

**CONTROL OF THE MAIN DISTRIBUTION MATERIAL INVENTORY (MDU) IN  
PT PLN UP3 MEMPAWAH WITH FSN-XYZ AND RISK ANALYSIS****Arrahmad Ihsan, Suparno**

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**Abstract****Keywords:** Inventory control, FSN-XYZ, FMEA, FMECA.

Main Distribution Materials (MDU) have a vital role in supporting the operational activities of PT PLN UP3 Mempawah, especially in meeting the needs of electricity services for new installations and power changes. The management of MDU inventory that is not optimal often causes problems such as shortage or excess stock due to not taking into account demand uncertainty. This study aims to optimize the inventory management and distribution of MDUs by combining the FSN-XYZ analysis method with the FMEA and FMECA risk assessment approaches. The FSN-XYZ method is used to classify materials based on the frequency of movement and demand variability, while FMEA and FMECA are used to identify potential failures and assess their criticality. The data used in this study came from primary and secondary data, including inventory history and company policies. The results show that most MDU items are classified as Z which has high demand but is unstable, so there is a risk of causing operational disruptions. By implementing an integrated risk-based classification strategy, PLN can prioritize critical items, reduce operational disruptions, and improve cost efficiency. The study also recommends strategies tailored to each category of inventory, such as Just-In-Time for stable materials and a consignment or bundling system for slow-moving materials. The implications of this study emphasize the importance of data-driven adaptive inventory policies in the electricity infrastructure industry that requires high reliability.

**INTRODUCTION**

Failure Modes and Effects Analysis (FMEA) and Failure Modes, Effects, and Criticality Analysis (FMECA) are interrelated risk analysis methods and are often used in system quality and reliability management (Onofrio et al., 2015; Panuntun, 2021). FMEA is a systematic process to identify potential failure modes in a system, product, or process and evaluate their impact on performance (Ardian Burhandono & Sinaga, 2022; Rizma, 2023). This method helps determine the priority of corrective action based on severity, probability of occurrence, and failure detection. FMECA, on the other hand, is a development of FMEA that adds elements of criticality analysis (Octaviani & Pramitari, 2022; Onofrio et al., 2015). In FMECA, the failure modes that have been identified through FMEA are further analyzed to determine their level of criticality by considering the frequency of occurrence and their consequences. The interconnectedness of the two lies in the order of use, where FMEA is used as a preliminary step to identify potential problems, while FMECA deepens the analysis by prioritizing failure modes based on their impact on the system as a whole (Ardian Burhandono & Sinaga, 2022).

Inventory control is a topic that is often discussed in various studies, including the control of Main Distribution Materials (MDU) at PLN (Agustina, 2021). discussed the control of MDU at PT PLN UP3 Ponorogo, while conducting a similar study at PLN Distribution Main Unit (UID) East Java, by applying the Al Fatih (2020) *continuous review*. In this approach, stock is monitored continuously, and reorders are made as soon as the stock reaches the point of reordering (*reorder point* São Paulo São (2019). in his research at PT PLN South Surabaya Area found that for fast-moving materials, the *continuous review model (s,Q) simultaneous* used, while for intermittent materials the *periodic review (R,s,S) Power Approximation* (Gu et al., 2017; Khor & Udin, 2019; Singh & Khanduja, 2020).

To improve the efficiency of inventory management and avoid *stockout* problems, a control strategy based on data analysis is needed. The application of FSN and XYZ Analysis is very relevant in classifying materials based on their frequency of movement and economic value. In this context, materials such as transformers and MCBs can be categorized as *Fast-moving* (F) items and also fall into category X, given the critical role and high value of these materials.

The research "Distribution Material Inventory Control (MDU) at PT PLN UP3 Mempawah with a Combination of FSN and XYZ Analysis" is superior to the previous research according to the researcher because 1) this study uses a combination of two methods, namely FSN (Fast-Moving, Slow-Moving, Non-Moving) and XYZ (category based on demand fluctuations). This approach provides more comprehensive results in grouping goods based on movement levels and demand patterns, thus supporting more strategic decision-making; 2) the combination of FSN and XYZ is able to minimize storage costs and the risk of overstock or stockout. This is more effective than a single method such as EOQ (Economic Order Quantity) which focuses only on calculating the optimal quantity of orders without considering fluctuations in demand and the movement of goods; 3) this research is directed at the main distribution materials (MDU) which are important supports of PT PLN's operations. Adjusting methods to industry-specific needs provides higher practical value than more general research, and the latter is 4) by utilizing the FSN and XYZ classifications, managers can prioritize resources for critical items (fast-moving with a stable pattern), thereby improving overall operational efficiency.

