INVESTIGATION LOW STOCK ACCURACY USING FAILURE MODE AND EFFECT ANALYSIS STUDY AT PT. XYZ PHARMACY

Dandi Nurdiansyah,
Dikdik Rinaldi
Ikhsan Baharudin
Ahmad Jaka Purwanto
Muhammad Andito Destiano
Didit Damur Rochman

DOI: https://doi.org/10.37178/ca-c.23.1.211

Dandi Nurdiansyah, Industrial Engineering, Universitas Widyatama, Bandung, Indonesia
dandi.nurdiansyah@widyatama.ac.id

Dikdik Rinaldi, Industrial Engineering, Universitas Widyatama, Bandung, Indonesia
dikdik.rinaldi@widyatama.ac.id

Ikhsan Baharudin, Industrial Engineering, Universitas Widyatama, Bandung, Indonesia
ikhsan.baharudin@widyatama.ac.id

Ahmad Jaka Purwanto, Industrial Engineering, Universitas Widyatama, Bandung, Indonesia
ahmad.jaka@widyatama.ac.id

Muhammad Andito Destiano, Industrial Engineering, Universitas Widyatama, Bandung, Indonesia
andito.destiano@widyatama.ac.id

Didit Damur Rochman, Industrial Engineering, Universitas Widyatama, Bandung, Indonesia
diditdr@widyatama.ac.id

Abstract

Failure Mode and Effect Analysis (FMEA) is a method used to identify the risk of failure. This paper aims to identify the factors that can affect the accuracy of the data in the warehouse of the pharmaceutical company PT. XYZ Pharmacy is located in Bandung, Indonesia. Inventory data accuracy refers to the consistency between the actual amount of inventory and the amount of inventory recorded in the system. The results showed that the highest RPN value in FMEA was 336 and based on randomly selected sample data showed that the largest difference between stock and actual reached 48 pcs. Based on the identification results that have been carried out, the main cause of data accuracy failure is caused by the activity of borrowing goods from the warehouse to the user. Judging from the existing SOPs, it is known that there is no

more detailed form of releasing goods so that the control of recording the expenditure of goods is still not good. Therefore, the author proposes to eliminate the process of borrowing goods by making policies or standard operating procedures related to Work Order Forms (WO). This WO serves to become a record issue for warehouse documentation, if there is a difference in the stock of goods in the warehouse, the cause of the difference will be known from the WO which is integrated with the CWorks system. This policy is expected to minimize or even eliminate the occurrence of stock mismatches or lack of stock accuracy.

Keywords: *Inventory, Warehouse, Pharmacy, FMEA.*

Introduction

Inventory record accuracy is a system or document that contains the type of inventory and the amount owed by the company [1, 2]. Inventory records will make it easier for companies to find out the amount of inventory they have without having to do physical calculations when they want to know the status of existing inventory. Inventory errors or often known as Inventory Errors are one of the factors that can affect the quality of warehousing information. The impact of inventory errors causes differences in inventory information that is in the IT system records with inventory that is in the field. The three main factors that can affect inventory errors are item shrinkage, misplacement, and scan errors. The impact of inventory errors is quite risky because it can hamper the logistics process. There are two objectives associated with the logistics process, namely maximizing the use of resources such as space, equipment, labor, and satisfaction of customer needs. To achieve this goal, proper warehouse management is needed to be able to support the process of managing stock in the warehouse [3, 4].This is a fairly serious problem, considering that if a process is hampered that can disrupt the company's operational gaps, it will reflect the financial results needed by the company. In addition, inventory errors become a habit made by workers in warehouses. If this inventory error continues, a lot of inventory will inevitably continue to not meet the needs over time[5-7].

