**JURNAL ILMIAH TEKNIK INDUSTRI**
ISSN: 1412-6869 (Print), ISSN: 2460-4038 (Online)
Journal homepage: http://journals.ums.ac.id/index.php/jiti/index
doi: 10.23917/jiti.v21i1.17182

# Improved Warehousing Performance Using the Frazelle Model in Pharmacies During a Covid-19 Pandemic

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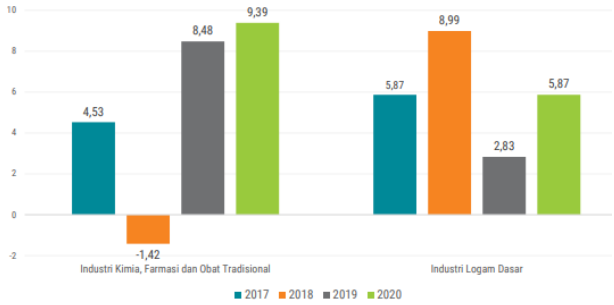
***Abstract.*** *In order for warehousing performance to remain at the standard, it is necessary to monitor the performance in the warehousing area, such as utilization and quality of goods in the warehouse, to increase the value of a company. Several drug retailers in Indonesia, especially in the Yogyakarta area, have not yet measured the performance of their warehousing activities, so it is not clear what improvements need to be made. With a comprehensive monitoring activity of warehousing activities, it can support the company to obtain helpful information that can help improve the performance of ongoing operations. This study was conducted to determine the performance position using the Frazelle model during the covid 19 pandemic in a drug retail business or pharmacy so that researchers can provide recommendations for improvements that can improve warehouse performance. The performance for the warehouse has a warehouse performance value of 55.60 and is included in the Average category. This recommendation can also be used as a benchmarking reference for other industries.*

***Keywords:*** *warehouse; frazelle; pharmacy; performance*

## I. INTRODUCTION

The need for medicine, vitamins, masks and other sanitation items increased significantly during the COVID-19 pandemic. Even masks and hand sanitizers are currently included in basic needs. The chemical, pharmaceutical, and traditional medicine industries are industrial groups that experienced positive growth during the COVID-19 pandemic. In 2020, the industry experienced an increase in Gross Domestic Product (GDP) of 9.39% and became the industrial group that experienced the highest growth (Kementrian Perindustrian, 2020). It makes the pharmaceutical industry one of the strategic industries that focus on development.




(Source: Kementrian Perindustrian RI, 2021)

**Figure 1.** Industries that are experiencing growth in 2020

Pharmacies are forms of the pharmaceutical industries and infrastructures, those provide medicines and other medical needs. Pharmacies are also the infrastructure supporting the running of hospital business processes. The increasing need for drugs during the covid 19 period has affected the existing business processes in the entire pharmaceutical industry, where the pharmaceutical industry or pharmacies must provide medicines and medical equipment needed by covid 19 patients. One of the critical factors in health agencies, hospitals, and the health industry is inventory management of medicines to avoid a shortage of medicine stocks (Kindangen et al., 2018). A complete supply of medicines is the result of good logistics management.

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Submited: 17-01-2022 Revised: 16-05-2022
Accepted: 20-06-2022

Logistics management in the pharmaceutical industry, in general, has activities such as selection, planning, procurement, receiving, storage, distribution, disposal, control, and administration (Ladu Day et al., 2020). It is undeniable that most logistics activities often take place in the warehouse. Warehouses are the starting and ending places in the flow of goods, money, and information that run a company's business. If warehouse management is appropriately managed, the company can control the quality both in terms of service to customers and the quality of the products produced (Ackah, M. R., Erick, 2016).

The number of activities carried out in the warehouse in a company, such as receiving goods, sorting, storing, counting, packing, and shipping, makes the warehouse an element that needs special attention in managing. In addition to having many functions and activities, the warehouse is also one of the activities that have many costs and is sometimes not realized by the company. Therefore, the cost of warehousing or inventory must be minimized and improved continuously (Elisa Kusrini, Indah Asmarawati, et al., 2018).

The focus of attention on logistics performance is warehouse performance, where good logistics performance can improve quality, reduce delivery times, and reduce costs in the logistics system (de Marco & Mangano, 2011).