In this study, the main focus is on MDU inventory control using a combination approach of FSN and XYZ Analysis, where items are categorized based on their movement level and financial value. This approach allows for the prioritization of management based on actual needs and potential cost impacts. The inventory control policy used by PLN must be proactive and dynamic, with a minimum stock setting for items in the FX category, as well as a procurement strategy focused on high-value items.

The implementation of these strategies synergistically can help PLN better manage MDU inventory, avoid stockout risks, reduce operational costs, and maximize company revenue by increasing customer satisfaction. The right inventory management strategy also allows PLN UP3 Mempawah to maintain the sustainability of electricity services to industrial customers, support regional economic growth, and ensure sustainable operational efficiency. Failure Modes and Effects Analysis (FMEA) and Failure Modes, Effects, and Criticality Analysis (FMECA) are interrelated risk analysis methods and are often used in system quality and reliability management (Onofrio et al., 2015). FMEA is a systematic process to identify

potential failure modes in a system, product, or process and evaluate their impact on performance (Ardian & Sinaga, 2022). This method helps determine the priority of corrective action based on severity, probability of occurrence, and failure detection. FMECA, on the other hand, is a development of FMEA that adds elements of criticality analysis (Onofrio et al., 2015). In FMECA, the failure modes that have been identified through FMEA are further analyzed to determine their level of criticality by considering the frequency of occurrence and their consequences. The interconnectedness of the two lies in the order of use, where FMEA is used as a preliminary step to identify potential problems, while FMECA deepens the analysis by prioritizing failure modes based on their impact on the system as a whole (Amri et al., 2020; Ramadhani & Hapsari, 2022).

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To improve the efficiency of inventory management and avoid stockouts, a control strategy based on data analysis is needed. The application of FSN and XYZ Analysis is very relevant in classifying materials based on their frequency of movement and economic value. In this context, materials such as transformers and MCBs can be categorized as Fast-moving (F) items and also fall into category X, given the critical role and high value of these materials.

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as a procurement strategy focused on high-value items (Musdirwan, 2022; Voss & Blackmon, 2016).

The implementation of these strategies synergistically can help PLN better manage MDU inventory, avoid stockout risks, reduce operational costs, and maximize company revenue by increasing customer satisfaction. The right inventory management strategy also allows PLN UP3 Mempawah to maintain the sustainability of electricity services to industrial customers, support regional economic growth, and ensure sustainable operational efficiency.

The formulation of the problem in this study is how the inventory control and distribution strategy of MDU for New Installation and Power Change can be fulfilled in order to achieve Company Revenue, achieve PLN UP3 Mempawah Electricity Sales KPIs, Customer Satisfaction is fulfilled and reduces the risk of stockout and material overstock that is very heavy for the company's business processes.

The control of the inventory of main distribution materials (MDU) is a crucial issue in the electricity sector, especially for PT PLN UP3 Mempawah, because it has a direct effect on smooth operations, cost efficiency, and customer satisfaction. The urgency of this research lies in the need to reduce the risk of *stockout* and *overstock* which still often occur due to demand uncertainty and inaccurate needs planning. Previous research has applied methods such as *continuous review* and *ABC analysis* approach in the context of inventory control in several other PLN units, but there has been no approach that simultaneously combines the *FSN-XYZ* method with *FMEA and FMECA* in one integrated analysis system. The research gap lies in the lack of integration between the classification of demand patterns and the risk analysis of failures that have the potential to affect material availability. The novelty of this study is the combined use of the *FSN-XYZ* method to classify materials based on their frequency of movement and economic value, as well as the *FMEA-FMECA* analysis to prioritize the risk of failure in crucial materials, resulting in a strategic and applicable double classification matrix. The purpose of this study is to analyze the Main Distribution Materials (MDU) based on the company's inventory policy by considering aspects of its criticality, availability, and level of use; determine optimal MDU inventory parameters to meet new installation demand (PB) and change in tariff power B (PD) in order to increase the company's revenue; establish effective MDU inventory control and distribution methods to achieve sales targets while minimizing the risk of stockouts and material overstockings; and provide concrete suggestions for improvements to reduce the potential imbalance of MDU inventory in supporting PB and PD operations.