PT. XYZ is a leading pharmaceutical company in Indonesia, located in Bandung, West Java. During the Covid-19 pandemic, the demand for these types of drugs is very high, so good supporters are needed. In this study, the data accuracy factors in the inventory in the spare parts warehouse area of PT. XYZ. The results of this study are a set of actions that must be taken by the company to improve the accuracy of stock and field data to meet the supply of supporting materials to support the operations of the pharmaceutical industry of PT. XYZ. In this research process, data is needed as a test material which will then be processed using the Failure Mode and Effects Analysis (FMEA) method. Various studies using the FMEA method have been carried out to analyze potential failure in warehouse such as in papers [4, 6, 8]. FMEA is used in this study to identify the risk of failure of data warehousing accuracy. Inventory data accuracy refers to the consistency between the actual amount of inventory and the amount of inventory recorded in the system. In most cases, it is the difference between what is recorded in the system and what is held in the warehouse or storage location that causes the discrepancy. It is hoped that this research using the FMEA method can anticipate differences between the actual stock inventory and the stock inventory in the system which can have an impact on material losses and even financial companies [9, 10].

Literature Review

Inventory Record Accuracy (IRA) is used to balance the organizations goals to achieve sustainable products, especially on the accuracy of recording inventories of raw materials and finished goods. The performance of the company can be described by two condition namely high inventory levels and low inventory levels. High inventory

level of responsiveness is good but lower in efficiency otherwise. Low inventory levels will result in a product that is poorly responsive but high in efficiency [1, 11]\. In the pharmaceutical world, inventory refers to the inventory of pharmaceutical products maintained to satisfy future demand. Inventories represent the largest current asset whose value continues to increase due to growth in the variety and price of pharmaceutical products [12, 13]. Inventory errors impact departments across the business, from operations to sales and finance, to stockroom [5, 14]. Good Inventory Record Accuracy is needed to reduce inventory shortages in the warehouse, maintain order schedules for suppliers, avoid excess inventory and provide good service to customers. One of the methods used to find the root cause of inventory record accuracy is FMEA.

Failure Mode and Effect Analysis (FMEA) is a method for the possibility of an error or failure of a system, design, or process. Assess risk with identified failure modes, effects and causes, as well as prioritizing key issues for action improvement, as well as identify and implement corrective action to address the most serious problem[12]. The FMEA method was first developed by the United States military in 1940, when it was used as a technique for evaluating the effects of equipment system failures. This method has also been used by NASA to verify and improve the reliability of the space program hardware, finally this FMEA method can be widely accepted both from the military and commercial industries. There are two main types of FMEA, namely FMEA Design which is used to analyze the product before it is released into production and focuses on the potential failure modes of the product caused by design flaws. Then FMEA Process which is usually used to analyze manufacturing and assembly processes at the system, sub-system or component level [9, 15]. Every possible failure that occurs is quantified and the best handling priority is made.

There are three things that can be used to determine disturbances that my occur, namely frequency (occurrence), level of damage (severity), and level of detection. The following is a table to determine the Severity, Occurrence, and Detection values in solving FMEA problems.

Table 1

Severity Rating

Rating	Impact	The Seriousness of Impact
1	No Impact	Does not cause any impact
2	Minor Disturbance	Few process, operational and operator inconvenience
3-4	Medium Disturbance	Low-level errors that cause little disruption to the process and require little rework
5-6	Significant Disturbance	Moderate/decent order because of this error. This error may result in the need for unscheduled repairs or damage to equipment
7-8	Major Disturbance	Errors that can lead to dissatisfaction with the process. Does not avoid the issue of security of funds or laws and regulations. May cause disruption to the ongoing process of funds or services
9-10	Related to safety/ laws and regulations	The error rate is very high and affects safety and involves breaking the law and regulations

