Available online at: http://publikasi.mercubuana.ac.id/index.php/ijiem

IJIEM (Indonesian Journal of Industrial Engineering & Management)

ISSN (Print) : 2614-7327 ISSN (Online) : 2745-9063

Inventory Management of Spare Parts Using ABC Classification Method (Case Study: PT Bina Sarana Sukses)

Ayup Mentaruk*, Farida Djumiati Sitania, Wahyuda
Faculty of Engineering, Mulawarman University, Jalan Sambaliung No.9, Samarinda City, East Kalimantan 75119 Indonesia

ARTICLE INFORMATION

Article history:

Received: 7 July 2024
Revised: 9 September 2024
Accepted: 10 Marh 2025

Category: Research paper

Keywords:
Inventory
Spare parts
ABC
Classification

DOI: 10.22441/ijiem.v6i2.28212

A B S T R A C T

The increasing coal production directly requires special attention in inventory management. This research aims to categorize spareparts inventory based on ABC classification. PT Bina Sarana Sukses has 20,108 spare parts. The method used is ABC classification, dividing inventory into three categories based on the type of inventory and the amount of capital used. The classification results in three classes A, B, and C. Class A absorbs IDR 9,482,425,725 or 80.5% of the total inventory value, consisting of 26 items (25%). Class B absorbs IDR 1,819,909,151 or 15% of the total inventory value, consisting of 33 items (32%). Class C absorbs IDR 478,231,982 or 4.5% of the total inventory value, consisting of 45 items (43%). Based on the classification results, different control strategies are applied for each spare part class. Class A includes strict supervision, automatic ordering, and procurement priority. Class B includes periodic control and supplier evaluation. Class C includes minimal control and needs evaluation.

*Corresponding Author
Name
E-mail:

1. INTRODUCTION

The rapid advancement of the times has led to increased competition in the industrial world. This development is marked by the rise in the number of new companies, creating a more competitive business environment. One of the rapidly growing industrial sectors in Indonesia is coal mining. According to data from the, Ministry of Energy and Mineral Resources (2023), coal production growth in 2023 reached 775.2 million tons, or 112%. The increasing coal production directly necessitates special attention in inventory management. Spare parts inventory plays a very important role due to the fact that the smooth operation of heavy equipment and machinery in the company heavily relies on the availability and feasibility of spare parts inventory (Sofia et al., 2020)). Therefore, to maintain operational sustainability and productivity, good inventory management is needed.

To achieve good inventory management, companies can use inventory management systems to become more effective and efficient. Inventory management is used to regulate the amount of inventory stored. Inventory is applied to anticipate demand fulfillment and reduce excess or shortage of goods (spare parts) in the warehouse. According to Meyliawati and Suprianto (2016) in Lutfiana dan Puspitosari (2020), if the availability of goods (spare parts)

is not met when there is a demand, then an appropriate inventory management system is needed so that the company's inventory can be well controlled. If the amount of inventory is too large, it will incur high storage costs and risk of goods damage. However, if the inventory is too little, it can risk causing a stock out.

PT. Bina Sarana Sukses Site BSSR in East Kalimantan, a mining contractor company, is engaged in mining services. This company has heavy equipment along with its spare parts, which are used for smooth operations. PT. Bina Sarana Sukses Site BSSR East Kalimantan has a warehouse for storing items such as spare parts, consumables, tires, modules, and fluids. This warehouse functions to store items needed by the plant department. Based on initial observations, the spare parts in the warehouse are very varied and number 17,915. These items have different types and brands and are used for the repair of heavy equipment units and the company's maintenance needs. At PT. Bina Sarana Sukses Site BSSR East Kalimantan, there are warehouse issues caused by the relocation to a new warehouse and the large number of items in the warehouse. The resulting impacts include difficulties in finding the location of spare parts, damage, uncontrolled spare parts, minimal and maximal reordering levels not functioning well, and obsolescence, thus reducing the company's profit.

Based on the above issues, calculations can be performed using the ABC method. The ABC method was introduced by HF Dickie in the 1950s and developed by Vilfredo Pareto (Roni, 2016). The ABC method is a method used for inventory classification utilizing the Pareto principle. The parameter used for the ABC classification method is the annual usage of each item. The current general strategy in inventory management is the ABC classification, which consists of three categories: A, B, and C based on the type of inventory and the amount of capital used (Lin and Ma, 2021). By understanding the criteria for each class, inventory items that require special attention and those that only need to be checked sporadically (at certain times) can be identified. Therefore, it is evident that inventory management is essential in company operations to anticipate risks that may cause production processes to halt.