One of the expected benefits of this research is to be able to provide advice to companies in managing MDU inventory so that it can minimize stockout and overstock by paying attention to inventory and demand so that optimal revenue from New Installation and Power Change services can increase KPIs and Customer Satisfaction.

## RESEARCH METHODS

The data collection in this study at PT PLN UP3 Mempawah includes two main categories, namely historical data related to MDU inventory and company policy documents regarding inventory control. Inventory data includes information about MDUs received and discharged from warehouses, MDU demands, procurement lead times, available stock, as well as various related costs such as ordering, procurement, storage, and backordering. In addition,

company documents are also collected to analyze the inventory control policies implemented. In addition, additional data on the demand for New Installments (PB) and Power Changes (PD) of household tariffs, Bill of Quantity Materials according to PLN standards, MDU Goods Order Letters (SPB), as well as lead time information, unit prices, and storage and stockout costs from the latest contracts and amendments were also obtained to enrich the analysis of MDU's inventory policy in the field.

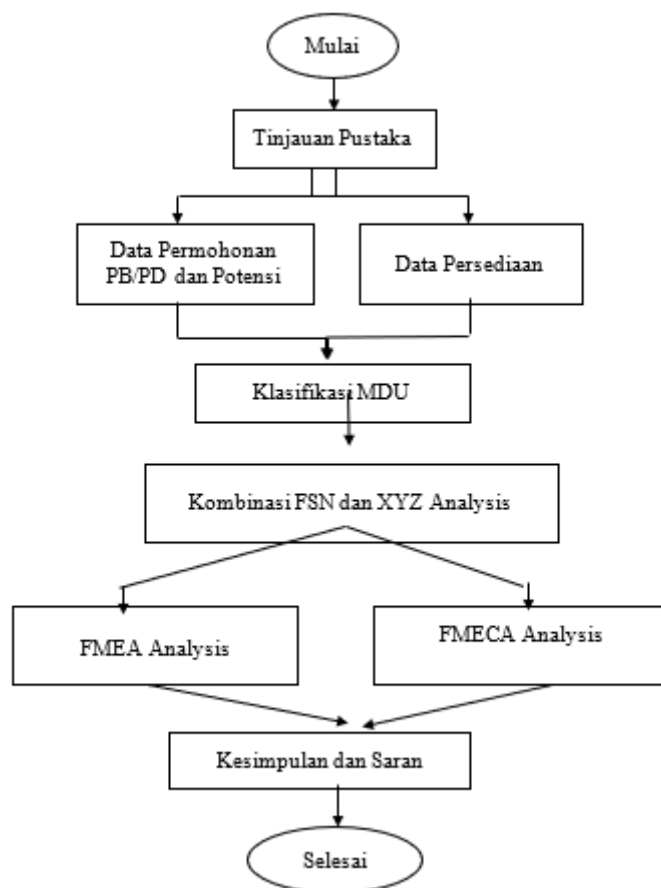


Figure 1. Research Flow  
Source : Researcher (2025)

The types of data used in this study are primary data and secondary data.

### Data Primer

Primary data is data collected by researchers directly from primary sources, such as the object of the research. Primary data is usually raw and needs to be reprocessed (Arikunto, 2020)

### Data Seconds

Secondary data is data that has been collected by other parties and used to complete research data needs (Unaradjan, 2019).

The research model in this study is designed to analyze and control the inventory of Main Distribution Materials (MDU) at PT PLN UP3 Mempawah through a combination approach of FSN-XYZ and FMEA/FMECA risk analysis. The model starts with collecting historical data on material use and service demand from 2022 to 2024, which is then classified by frequency of movement of goods (FSN) and level of variation in demand (XYZ) to identify priority material groups. Furthermore, a risk analysis of the critical material group was carried out using

the FMEA method to identify the failure mode and its impact, which was reinforced with FMECA to assess the level of criticality of each risk that arose. This model generates a classification matrix and risk score that is the basis for inventory control strategies, such as priority category-based procurement, stock buffer arrangements, and the establishment of periodic monitoring systems. With this model, the company is expected to optimize the efficiency of inventory management while minimizing the potential for distribution disruptions due to uncontrolled critical materials.

## **RESULTS AND DISCUSSION**

Based on secondary data obtained from 2022 to 2024, this study identified the grouping of main distribution materials at PT. PLN UP3 Mempawah is in the fast moving and non-fast moving categories. The fast moving category includes materials that are used high and repeated, especially in new installation service activities, adding power, and handling electrical disturbances. Some materials such as KWH meters (ZM0219), Cable Power (ZM0311), and Cable Power ACC (ZM0312) show dynamic usage patterns, reflecting fluctuations in service demand and the company's adaptive strategy. In particular, Cable Power experienced a sharp increase from 524,027.25 in 2022 to 1,726,586.06 in 2024, indicating a great need for strengthening electricity distribution infrastructure.