Table 2

Occurence Rating

Possible Failure	Description	Criteria: Occurrence of Cause (Incident / Item)	Rating
Very High	Failure is almost inevitable	≥ 100 / Thousand ≥ 1 / 10	10
High	Failure that can potentially repeat it self	≥ 50 / Thousand ≥ 1 / 20	9
		≥ 20 / Thousand ≥ 1 / 50	8
		≥ 10 / Thousand ≥ 1 / 100	7
Moderate	Failure that can happen again every now and then	≥ 2 / Thousand ≥ 1 / 500	6
		≥ 0.5 / Thousand ≥ 1 / 2000	5
		≥ 0.1 / Thousand ≥ 1 / 10.000	4
Low	The probability of failure that occurs is relatively small	≥ 0.01 / Thousand ≥ 1 / 100.000	3
		≥ 0.001 / Thousand ≥ 1 / 1.000.000	2
Very Low	Failure is impossible	Can be eliminated by preventive control	1

Table 3

Detection Rating

Rating	Description	Criteria

1-2	*Very High*: Supervision can almost certainly detect defects/errors/damages	Lowest reliability/detectability at 99.99% level
3-4	*High*: Supervision has a high probability of detecting defects/errors/damages	Lowest reliability/detectability at 99.8% level
5-6	*Moderate* : Supervision may detect defects/errors/damages	Lowest reliability/detectability at 98% level
7-8	*Low* : Supervision is more likely to detect no/error/breakdown	Lowest reliability/detectability at 90% level
9-10	*Very Low*: Supervision is very likely not to detect defects/errors/damages	Lowest reliability/detectability at 90% level or lower

Methods

Please note that the process flow in the spare parts warehouse area of PT. XYZ is as follows:

Figure 1 Process Flow of Warehouse Sparepart PT. XYZ

Good receipts are all activities related to the receipt of goods by the warehouse from the vendor. Put away is an activity related to checking documents on goods that have been received and then proceeding to the process of placing goods in the warehouse area according to the availability of space in storage. Storage is a place for storing goods where the placement of goods must match the address or identity. Picking is an activity related to the process of taking and borrowing goods carried out by warehouse officers and then handed over to the user. Shipping is a process where the goods have been brought by the user to be used in the production line area according to their needs.

This research methodology will explain the steps taken in research to facilitate the identification process in research.

1. Identify Potential Failure Modes and Potential Causes

This data collection contains a sequence of process flows from receipt of goods to distribution of goods in the spare parts warehouse area. To make it easier during the identification process of Potential Failure Mode and Potential Cause, the method used is brainstorming.

2. Determination of Severity, Occurrence, and Detection Values

The Severity value states that the occurrence of failure will have an impact in the form of disturbances to the system as a whole. The occurrence value states the probability for each potential cause of failure. Furthermore, the Detection value states how much potential failure can be detected before it occurs and also whether the control that is owned can reduce the potential for failure that occurs. The scale used

for each of these values is 1 to 10, where 1 is the lowest value and 10 is the highest score.

3. Calculation of Risk Priority Number (RPN)

Value After performing the steps with the FMEA method, the next step will be to calculate the RPN value for each potential failure where the RPN is the product of Severity (S), Occurrence (O) and Detection (D). In this study, the calculation of the Risk Priority Number (RPN) is written in the following equation:

Equation 1 RPN = Severity (S) × Occurrence (O) × Detection (D)

4. Ordering of Risk Priority Number (RPN)

After getting the RPN value, the next step is to sort the RPN value from the largest to the smallest. Then the next step is to calculate the percentage of RPN and the cumulative percentage of RPN based on the results of the calculation of the RPN for potential failures in each process. Next is to make a Pareto diagram based on the highest RPN value. The RPN value can be used as a reference basis for improvement in each process. The RPN value > 100 is used as a reference for corrective actions that must be taken considering the priority of improvement must consider Severity and the critical function of the process is prioritized (ref. FMEA Guidance manual ed.4 regarding RPN threshold).

5. Analysis

The analysis contains an evaluation based on the RPN value where the selected failure potential will be analyzed and identified further using the Failure Mode and Effects Analysis method to obtain proposed improvements and to anticipate the occurrence of stock differences in the warehouse.