From the background explained above, this research will manage inventory by classifying spare parts inventory using the ABC classification method at PT Bina Sarana Sukses.

2. LITERATURE REVIEW

2.1 Warehouse

In company operations, the initial step to produce a product is through production activities. To ensure the product reaches consumers effectively, warehouse management becomes essential as a secure storage place. The function of a warehouse in storing production results for a certain period is very important, and the distribution of products to the intended locations depends on demand. Challenges in warehouse management involve the accuracy of goods movement and the calculation of storage periods. Active control of goods movement and documentation is required to increase warehouse usage efficiency so that the quantity and duration of goods storage can be managed with minimal value or according to the plan.

Warehouse management has a direct impact on business continuity, especially in relation to sales. Discrepancies between warehouse inventory and sales levels can result in losses, either due to failed sales or excessive stock accumulation. A warehouse management system is a key component in the supply chain, with the main goal of controlling various processes within it, such as shipping, receiving, storage, movement, and retrieval or issuance. With a warehouse management system, control over movement and storage can be improved, space utilization within the warehouse can become more efficient, and the accuracy in assessing stock quantities can be significantly enhanced (Jacobus and Sumarauw, 2018).

2.2 Definition of Spare Parts

According to Mehdila dan Umagapi (2019), spare parts are products consisting of several components that form a single unit with a specific function. Two types of spare parts that can be combined into a single sentence are genuine spare parts, which are authentic, and counterfeit spare parts. In terms of price, counterfeit spare parts are much more economical compared to genuine ones.

2.3 Inventory Management

According to Indrajit (2003) in Wahyudi (2015), inventory management is the process of execution to achieve certain goals conducted through supervision. Several experts have put forward definitions of inventory management. According to Indrajit in his work, inventory management is defined as activities related to the planning, execution, and supervision of determining material needs in a way that ensures the fulfillment of operational requirements in a timely manner and optimizes material investment.

On the other hand, according to Manullang (2005) in Wahyudi (2015), inventory management is described as the activity of organizing, supervising, and procuring materials according to the required quantity and timing at minimum cost to determine the level and composition of inventory. Thus, it can be concluded that inventory management involves planning, execution, and supervision of material needs, as well as determining the level and composition of inventory to ensure smooth production.

2.4 Inventory

Inventory is a current asset with significant risks in company operations if not properly managed. The risks that may arise can be physical or financial. For example, physically, risks can occur in the form of fraud regarding inventory in the warehouse due to lack of supervision and damage to goods, which can disappoint consumers. Financially, risks can arise if there are recording errors resulting in losses in the accounting period. In the context of industrial companies, the term inventory includes raw materials, work-in-process goods, and finished goods. Inventory has two main characteristics: ownership by the company and availability for sale to consumers. Therefore, in trading companies, there is only one type of inventory known, namely merchandise inventory (Riani & Wiyono, 2016).

According to Martono (2002) in Wahyudi (2015), inventory itself is a major component of working capital that is constantly changing. Without inventory, companies risk being unable to meet customer demands for their products. Therefore, in managing inventory, a balanced investment is necessary, not too low but also not too high. Several experts have provided definitions of inventory, describing it as a very dynamic element in company operations that is continuously acquired, transformed, and then resold.

2.5 Types of Inventory

Inventory has various types, each with its own specific characteristics and management approaches. According to Assauri (2004) in Wahyudi (2015), inventory can be categorized into several types as follows: (1) Raw Material Stock**:** Inventory of tangible goods used in the production process. These goods can be sourced from natural resources or purchased from suppliers or raw material producers. (2) Purchased Part**:** Inventory of goods consisting of parts received from other companies. These items can be directly assembled with other parts without going through a prior production process. (3) Supplies Stock**:** Inventory of goods or materials used in the production process to support production smoothness but are not part of the finished product. (4) Work in Process/Progress Stock**:** Inventory of goods that have passed through each stage in a factory or materials that have been processed into a certain form but still require additional processing before becoming finished goods. (5) Finished Goods Stock**:** Goods that have been fully processed or manufactured in the factory and are ready to be sold to customers or other companies.