Other materials such as MCB & MCCB (ZM0325), Connector (ZM0328), and Cable Control ACC (ZM0417) also show significant change patterns. For example, MCB & MCCB experienced a decrease in usage from 116,030.83 to 106,307.00, which may be related to the improved efficiency of the electrical protection system. Meanwhile, even though Cable Control usage was not recorded in 2023, Cable Control ACC still saw a slight increase year-on-year. Some materials such as Switchgear (ZM0324) remain considered crucial despite not recording significant usage data, as their vital role in the regulation and protection of electrical systems remains necessary in the long term.

Overall, this analysis shows that there is a need for PT. PLN UP3 Mempawah to continue to evaluate and monitor the consumption trends of main distribution materials. Fluctuations in material use not only reflect technical demand, but are also an important indicator in formulating more efficient material procurement and storage strategies. The company's ability to adapt the use of materials to changing market needs and technological innovations will greatly determine the sustainability of services and the reliability of the electricity distribution network in the future.

### **Discussion**

MDU inventory control and distribution strategies for PB and PD can be optimized to reduce the risk of stockout and material overstock. In the context of inventory control and material distribution at PT PLN UP3 Mempawah, the importance of FSN (Fast, Slow, Non-moving) analysis cannot be ignored. An effective inventory control strategy will contribute significantly to operational efficiency, especially in the context of new installations and additions of power and electrical services. In this case, the implementation of the recommendations outlined earlier can be the foundation for optimizing stock management, so that the risk of stockout and material overstock can be minimized.

First, periodic reviews of the classification of goods are a crucial first step. In the electrical industry, the need for materials can change quickly, depending on ongoing projects and customer demands. For example, if there is an increase in demand for new installations in an area, then fast-moving items such as cables, transformers, and electrical measuring devices must be available in sufficient quantities. Instead, slow-moving items such as certain components that are rarely used should be re-evaluated to determine if they are still relevant to keep. By conducting periodic reviews, PT PLN UP3 Mempawah can ensure that the classification of goods remains in accordance with market dynamics and operational needs.

Second, for fast-moving items, the integration of an automated ordering system based on usage level can be a very effective solution. For example, by using an integrated ERP (Enterprise Resource Planning) system, companies can monitor material usage in real-time and automatically reorder when stock reaches a certain threshold. This not only reduces the risk of stockout, but also optimizes expenses by avoiding overbuying that can lead to overstock. For example, if PT PLN UP3 Mempawah knows that the use of power cables is increasing during certain months, they can set up a booking system to automatically increase stock before the peak period.

Third, for the slow-moving category, a promotional strategy or bundling products with fast-moving goods can be an effective way to increase the movement of goods. For example, if there are certain components that are rarely sold, the company may offer bundling packages that include fast-moving items that are in higher demand. This way, customers who need fast-moving items may be interested in purchasing the slow-moving items as part of the package. This strategy not only helps reduce the stock of stationary goods, but it also increases overall sales. In the context of PT PLN UP3 Mempawah, this can be applied by offering an installation package that includes electrical measuring devices and other supporting components that are rarely purchased separately.

Finally, for non-moving items, companies need to formulate an effective clear-out strategy. Items that have not moved for a long time can bind capital and storage space that could otherwise be used for more relevant items. One strategy that can be implemented is to provide discounts on those items or divert the goods to distributors who may have demand. For example, if there are components that are not used in the previous project, PT PLN UP3 Mempawah can collaborate with local distributors to sell the goods at a discounted price. Not only does this help clear stock, but it can also provide additional benefits for the company.

In the implementation of these strategies, it is important for PT PLN UP3 Mempawah to utilize advanced information technology and management systems. The use of integrated inventory management software can provide the analytical data needed for better decision-making. With accurate data, management can plan material needs more precisely, reduce the risk of stockout and overstock, and improve overall operational efficiency.

As an illustration, let's look at a case where PT PLN UP3 Mempawah faced a stockout problem on power lines during a new installation project in a certain area. When demand increases, companies do not have enough stock to meet needs, resulting in delays in installation and customer dissatisfaction. After conducting the analysis, the company realized that they did not have an adequate automated ordering system to monitor cable usage. By implementing an automated ordering system, companies can avoid similar situations in the future, ensuring that they always have enough stock to meet demand.