6. Conclusion

The conclusion contains the results of the evaluation based on data processing and analysis at the previous stage in order to minimize and anticipate the occurrence of differences in the stock of goods in the spare parts warehouse.

Results and Discussion

The lack of accuracy in recording inventory/stock (IRA) at the spare parts warehouse of the pharmaceutical company PT. XYZ can interfere with the company's operational activities, especially in related departments. The problem that occurs is the difference between the amount of inventory/stock recorded in the system and the amount held in the warehouse or storage location that causes the difference, as in table 4 below is the historical stock taking data in July 2021 from the company.

Table 4

Stock Opname Data July 2021

No.	Item	Inventory Classification	System Count.	Real Count.	Diff.
1	Diaphragm silicone 892-3-231	A	8	6	2
2	Diaphragm for metal DN8	A	13	11	2
3	Bearing 608	A	100	94	6
4	Bearing UCFB 205FYH	A	8	5	3
5	Bushing 260358	A	9	8	1
6	Proximity sensor E2A.M12	A	11	11	0
7	Ball Bearing 6000	A	60	12	48
8	Bellow Nipple 5x11x16	A	28	26	2

9	Proximity Switch IPF	A	12	11	1
10	Welding Profile Port	A	3	2	1
11	Saklar Double CLIPSAL	B	32	28	4
12	Sproket Modular Conveyor	B	13	11	2
13	O-ring viton 1D14 x 0D4MM	B	5	0	5
14	Spi motor	B	2	1	1
15	Relay Plug 24VDC	B	9	9	0
16	Sealant Glass Black	C	7	6	1
17	Relay 250V 5A	C	2	2	0
18	Shaft 440329	C	21	21	0
19	Digital Output Siemens	C	5	5	0
20	Solenoid Valve 2/2 ways	C	1	1	0

Data information uses historical data, interviews, direct observation, and brainstorming, then the data processing process is carried out to solve the problem. The results and preparation of the FMEA are shown in the table below. The values of Severity (S), Occurrence (O), and Detection (D) and the value of Risk Priority Number (RPN) for each potential failure are as follows:

Table 5

FMEA Result

Process Failure Mode and Effect Analysis

System: Sparepart Warehouse - Sterile PT. XYZ			**Checked by:**			
FMEA Date: 29 September 2021			Evan Permana			
Prepared by: Dandi Nurdiansyah, et al						
Process	**Potential Failure Mode**	**Potential Causes of Failure**	**Potential Efffect of Failure**	**Rating**			**RPN**
				S	**O**	**D**	
Purchase	Wrong writing of goods specifications in BPPB	User negligence in checking the specifications of the ordered goods	Product specifications do not match what is needed	2	2	3	12
Reception	The items do not match the Delivery Notes	Negligence on the part of the supplier not checking first	Waste Time due to the long process of returning goods	2	2	2	8
	Item does not match specifications	Negligence on the part of the supplier not checking first	Items cannot be used as needed	2	2	2	8

Table 6

FMEA Result (Continue)

Process Failure Mode and Effect Analysis

System: Sparepart Warehouse - Sterile PT. XYZ	**Checked by:**
FMEA Date: 29 September 2021	Evan Permana