As the level of complexity of a logistics system network grows, it is necessary to carry out a performance analysis of the warehouse (Wu & Dong, 2008). One of the functions of measuring warehouse performance is to analyze the efficiency of labor costs, inventory costs, and shipping costs (Chandra, 2014). This study will measure the performance of the warehouse in a store-based pharmacy conducted at the Samudro Farma pharmacy in Yogyakarta because the warehouse performance measurement has never been carried out at the pharmacy. Measurement of warehouse performance using the Frazelle model to measure operational activities in the warehouse. This model was chosen because this model measures not only the dimensions of cost, time, quality, and productivity, but also warehouse activities such as receiving, order picking, put away, storage, and shipping (Frazelle, 2002).

In previous studies, performance measurements were often carried out on the entire supply chain, including supply chain performance measurement using SCOR, which was carried out in the leather industry (E. Kusrini et al., 2019), the textile industry (Purnomo, 2015), and the make-to-order batik industry (Hidayatuloh & Qisthani, 2020). Meanwhile, the measurement of warehouse performance carried out previously is measuring warehouse performance in the textile industry with a balanced score card model (Indrawati et al., 2018) and measuring warehouse performance in material construction warehouses (Elisa Kusrini, Novendri, et al., 2018). Therefore, this study raised the pharmaceutical industry as a research subject. This research focuses on measuring the performance of the store-based pharmaceutical industry using the Frazelle model and the Hierarchical Analysis Process (AHP) for the weighting of the criteria. This research aims to produce helpful information for the pharmaceutical industry to develop and improve future business process strategies.

## II. RESEARCH METHOD

Warehouse performance measurement research was conducted during a pandemic at a pharmacy in Yogyakarta, Central Java. Performance measurement uses the Frazelle model with warehouse performance gap analysis, normalization of SNORM, and AHP to determine KPI weights. This research uses several data collection methods: observation, direct measurement, interviews, questionnaires, and documentation. The data types taken are primary data and historical data obtained from the company. At the same time, secondary data is in the form of document data from the company, such as the number of employees, working hours, business processes, employee salaries, and some supporting literature regarding warehousing.

The K-Chart is used to understand the framework for applying the warehousing

performance measurement, shown in Figure 2. The study's novelty in this research is the warehouse improvement strategy based on the analysis of warehousing performance measurements on the type of retail store based on the object of retail drugs or pharmacies. Measurement of warehousing performance using the Frazelle model by measuring warehousing activities, namely, receiving, put away, storage, order picking, and shipping (Frazelle, 2002).

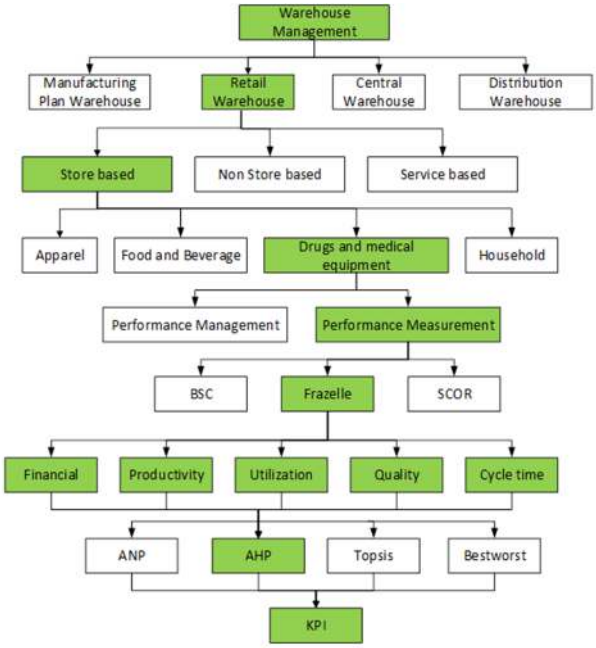


**Figure 2.** K-chart

The data processing process in this study was carried out by following the following flow: (1) identifying the weight of importance from the Key Performance Index, (2) determining the KPIs most relevant to warehousing activities, (3) measuring warehouse performance with the selected KPIs, (4) Perform data normalization processing using SNORM, and (5) Formulate improvement strategies.

KPI for Gap performance analysis from Frazelle, there are five warehousing activities: receiving, put away, storage, order picking, and shipping. These five activities measured five influencing factors: financial, productivity, utility, quality, and cycle time (Frazelle, 2002).