On the other hand, let's consider a situation where PT PLN UP3 Mempawah has a large number of slow-moving goods, such as certain components that have not been sold for a long time. By implementing a bundling strategy, companies can combine these items with products that are more in demand, such as electric meters. This not only helps reduce the stock of stationary items, but also provides added value for customers who may need both types of items. For example, if a customer buys an electric meter, they may also be interested in purchasing supporting components that are rarely sold, thus increasing overall sales.

In the context of inventory control and distribution, PT PLN UP3 Mempawah must also consider external factors that can affect material availability. For example, fluctuations in raw material prices, regulatory changes, or disruptions in the supply chain can impact a company's ability to meet demand. Therefore, it is important for companies to have a clear contingency plan, including supplier alternatives and a flexible procurement strategy. In this way, PT PLN UP3 Mempawah can be better prepared to face challenges that may arise and maintain smooth operations.

In addition, training and human resource development is also an important aspect of inventory control. Well-trained employees will be better able to manage stock efficiently, understand automated ordering systems, and implement promotional strategies effectively. Therefore, investment in employee training should be a priority for PT PLN UP3 Mempawah to ensure that they have a competent team in managing inventory and distribution.

In order to achieve the goal of optimal inventory control, PT PLN UP3 Mempawah also needs to periodically evaluate the strategies implemented. By conducting a performance analysis, companies can identify areas that need improvement and adjust strategies according to evolving needs. For example, if after implementing an automated ordering system, the company is still experiencing stockout problems, then it is necessary to conduct further evaluation to understand the cause and find a more effective solution.

Based on the results of the XYZ analysis that the researcher has conducted, most of the materials and equipment recorded in the UP3 Mempawah logistics system are included in the Z category, which shows a very high level of demand fluctuations. This category indicates that the consumption of these items is highly volatile, tends to be random, and is difficult to predict. Of the 57 entries analyzed, only a small fraction fall into categories X (stable demand) and Y (moderate or seasonal demand), while more than 80% fall into category Z. This phenomenon reflects major challenges in supply chain management and material supply strategies in the electrical operational environment.

Items in category X, such as the KWH Meter (ZM0219) and LVSB (PHBTR) showed low coefficient of variation (CV) values, at 0.23 and 0.24, respectively. This indicates that the demand for these items was relatively consistent throughout the observation period. For items like this, an efficient and lean inventory management approach can be applied. For example, the use of Just-In-Time (JIT) systems can be optimized to reduce storage costs and avoid overstocking. The availability of accurate and historical data is a major strength in precise needs planning for this category.

Meanwhile, category Y is filled by items such as PT (ZM0207) and Pole (ZM0303) that indicate seasonal fluctuations or predictable trends. The CV for this group ranges from 0.26 to 0.61. Managing this category requires a mixed approach between historical demand-based strategies and limited stock buffers. Monitoring seasonal trends and collaboration

between divisions is important, especially to ensure the availability of materials when demand increases without causing stock accumulation when demand decreases.

Category Z dominated the data with very high CVs, some of which even exceeded 1000%—such as Installation and Machinery (ZK5945) with a CV of 766.59 and Panels (ZM0414) with a CV of 162.56. These extreme fluctuations represent significant uncertainty in the need for these items. Generally, category Z contains special materials, spare items that are rarely used, or equipment related to project or incidental work. The inventory management approach applied to this group must be careful. Strategies such as make-to-order, consignment, or actual demand-based ordering systems are more appropriate to avoid wasting resources due to overstocking.

In the logistics management forum, this analysis can be a strategic basis for optimizing warehouse management, including in the preparation of storage priority item categories, supplier evaluation, and procurement budget preparation. For example, for items in category Z with high investment value and low utilization rate, companies need to consider an umbrella contract-based procurement system or a shared stock pool scheme between UP3 units. As for Z items that have low value and small volume, they can be prepared in limited stock with periodic evaluation based on actual demand.

The extreme conditions shown in the data, such as CVs reaching thousands of percent, also indicate the possibility of demand data that is not standardized or overly affected by outliers (unnatural demand in a certain period). Therefore, data cleansing and more representative time segmentation can help produce a more accurate and reliable XYZ classification.

Furthermore, the dominance of the Z classification indicates the need for a risk-based approach in material management. This means that in addition to looking at demand stability, management needs to consider the operational impact if the item is not available when needed. By combining XYZ and FMEA analyses, such as those contained in this document, companies can map material supply priorities not only in terms of demand stability, but also in terms of their impact on the sustainability of electricity services.