2.6 Inventory Function

Inventory control is a crucial managerial function because physical inventory often involves significant investment. If a company allocates too much funding to inventory, it can lead to excessive storage costs and potentially incur an "opportunity cost" (funds that could be invested in more profitable investment opportunities). Conversely, if a company does not have adequate inventory, it can lead to increased costs due to material shortages. The term inventory encompasses everything or all

company resources stored with the expectation of meeting demand, whether from internal or external sources. This includes raw materials inventory, work-in-process inventory, finished goods or final products, auxiliary or complementary materials, and other components that are part of the company's product output (Wahyudi, 2015).

2.7 Inventory Control

Inventory control is a system implemented by a company as a report to upper management and inventory managers, serving as a tool for evaluating inventory performance and assisting in the formulation of inventory policies. This report includes information on the desired inventory levels, operational costs of inventory, and investment levels, which can be used as a basis for comparison with other periods (Wahyudi, 2015).

According to Matz (1994) in Sofia et al. (2020), inventory control systems and techniques need to be established based on the following principles: (1) Inventory results from various aspects such as the purchase of materials and spare parts, additional work costs, and the overhead required to manage materials into finished goods. (2) Inventory reduction occurs through the process of sales and damage. (3) Accurate estimation of sales and production schedules is a key factor for efficiency in purchasing, billing, and material investment. (4) Management policies that create a balance between the variety and quality of inventory to support efficient operations with inventory holding costs are the most crucial factor in determining the company's investment. (5) Ordering materials should be a response to forecasts and production control planning. (6) Simply recording inventory does not achieve adequate control over inventory.

2.8 Inventory Factors

Although inventory offers many benefits for companies, companies must be cautious in setting inventory policies. Inventory involves investment costs, and therefore, management's task is to determine the optimal investment in inventory. Inventory issues present a challenge in asset management, where companies use their funds in inventory efficiently. Most companies recognize the need to maintain inventory to ensure smooth operations. According to Riyanto (2001) in Wahyudi, (2015), the size of the inventory held by a company is influenced by several factors, such as: (1)The volume of inventory needed to protect the company from stockouts that can disrupt production. (2) The planned production volume, which depends on the planned sales volume. (3) The amount of raw material purchased each time to minimize purchasing costs. (4) The estimated future price fluctuations of raw materials. (5) Government regulations related to material inventory. (6) The purchase price of raw materials. (7) Storage costs and storage risks in the warehouse. (8) The rate at which materials deteriorate or experience a decline in quality.

2.9 Inventory Classification Using the ABC Method

The ABC classification method is an inventory management technique that groups items based on their usage level. This concept emphasizes that the importance of inventory depends on high usage levels, despite having a relatively small number of items. According to Herjanto (2007) in Chatisa et al. (2019), the grouping in ABC classification is divided into three categories: (1) Category A includes items that account for about 70%-80% of the total inventory investment, with the quantity of items around 10%-20% of all items managed. The cumulative percentage reaches approximately 75%. Items in Category A are placed at the front of the warehouse for easy access by warehouse staff. (2) Category B consists of items that account for about 15% of the total inventory investment (after Category A), with the quantity of items around 20%-40% of all items managed. The cumulative percentage ranges between 75%-95%. Items in Category B are placed after the Category A boundary or in the middle of the warehouse. (3) Category C includes items that account for about 5% of the total inventory investment (excluding A and B), with the quantity of items around 50%-60% of all items managed. The cumulative percentage reaches between 95%-100%. Items in Category C are placed at the back of the warehouse.

The procedures and steps for grouping items in ABC analysis are as follows (Ermayana

Megawati et al., 2021): (1) Determine the number of units for each type of item. (2) Determine the unit price for each type of item. (3) Calculate the total monetary value for each type of item by multiplying the unit price by the number of units. (4) Sort the items based on total monetary value, with items having the highest total monetary value placed first. (5) Calculate the cumulative percentage of the number of item types. (6) Calculate the cumulative percentage of the monetary value of the items from the total monetary value. (7) Form classes based on the percentage of items and the percentage of the monetary value of the items. (8) To illustrate the importance level, generate an ABC analysis curve (Pareto Diagram).

2.10 Pareto Diagram

According to Evan and Lindsay (2007) in Gunawan dan Tannady (2016), the Pareto Diagram is a visual representation of data in the form of a histogram that ranks frequencies from largest to smallest and also calculates their accumulation. This diagram serves as a tool for management to quickly identify the most critical areas requiring special attention and prompt handling. The Pareto analysis process involves ranking opportunities to determine the priority of potential opportunities that should be pursued first. Pareto analysis is essential at various stages of quality improvement programs to determine the next steps to be taken.