Normalization is carried out to equalize the rating scale of each indicator. Each indicator has a different scale and needs to be normalized to have the same value scale. The method used to normalize the value is SNORM, where the lowest value will be assigned a value of 0 and the highest value will be assigned a value of 100 (Hartati, 2017).

$$\text{Snorm} = \frac{Si - Smin}{(Smax - Smin)} X\ 100 \quad \textbf{(1)}$$

Si indicates the value of the actual indicator that has been achieved, Smin is the value of the worst performance achievement of the performance indicator, and Smax is the value of the best achievement of the performance indicator.

After obtaining the KPI measurements for each indicator in each company being measured, the highest and lowest values are sought, then entered into the SNORM formula to produce a normalized score on each company's KPI.

**Analytic Hierarchy Process**

The weighting of the AHP results is helpful for factor weighting for each activity in the KPI and determining input and output data in the DEA model. AHP weighting stage as bellow (Saaty, 2002): (a) Pairwise comparisons between KPIs, (b) Weighting on each KPI, and (c) AHP results are also used to determine critical categories for each indicator.

**Frazelle Performance Data Processing**

Design and measurement of warehouse performance using the Frazelle model for pharmacies with the following steps:

1. Identify the needs of policymakers in retail companies today.
2. Identify the business processes that run in each company under study.
3. Measurement indicators for warehouse performance with key indicators from the Frazelle model are financial, productivity, utility, quality, and cycle time.
4. Develop a work measurement model based on KPIs.

The steps in this research can be seen easily through the Figure 3.

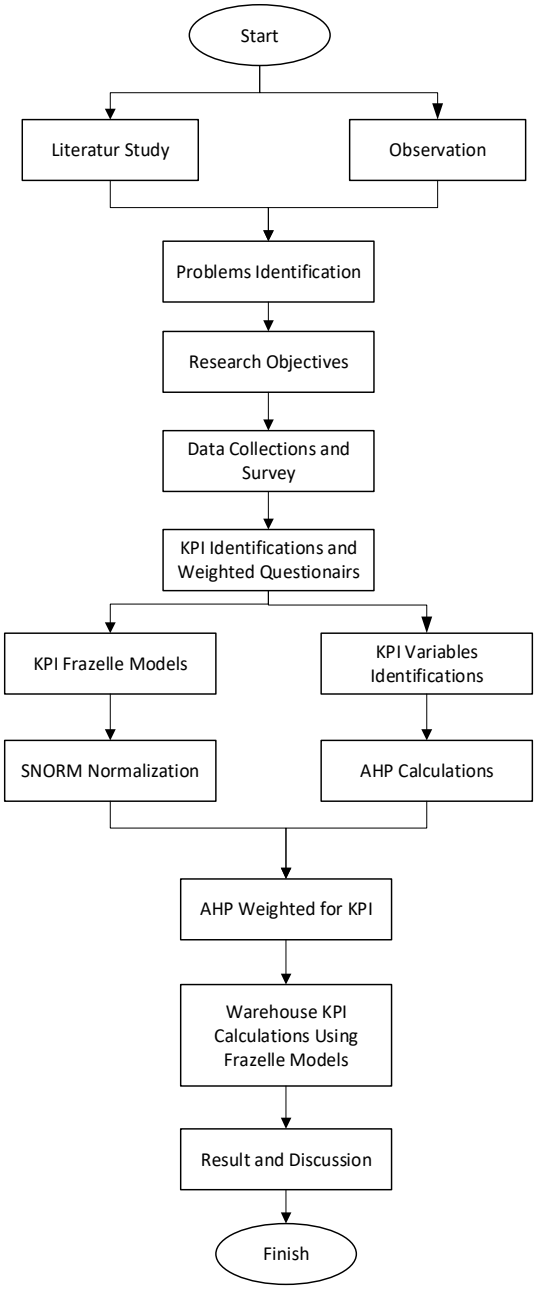


**Figure 3.** Flowchart

Scoring

1. The weights generated from the AHP for each KPI variable have different values.
2. The normalization result of the KPI variable for the warehouse is multiplied by the weight of each KPI.
3. After the product is known, the total value of the warehouse can be known.
4. The scoring result of each activity performance is presented in the form of a dashboard or spider web.

# III. RESULT AND DISCUSSION

In this study, the measurement of warehouse performance was carried out at a drug retailer or pharmacy in Yogyakarta. The drug retail used in this study is store-based retail, where various drugs are stored.