In other words, an item, even if it is classified as category Z because its demand is volatile, must still be available if the severity value of the failure effect is high (based on FMEA). This approach results in a more strategic and system-reliably-oriented dual classification matrix.

Based on these results, the XYZ method analysis of this data shows that the success of material management depends not only on how often an item is used, but more importantly how to combine statistical data with managerial intuition, technical knowledge, and an understanding of the ever-changing operational dynamics. Thus, companies can be more adaptive, efficient, and responsive in ensuring reliable continuity of electrical services.

Inventory and distribution control is a crucial aspect that affects operational and service efficiency in electricity companies such as PT PLN UP3 Mempawah. In the context of new installations and power additions, the application of the XYZ analysis method offers a systematic framework for categorizing inventory items based on demand patterns. Proper strategies in managing these inventory items can reduce the risk of stockout and material overstock, ensuring that every item needed is available at the right time.

XYZ analysis divides prep items into three categories: X, Y, and Z.

### 1. Category X

Items with stable demand and low variance. Examples of this category include KWH (ZM0219) and Cable Power ACC (ZM0312). These items show a low standard deviation, so they require strict inventory control. The use of the Just-In-Time (JIT) method can be very effective to avoid running out of stock, given the critical nature of these items.

### 2. Category Y

Items whose demand is more volatile but still predictable. Examples such as Cable Power (ZM0311) and Conductor (ZM0305) require more attention to replenishment policies. Adjustments to order quantities based on demand trend analysis should be made periodically to ensure that inventory levels remain optimal and do not overload the logistics system.

### 3. Category Z

Items in this category are marked with irregular requests. For these items, such as Relay (ZM0217), PT PLN needs to implement periodic monitoring strategies and in-depth analysis to manage procurement policies, ensuring that inventory can be adjusted to changing needs.

A real case can be seen from the experience of PT PLN UP3 Mempawah in dealing with a surge in demand during the increase in electricity demand in the Mempawah area. In this context, items in category X such as KWH may be urgently needed items. Delays in the procurement or distribution of such items may result in stockouts, potentially hindering new installation and power addition projects, as well as lowering customer satisfaction levels.

On the other hand, in category Y, if trend analysis shows that the demand for Cable Power (ZM0311) fluctuates seasonally, PT PLN must be able to adjust the order of goods dynamically. For example, in certain months when there are much more construction projects, the number of orders for these items can be increased based on the existing historical data.

As part of an effective distribution strategy, PT PLN must ensure that items from category X are distributed with the highest priority. An efficient distribution scheduling system can reduce delays in delivery. In addition, the use of an effective tracking system for real-time monitoring of the shipment of goods will be of great help in improving logistics efficiency.

For Y and Z categories, more flexible distribution routes can be adopted; This includes the ability to change delivery schedules based on live mapping of rapidly changing demand. This is especially important given the dynamics of demand that often depend on external factors such as sudden large-scale construction projects.

This risk analysis (Stockout and Overstock Risk) is important, as errors in management can have a major impact on operations. The risk of stockout can be avoided through the implementation of a careful inventory control policy, especially for high-risk category X. On the other hand, overstock has the potential to result in a waste of resources in the form of storage costs.

To reduce these risks, PT PLN must continuously evaluate demand patterns and balance between excessive procurement and stock shortages. A good communication strategy between procurement and distribution teams is crucial to ensure that information about actual demand can be obtained and acted upon quickly.

The application of FMEA (Failure Mode and Effects Analysis) analysis at PT PLN UP3 Mempawah has provided significant insight into potential risks in the electricity system. Through a table that presents the various component parameters, standard deviation, coefficient of variation (CV), and XYZ classification of each item, this analysis helps in understanding the impact that may arise. As a result, solutions that can be implemented to reduce risk become clearer. The impact of the FMEA Analysis Findings includes:

a. Risk of Component Failure

One of the striking findings came from items that showed high standard deviations, such as "Cable Power ACC (ZM0312)" and "KWH (ZM0219)", which showed significant fluctuations. These fluctuations have the potential to cause disruptions in the reliability of the energy supply, which can lead to unplanned power outages. In this context, for example, if the electricity supply is interrupted during peak demand, this can lower customer satisfaction levels and affect the company's reputation.