3. RESEARCH METHOD

The data required in this research are primary and secondary data. Primary data is obtained through interviews regarding the condition of the warehouse and suppliers. Interviews are conducted with storemen or warehouse staff in the logistics department. Secondary data is obtained from the company's historical data, namely the annual demand or expenditure data of spare parts and the spare parts price per unit. The steps in this research are explained in the flowchart which can be seen in Figure 1.

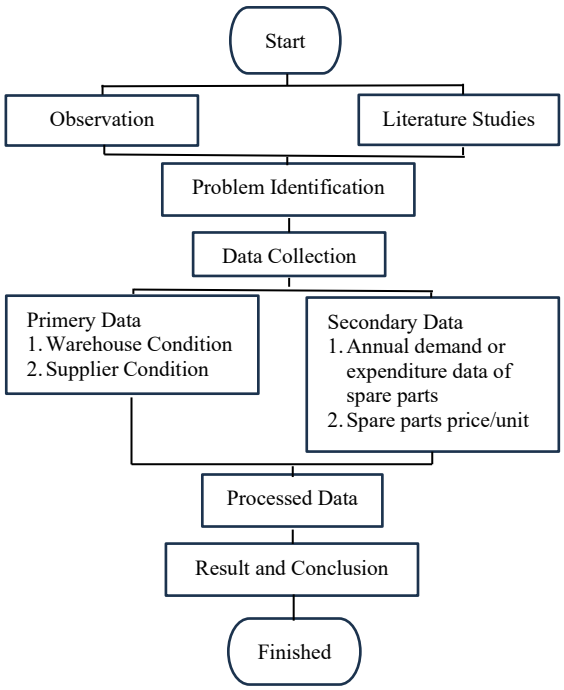

Figure 1. Flowchart analysis stages

4. RESULT AND DISCUSSION

The spare parts demand data used is the historical spare parts demand data over 12 months, which will then serve as the reference data for processing. The historical spare parts demand data is obtained through spare parts expenditure reports. The following are 104 spare parts expenditure data points over 12 months, which can be seen in Table 1.

Table 1. Inventory data

No	Material number	Material name	Annual demand	Unit	Price/unit
1	1000068064	Lining Brake Rr Wb	3957	PC	94.405
2	1000004181	Lining Brake Rr Ibk	2096	PC	119.407
3	1000036288	Fuel/Water Separator Fleetguard	2049	PC	300.207
…	…	…	…	…	…
104	1000018014	Breather Komatsu (Ut)	110	PC	361.712

Upon collecting the data obtained from the company over 12 months, data processing is then carried out. The data processing is done through ABC classification calculations. Several steps are taken, including calculating the annual volume value, the annual percentage value, and the cumulative annual percentage value.

4.1 Annual Volume Value Calculation

The annual volume value calculation results are obtained by multiplying the price per unit by the annual demand per unit (Ermayana Megawati et al., 2021). Calculations are provided as examples for items number 1. The complete data for the annual volume values can be seen in Table 2 as follows.

The calculation for the annual volume value for material number 1000068064:

Annual volume (Rupiah) = 3957 × 94.405
= 373.562.322

Table 2. Annual volume value

No	Material number	Material name	Annual demand	Unit	Price/unit	Annual volume value
1	1000068064	Lining Brake Rr Wb	3957	PC	94.405	373.562.322
2	1000004181	Lining Brake Rr Ibk	2096	PC	119.407	250.277.285
3	1000036288	Fuel/Water Separator Fleetguard	2049	PC	300.207	615.124.098
…	…	…	…	…	…	…
104	1000018014	Breather Komatsu (Ut)	110	PC	361.712	39.788.353

4.2 Annual Volume Percentage Calculation

After obtaining the annual volume value, the items with the highest total monetary value are placed in the first position according to the procedures and steps in the ABC analysis classification (Ermayana Megawati et al., 2021). The next step, after determining this order, involves calculating the annual volume percentage, as exemplified by item number 1. The complete data for the annual volume percentage values can be seen in Table 3 as follows.

