the product locations are not scattered. Colour labels also make it easier to determine which products to release first without having to check and compare each product's expiration date individually. Plus, counting and checking product stock becomes easier because products of the same type are in one storage area.

Table 2. Decrease in damaged and expired products

Products	Selling price	The quantity of damaged and expired products	Loss
Daia 800 kg Fresh Lemon Rinso Liquid	Rp18,600.00	3	Rp55,800.00
42 ml Rose Fresh renteng 12	Rp10,600.00	1	Rp10,600.00
Sedap Kare	Rp2,900.00	5	Rp14,500.00
The loss total			Rp80,900.00

CONCLUSION

Poor inventory management can cause products to spoil and expire quickly. Improving warehouse layout, along with proper and easily implemented goods storage procedures, helps reduce the number of damaged and expired products. Layout improvements using class-based storage principles help classify goods based on popularity level (fast-moving, medium-moving, and slow-moving). The area remains easy for employees to find items. The procedures governing product placement according to the designed layout are created to ensure items are arranged according to the principles of class-based storage. Additionally, procedures related to storing and retrieving goods are implemented as a form of first-in, first-out. The use of colour-coded labels as indicators of the goods' entry period helps employees monitor items with varying supply periods. Both of these solutions can be implemented at Alfa Omega Twin's Supermarket and successfully reduce the number of damaged and expired products by 79.07% (from 46 units to 9 units), while also decreasing losses by 85.54% (from Rp559,500.00 to Rp80,900.00).

Nevertheless, the supermarket must continue to monitor the placement of products according to their layout and established procedures. Retailers should also conduct regular stock opname to ensure the quality of products stored in the warehouse is maintained. In the future, the layout of product displays within supermarkets needs to be evaluated to prevent product damage and expiration. This display arrangement contributes to increasing sales volume for the often-overlooked retail industry, especially by local retailers.

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