b. Increased Operational Costs

Components that fall into the Y and Z categories, especially those with high coefficients of variation such as "Cable Control (ZM0416)" and "Relay (ZM0217)", indicate that the cost of maintenance and replacement of components will increase along with a higher frequency of failures. For example, if the frequency of failures on a particular component increases, annual maintenance costs can spike, contributing to the company's total operating costs.

c. Environmental Impact

Failures in the power distribution system can have a detrimental impact on the environment. For example, if any appliance is dropped or damaged, oil or other chemical leaks may occur. This not only has a negative impact on the environment, but can also lead to legal sanctions for companies.

d. Safety and Health

Component failure situations are not only detrimental to the company but can also threaten the safety of employees in the field. For example, a failure in an electrical system can lead to fatal accidents if not handled properly. Therefore, there needs to be serious attention to safety factors in all operational aspects.

### Risk Mitigation Measures

a. Preventive Maintenance and Routine Maintenance

The implementation of preventive care policies must be carried out consistently. This includes scheduled inspections of components that have a high potential for failure, especially those listed in categories Y and Z. This process will help detect and address problems before they become more severe, before affecting the company's operations.

b. Employee Training and Awareness

Increased training and awareness regarding the care and use of power tools is urgently needed. Employees need to be given knowledge on how to handle various problems that may occur with components, so as to reduce the risk of human error. For example, periodic training on emergency procedures can prepare employees to deal with failure situations.

c. Investment in Technology and Innovation

Updating technology and replacing with the latest equipment can result in huge gains in terms of reliability. The use of an IoT-based monitoring system (Internet of Things) in the field allows real-time monitoring of the condition of the device, so that anticipatory steps can be taken quickly. Thus, early detection of problems can prevent worse consequences.

d. Improvement of Component Quality

Ensure that all components used are of high quality and meet applicable standards. The use of a tested and proven product can significantly reduce the frequency of failures. For example, choosing a supplier who has a good track record can help in this regard.

e. Risk Management System

The implementation of a comprehensive risk management system can assist companies in identifying, assessing, and mitigating risks. With good management, companies can have a planned strategy to deal with each type of failure. The use of FMEA analysis as part of a risk management system also provides a solid framework.

f. Periodic Audits and Reviews

Conducting regular audits of all system components and processes is essential to find potential weaknesses. This audit will allow the company to assess the effectiveness of the solutions that have been taken and make the necessary adjustments. For example, if the audit shows that the frequency of failures is not decreasing, then there needs to be further evaluation of the strategies implemented.

From the FMEA analysis conducted at PT PLN UP3 Mempawah, effective risk management is very important in dealing with potential problems that may occur. Through the mitigation measures that have been outlined, the company is expected to reduce the possibility of system failures, improve operational efficiency, and ensure safety for both employees and the environment. With these measures, the company can not only meet customer demands but also contribute to better environmental sustainability.

FMECA (Failure Mode, Effects, and Criticality Analysis) analysis is a very important tool in risk management, especially in the context of companies such as PT PLN UP3 Mempawah that operate in the electricity and distribution sectors. FMECA assists in identifying, evaluating, and prioritizing potential failure modes of a product or system, as well as the impact that such failure causes. Through the table presented, several MDU (Material Distribution Unit) items have been analyzed by generating comprehensive data, including standard deviation and XYZ classification. The following discussion will explain how the results of the FMECA analysis can affect the inventory control and distribution strategy of MDUs for new installations and power additions at PT PLN UP3 Mempawah. Introduction to FMECA and XYZ Classification

4. FMECA: It is a systematic process in detecting and addressing potential problems at an early stage in the product life cycle. This analysis can identify the impact of potential failures on the electricity distribution system.

5. XYZ Classification: This method divides inventory into three categories based on demand, fluctuations, and importance.

1. X: Demand is stable, high, and fluctuations are low.
2. Y: Demand is unstable, moderate, and fluctuates moderately.
3. Z: Demand is highly volatile, low, and highly fluctuating.

From the table presented, each MDU item has a different classification based on the FMECA analysis, which will affect how the inventory control and distribution strategy is established.

#### Inventory Control Based on FMECA Results

6. Identification of Critical Items (XYZ Classification):

1. Goods with an X classification such as KWH, MCB, and MCCB require more attention in inventory control. Stable demand allows companies to maintain sufficient inventory to support operations.
2. For goods with a Y classification, companies must increase flexibility in procurement and storage, given the presence of higher fluctuations in demand.
3. Goods with a Z classification will require extra attention regarding storage, as unstable demand can lead to overstocking or stockout.