The calculation for the annual volume percentage value for material number 1000068064:

$$\text{Annual Volume Percentage} = \frac{2.262.000.000}{11.780.566.858}$$
$$= 19.2011\%$$

Table 3. Annual volume percentage value

No	Material number	Material name	Annual demand	Unit	Price/unit	Annual Volume Value	Annual Volume Percentage Value
1	1000080188	Filter 10 Micron N32On-Df010-Fa42F Hydac	390	PC	5.800.000	2.262.000.000	19.2011%
2	1000022070	Starmet Tooth V Mtg	222	PC	7.352.974	1.632.360.199	13.8564%
3	1000036288	Fuel/Water Separator Fleetguard	2049	PC	300.207	615.124.098	5.2215%
…	…	…	…	…	…	…	…
104	1000063160	Rivet Lgmg	110	PC	1.486	163.432	0.0014%

4.3 Cumulative Annual Volume Percentage Value

After obtaining the annual volume percentage, the cumulative annual volume percentage is then calculated (Ermayana Megawati et al., 2021). For example, the cumulative annual volume percentage calculation for items number 1 and 2 falls within the 0-80% range and is classified as class A.

The complete data for the cumulative annual volume percentage can be seen in Table 3 as follows:

1. Cumulative annual volume percentage = 19.2011% = 19.2011%
2. Cumulative annual volume percentage = 19.2011% + 13.8564% = 33.0575%

Table 4. Cumulative annual volume percentage value

No	Material Number	Material Name	Annual Demand	Unit	Price/Unit	Annual Volume Value	Annual Volume Percentage Value	Cumulative Annual Volume Percentage	Class
1	1000080188	Filter 10 Micron N32On-Df010-Fa42F Hydac	390	PC	5.800.000	2.262.000.000	19.2011%	19.2011%	A
2	1000022070	Starmet Tooth V Mtg	222	PC	7.352.974	1.632.360.199	13.8564%	33.0575%	A
3	1000036288	Fuel/Water Separator Fleetguard	2049	PC	300.207	615.124.098	5.2215%	38.2790%	A
…	…	…	…	…	…	…	…		
104	1000063160	Rivet Lgmg	110	PC	1.486	163.432	0.0014%	100.0000%	C
Total					**11.780.566.858**		**100.0000%**		

Here is the Pareto diagram of fund absorption based on its class, which can be seen in Figure 2.

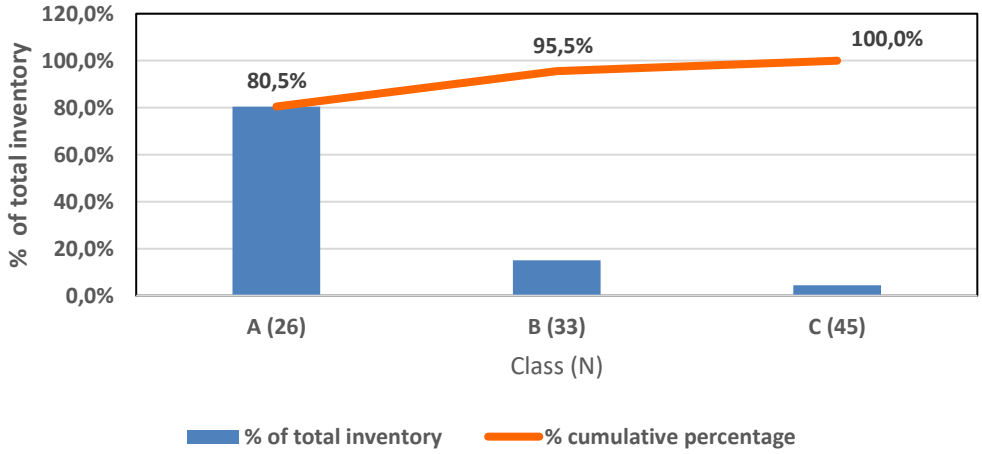

Figure 2. Pareto diagram of fund absorption

5. CONCLUSION

In the distribution of inventory values, the classification results in three classes: Class A, Class B, and Class C. From this classification, Class A absorbs 80.5% of the total inventory value, consisting of 26 items with a percentage of 25%. Class B absorbs 15% of the total inventory value, consisting of 33 items with a percentage of 32%. Class C absorbs 4.5% of the total inventory value, consisting of 45 items with a percentage of 43%. Based on the classification results, different control strategies are applied for each class of spare parts. For Class A, this includes strict supervision, automatic ordering, and procurement prioritization. For Class B, this includes periodic control and supplier evaluation. For Class C, this includes minimal control and needs evaluation.