The business process at Samudro Farma warehousing is almost the same as the business process at retail warehousing in general, which distinguishes the different treatments for its products in the form of drugs. Activities begin with the arrival of goods (receiving) from suppliers. Goods that come from suppliers are in the form of boxes or boxes in which there are many kinds of brands of types of drugs. The first activity is when the supplier checks the order letter with the goods arriving. After the goods are in accordance with the PO, the goods are moved into the warehouse using a trolley. Then the goods are placed in the inventory (put away). Employees are given the task of conducting periodic checks on the goods in the warehouse. Then the delivery of the ordered goods is based on checking from the display for the stock from the warehouse to the pharmacy.

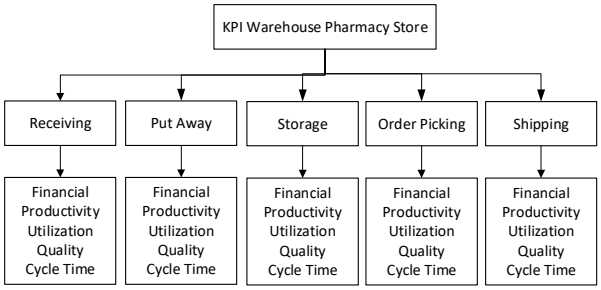


**Figure 4.** Interest Level

KPI Identification: When designing KPIs to improve warehouse performance, the first step is to determine what activities are carried out by the Samudro Farma Pharmacy warehouse. The daily activities of the warehouse have five main types of activities: receiving, put away, storage, order picking, and shipping. Figure 4 shows the identification of the pharmacy warehouse KPI.

The data used in this study are primary data and secondary data. Direct measurements obtain raw data, such as measuring activity time with a stopwatch. Secondary data is obtained from historical information of the company, such as

employee salaries, number of employees, and hours worked.

After processing and identifying the KPI variable data for each warehouse understudy, the KPI variable data for each warehouse is generated, shown in table 1. In addition, weight normalization is also carried out using the SNORM method to homogenize the data because the measurement scale is different from each activity and process.

**Table 1. Warehouse Performance Indicator**

| Process | Weighted | Weighted X Normalization |
|---|---|---|
| 1. Receiving | | |
| 1.1 Finansial (Rp/line recieving) | 0.04079 | 0.52306 |
| 1.2 Productivity (box/man-hour) | 0.08456 | 3.52354 |
| 1.3 Utilization (%) | 0.25328 | 16.88547 |
| 1.4 Quality (%) | 0.52607 | 25.16016 |
| 1.5 Cycle Time | 0.09527 | 8.74523 |
| 2. Put Away | | |
| 2.1 Finansial (Rp/line putaway) | 0.03774 | 1.57283 |
| 2.2 Productivity (box/man-hour) | 0.06301 | 2.62566 |
| 2.3 Utilization (%) | 0.27831 | 16.69908 |
| 2.4 Quality (%) | 0.48151 | 23.02907 |
| 2.5 Cycle Time | 0.13940 | 5.05076 |
| 3. Storage | | |
| 3.1 Finansial (Rp/line storage) | 0.38974 | 4.99667 |
| 3.2 Productivity (box/m2) | 0.04115 | 0.15679 |
| 3.3 Utilization (%) | 0.15509 | 0.73852 |
| 3.4 Quality (%) | 0.32446 | 9.27042 |
| 3.5 Cycle Time | 0.08954 | 9.88736 |
| 4. Order picking | | |
| 4.1 Finansial (Rp/line order picking) | 0.04412 | 0.56573 |
| 4.2 Productivity (box/man-hour) | 0.22315 | 16.32841 |
| 4.3 Utilization (%) | 0.16062 | 0 |
| 4.4 Quality (%) | 0.05735 | 5.73581 |
| 4.5 Cycle Time | 0.51473 | 52.42681 |
| 5. Shipping | | |
| 5.1 Finansial (Rp/line recieving) | 0.05944 | 0.762167 |
| 5.2 Productivity (box/man-hour) | 0.08716 | 3.63175 |
| 5.3 Utilization (%) | 0.23504 | 18.60749 |
| 5.4 Quality (%) | 0.30917 | 14.78653 |
| 5.5 Cycle Time | 0.30917 | 34.25298 |