7. Just-In-Time (JIT) Implementation:

The implementation of the JIT system will be very beneficial for goods with Z classification, avoiding high storage costs and increasing the company's liquidity. For example, for items such as "Relay" (ZM0217) that fall into category Z, companies could consider making agreements with suppliers so that maximum deliveries are made only when needed.

8. Monitoring and Evaluation:

Conducting a continuous evaluation of distribution and demand data will help in formulating better inventory control policies.

#### Distribution Strategy Based on FMECA Analysis

1. Optimization of Distribution Routes:

Using data from FMECA analysis, PT PLN UP3 Mempawah can design a more efficient distribution route. For example, by prioritizing goods with X and Y classifications to be distributed first to ensure availability.

2. Increased Collaboration with Suppliers:

Close collaboration with suppliers is essential especially for items with Y and Z classifications.

3. Use of Technology in Distribution:

The implementation of an information technology-based distribution management system can increase the effectiveness of delivery. Through this technology, information about inventory and demand status can be accessed in real-time, so that companies can respond more quickly to needs.

For example, it can be seen in the "Cable Power" component (ZM0311) which has a Y classification with a high deviation standard. This suggests that the demand may vary. In the event of a failure in the supply of these components, there will be a direct impact on the operation of the electricity distribution network.

1. Step One: Identify what is causing demand fluctuations.
2. Step Two: With FMECA data, risk analysis can be performed to prepare backup or alternative planning.
3. Step Three: Prioritize efficient stock control and distribution to avoid greater impact on customers.

The FMECA analysis conducted on the MDU at PT PLN UP3 Mempawah has a significant impact on the inventory control and distribution strategy. By understanding the classification and characteristics of each component, companies can take appropriate steps to improve operational effectiveness. Good inventory control, accompanied by efficient distribution, will contribute to better electrical service as well as higher customer satisfaction. Given the importance of this analysis, PT PLN UP3 Mempawah is advised to continuously evaluate and update its inventory management and distribution system.

## CONCLUSION

Based on the results of the research and discussion that has been carried out, the researcher tries to provide conclusions to answer the formulation of the problem that in the context of controlling the inventory and distribution of Material Distribution Units (MDU) for new installations and additional power at PT PLN UP3 Mempawah, FSN (Fresh, Slow, Non-moving), XYZ, FMEA (Failure Modes and Effects Analysis), and FMECA (Failure Modes, Effects, and Criticality Analysis) has a very significant role. These four methods contribute to understanding the demand patterns, risks, and effectiveness of existing distribution systems, as well as help in formulating better strategies for more efficient inventory management and distribution. FSN analysis serves to group MDUs based on the level of inventory movement. By distinguishing between fast-moving goods (Fresh), slow-moving goods (Slow), and non-moving goods (Non-moving) goods (Non-moving), PT PLN can optimize the storage and procurement of inventory. Items classified as Fresh can be prioritized in the procurement process for new installations, while Slow and Non-moving items can be more carefully considered to prevent overstock or shortages when needed. This approach helps in reducing storage costs and improving the response to customer demands. Meanwhile, XYZ analysis allows PT PLN to classify MDUs based on demand variability, which is important in inventory management. This classification helps companies in determining a more appropriate control strategy for each category of goods. Goods with stable demand (X) can be managed with a just-in-time approach, while goods with erratic demand (Z) require more intensive supervision to avoid supply shortages. Thus, the synergy between FSN and XYZ analysis can strengthen the right demand fulfillment strategy. FMEA and FMECA analysis emerged as an important tool in identifying and analyzing potential functional failures of the MDUs used. Through this approach, PT PLN can identify the types of critical damage that can occur to the electrical system, as well as provide appropriate mitigation measures. FMEA provides an understanding of the potential impacts of each failure mode, while FMECA goes further by assessing how critical those impacts are to the overall electrical system. Thus, the inventory control and distribution strategies implemented can be more targeted and planned, such as replacing high-risk components before damaging the system. Overall, the analysis of FSN, XYZ, FMEA, and FMECA formed a solid framework in the inventory control and distribution of MDU at PT PLN UP3 Mempawah. By adapting these analytical methods in its operational strategy, PT

PLN is not only able to improve efficiency in terms of inventory management and distribution, but can also face challenges in providing high-quality electricity services to the community, so as to optimally meet customer expectations and needs. The combination of these four analyses makes it an invaluable tool for companies to mitigate risks and create reliable and sustainable electricity services.

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