REFERENCES

A, Eka., Sofia., Darno, D., Wiraswati, M. O., & Ningrum, D. A. (2020). Analisa Pengendalian Persediaan Suku Cadang Pada PT. XYZ Dengan Metode Analisis ABC. *Abiwara: Jurnal Vokasi Administrasi Bisnis*, *2*(1), 5–13. https://doi.org/10.31334/abiwara.v2i1.1050

Chatisa, I., Muslim, I., & Sari, R. P. (2019). Implementasi Metode Klasifikasi ABC pada Warehouse Management System PT. Cakrawala Tunggal Sejahtera. *Jurnal Nasional Teknik Elektro Dan Teknologi Informasi (JNTETI)*, *8*(2), 123. https://doi.org/10.22146/jnteti.v8i2.501

Ermayana Megawati, Jihan Pradesi, Dewi Zainul Khabibah, & Firman Ardiansyah Ekoanindiyo. (2021). Pendekatan

Metode ABC Pada Toko X untuk Pengendalian Persediaan Barang. *Jurnal Teknik: Media Pengembangan Ilmu Dan Aplikasi Teknik*, *20*(2), 156–165. https://doi.org/10.26874/jt.vol20no2.400

Gunawan, C. V., & Tannady, H. (2016). Analisis Kinerja Proses dan Identifikasi Cacat Dominan ada Pembuatan Bag dengan Metode Statistical Proses Control (Studi Kasus: Pabrik Alat Kesehatan PT.XYZ, Serang, Banten). *J@Ti Undip : Jurnal Teknik Industri*, *11*(1), 9–14. https://doi.org/10.12777/jati.11.1.9-14

Jacobus, S. I. W., & Sumarauw, J. S. (2018). *ANALISIS SISTEM MANAJEMEN PERGUDANGAN PADA CV. PASIFIC INDAH MANADO*. *6*(4), 2278–2287. https://ejournal.unsrat.ac.id/index.php/emba/article/view/20996

Kementerian ESDM, & Peranan Sektor Pertambangan dalam Mendorong Perekonomian Nasional. (2023). *Beranda / Media Center / Arsip Berita*. *18*, 3804242. https://www.esdm.go.id/id/media-center/arsip-berita/produksi-batubara-domestik-tembus-target-ketahanan-energi-nasional-terjaga

Lin, H. L., & Ma, Y. Y. (2021). A New Method of Storage Management Based on ABC Classification: A Case Study in Chinese Supermarkets' Distribution Center. *SAGE Open*, *11*(2). https://doi.org/10.1177/21582440211023193

Lina Lutfiana & Indriyana Puspitosari (2020). Analisis Manajemen Persediaan Pada Usaha Mikro , Lina Lutfiana , Indriyana Puspitosari. *Jurnal JESKaPe, Vol.4, No.1 4(1), 55–66.* https://media.neliti.com/media/publications/326625-analisis-manajemen-persediaan-umkm-jazid-bdcbabfa.pdf

Mehdila, U. (2019). IJIS Indonesian Journal on Information System ISSN 2548-6438. *IJIS-Indonesia Journal on Information System*, *4*(April), 69–76. https://media.neliti.com/media/publications/260171-sistem-informasi-pengolahan-data-pembeli-e5ea5a2b.pdf

Riani, L. P., & Wiyono, B. (2016). Analisa ABC dalam Pengendalian Persediaan Spare Part Jenis Oil Sepeda Motor di Bengkel Piramida Motor Tulungagung. *Jurnal NUSAMBA, 1* (1), 13–21. https://ojs.unpkediri.ac.id/index.php/manajemen/article/view/294/282

Roni, S. (2016). Pengendalian Persediaan Bahan Baku dengan Menggunakan Activity Based Costing (ABC) Analisis Pada PT Besmindo Andalas Semesta. *Jom Fekon*, *3*(1), 14–27. https://media.neliti.com/media/publications/122071-ID-pengendalian-persediaan-bahan-bakudengan.pdf

Wahyudi, R. (2015). Analisis Pengendalian Persediaan Barang Berdasarkan Metode EOQ Di Toko Era Baru Samarinda. *Ejournal Ilmu Admistrasi Bisnis*, *2*(1), 162–173. http://ejournal.adbisnis.fisip-unmul.ac.id/site/wp-content/uploads/2015/03/E-journaL PDF (03-04-15-03-58-13).pdf