KPI Weighted: The next step is to perform an AHP analysis based on data collected using a questionnaire. The questionnaire used pairwise comparisons to find solutions to complex problems based on various criteria. The first step is weighting the KPI by calculating the level of importance between criteria in the warehouse process based on a paired matrix. The next step is weighting each level of importance from the KPI Warehouse criteria (receiving, putaway, storage, order picking, and shipping). The criteria considered for KPI indicators include financial, productivity, utilization, quality, and cycle time. KPI weights are based on a questionnaire assessing the importance of each KPI value that affects warehouse performance conditions. Questionnaires were distributed to company experts who had information on pharmacy warehousing. KPI weighting by calculating the level of importance between criteria in the process of receiving, put away, storage, order picking, and shipping. Table 2. shows the calculation of the results of the warehouse activity assessment.

**Table 2. Warehouse Performance Indicator**

| Indikator | order picking | put away | receiving | shipping | storage |
|---|---|---|---|---|---|
| cycle time | 0.515 | 0.139 | 0.095 | 0.309 | 0.090 |
| financial | 0.044 | 0.038 | 0.041 | 0.059 | 0.390 |
| productivity | 0.223 | 0.063 | 0.085 | 0.087 | 0.041 |
| quality | 0.057 | 0.482 | 0.526 | 0.309 | 0.324 |
| utilization | 0.161 | 0.278 | 0.253 | 0.235 | 0.155 |

After obtaining all the weight values of each variable and activity with the AHP geometric mean, the weighted values are shown in a hierarchical chart. The hierarchical diagram in Figure 5 shows the AHP weights for each KPI variable activity and its derivatives. The weight is used to calculate the final score or score on the Frazelle KPI variable measurement.

Frazelle Calculation: The measurement of the Frazelle model is carried out to know the value or total performance score of each warehouse in the company under study. The calculation is done by multiplying all the variables in the KPI variable by the weight of each variable from the results of the AHP calculation. Furthermore, the multiplication results between variables are added up and will produce a total value for each KPI variable activity (receiving, putaway, storage, order picking, and shipping) in the warehouse under study. As getting the total value of the warehouse, the value of each activity is multiplied by the weight of each activity. Then, the results are added up to get the final performance value of the warehouse.

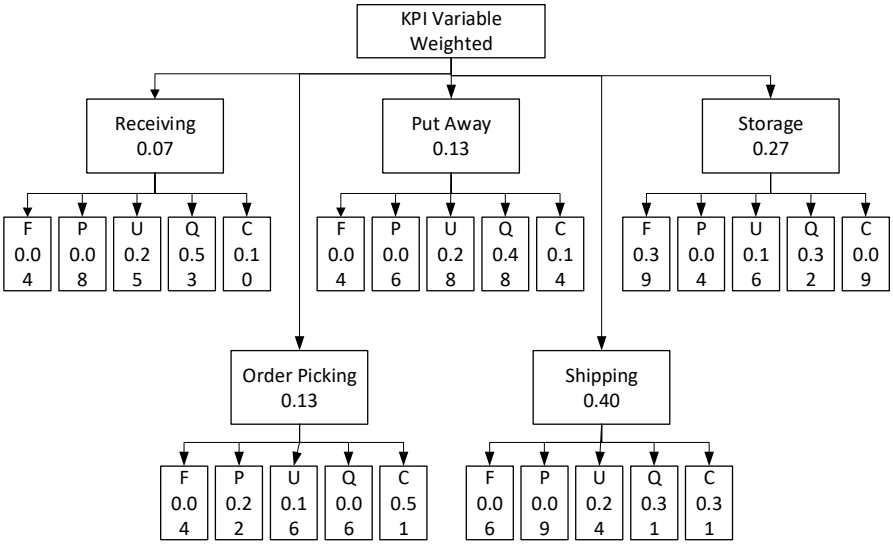


**Figure 5.** Weighted of Important

In table 2. it is known the result of the sum of all variables for each activity.

**Table 2.** Warehouse Performance Indicator

| Process | Weighted Criteria | Warehouse Performance | Weighted Crit. x Warehouse Performance |
|---|---|---|---|
| Receiving | 0.07 | 54.84 | 3.88 |
| Put Away | 0.13 | 48.98 | 6.51 |
| Storage | 0.27 | 25.05 | 6.69 |
| Order picking | 0.13 | 75.06 | 9.98 |
| Shipping | 0.40 | 72.04 | 28.53 |

The performance scores for each activity are then analyzed for each activity score into the category according to table 3. or the indicator category table. The results of each warehouse activity performance can be seen in table 2. namely Receiving of 54.84 is included in the average category, Put-away of 48.98 is included in the marginal category, Storage of 25.05 including the poor category, Order Picking of 75.06 is included in the good category, and Shipping of 72.04 is included in the good category.

**Table 3.** Indicator Category

| Indicator Rate | Indicator Label |
|---|---|
| < 40 | Poor |
| 40-50 | Marginal |
| 50-70 | Average |
| 70-90 | Good |
| > 90 | Excellent |

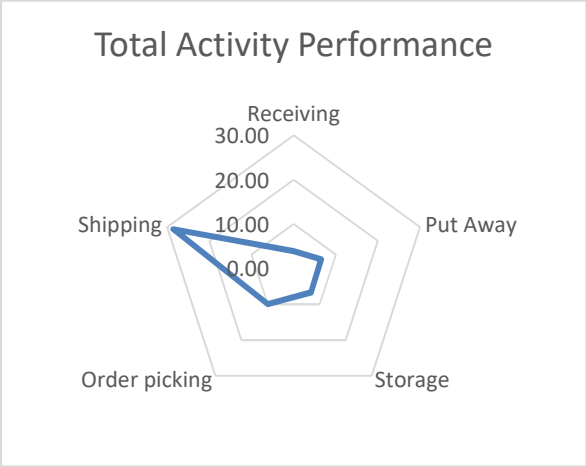


**Figure 6.** Total Activity Performance

Figure 6 is a spider web that describes the performance of each activity in the warehouse where the total performance of shipping activities is the highest than the performance of other activities. Meanwhile, the total value of the overall performance of the activities in the warehouse is 55.60. In this case, the overall performance of the warehouse is included in the average category.

The performance of the storage category is included in the poor category and is the category that has the lowest performance value, so there need to be improvements in this category to improve warehouse performance. The warehouse still uses simple facilities, and the application of technology is still semi-modern. Previously,

pharmacy managers implemented the ABC strategy for drugs that were in the slow move category in warehouses by providing less stock, and for drugs in the fast move category, large stocks were provided, but during a pandemic, this strategy cannot be done because it is less profitable for pharmacies. Inefficiencies in inventory management occur because of the close relationship between resources and slow-moving stock management, stock-outs of some essential drugs, or other overstocks, resulting in obsolescence and a decline in the quality of healthcare services (Gurmu & Ibrahim, 2017).

Several things to improve are using storage rack space, stacking shelves to be more efficient, and providing high alert sticker markers for drugs requiring high alertness (Elizabeth, 2015). It is also recommended to improve the layout of goods so that the flow of goods-ins and outs is much more effective. Make a regular evaluation schedule related to sanitary conditions, temperature, light/light, humidity, ventilation, and evaluation of cold storage to ensure drug quality (Susanto et al., 2017).

Put away activities are included in the marginal category or below average because there is no good standardization related to handling goods from receiving goods to placing them in predetermined positions. Pharmacy managers have challenges in managing drugs with a high level of variation and handling goods allocation techniques that take a long time.

Products with high demand must be rearranged in the warehouse closest to the ordering and delivery area so that warehouse personnel can inspect, access, select, track, and ship products promptly for order fulfillment (Gizaw & Jemal, 2021). Improvements can also be made by building an information system with automatic operation at the time of receipt of prescription drugs by checking the quantity of stock in the warehouse to increase the efficiency of the service activity process (Abd-Ali & Al-Qaraawi, 2017).

# IV. CONCLUSION

The Frazelle model with KPI variables is used based on five activities in the warehouse, namely receiving, put away, storage, order picking, and shipping. The performance for the warehouse has a warehouse performance value of 55.60 and is included in the average category. To improve the performance of the warehouse, based on the results of the study, it provides suggestions by making continuous improvements to every activity that runs in the warehouse. Such as the need to increase empowerment, use of tools, increase quality standards and accuracy to improve warehouse performance. Warehouses can also do benchmarking with other superior companies; warehouses with high values must continue to investigate and improve. Suggestions for further research are to measure warehouse work efficiency using the Data Envelopment Analysis.

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