Process	Potential Failure Mode	Potential Causes of Failure	Potential Efffect of Failure	Rating			RPN
				S	O	D	
Reception	Data entry error on BPB	Operator negligence in re-checking incoming goods	Item identification difficulty	4	2	2	16
Purchase	The number of items does not match	Negligence on the part of the supplier not checking first	Goods will be quarantined (will not directly enter warehouse stock)	2	2	2	8
	Error receiving goods belonging to other unit departments	Negligence on the part of the supplier not checking first	Items belonging to other units will go to warehouse stock	2	2	3	12
Storage	Double code item in Cwork	Negligence of the warehouse operator in the adjustment of goods	Difficulty finding items that will be requested by the user	2	2	3	12
	Double item in 1 code	Negligence of the warehouse operator in the adjustment of goods	Items are not stored in one location	1	1	1	1
	Error data entry on Cworks by Warehouse	Warehouse operator negligence in the entry of new goods receipts in the system	Double code, other items will be added, difficult to identify items	2	2	3	12
	Error storage location	Negligence of the warehouse operator in the adjustment of goods	Accumulation of goods that do not match the location	2	2	3	12
	Error writing item code	Warehouse operator negligence in writing item code	Data entry which will cause the wrong item data	2	2	3	12
Expenditiuns	User borrows goods	Operator and user negligence in communication regarding the status of goods	Difference in stock of goods	6	8	7	336
	Wrong code and number of items	Operator's negligence in writing the Item Expenditure Bill	Items come out not updating the system	3	5	5	75
	Wrong entry of goods release data on Cworks	Operator error in data entry	Items come out not updating the system	2	2	3	12
Stock Opname	Error in item calculation	User negligence in calculating stock items	The data will be different, the data does not match the balance	2	2	3	12

Table 7

FMEA Result (Continue)

Process Failure Mode and Effect Analysis
System: Sparepart Warehouse - Sterile PT. XYZ **Checked by:**
FMEA Date: 29 September 2021 **Evan Permana**
Prepared by: Dandi Nurdiansyah, et al

Process	Potential Failure Mode	Potential Causes of Failure	Potential Efffect of Failure	Rating			RPN
				S	O	D	
Stock Opname	Error recording the number of items	Negligence of the warehouse operator in recording the calculated stock of goods	The data will be different, the data does not match the balance	2	2	3	12
	Error correction of goods difference on Cworks	Warehouse operator error is not corrected in the system	The data on the system is not updating	1	1	2	2
	Data print error	Warehouse operator omission in data printing for SO	User will work 2 times	1	1	2	2
	Error storing goods after calculation	Negligence of warehouse operators and users in communication	Accumulation of goods that do not match the location	1	1	2	2
	The stock card storage error does not match the item	Negligence of warehouse operators and users in communication	Missing card stock, double card stock	1	1	2	2

Calculation of RPN is an important part of FMEA because the value of RPN will determine the priority of the Risk Priority Number including Critical Risk . Judging from the value of the largest RPN is in the process of releasing goods, namely, in the process of borrowing goods by the user, Potential Failure in this process has a Severity value of 6 because if this happens it will have a significant impact on the smooth operation of the warehouse. The Occurrence value for potential failure is 8 because the frequency of occurrence is frequent, and this occurrence is more frequent than other potential failures. The Detection value for potential failure is quite low, namely 7, supervision is more likely not to detect errors. Based on the SOP in the warehouse, it is known that there is no more detailed form for the release of goods, there is only a BPB (Goods Expenditure Bill) which can only be used for warehouse documentation, while in the CWorks system during the input process there is information on whether there is the use of WO (Work Order) Form or not when releasing goods, the problem is that the warehouse does not have a record of issues related to the user's work and the status of the use of a part of the goods used either in production or other departments related to engineering. Therefore, the author proposes to eliminate the process of borrowing goods to reduce or even eliminate the occurrence and severity of the potential failure and create a policy or standard operating procedure related to WO to increase the detection value so that the activity of releasing goods is more controlled. This WO serves to become a record issue for warehouse documentation, if there is a difference in the stock of goods in the warehouse, the cause of the difference will be known from the WO which is integrated with the CWorks system, the process

of finding the cause and effect of stock differences will make it easier for warehouse PIC. The advantage for users and other departments is that there is a good history of corrective or preventive actions taken by the engineering division. It is hoped that this policy will minimize and even eliminate the occurrence of discrepancies in stock of goods or the lack of stock accuracy. The second-largest RPN is in the process of releasing goods, namely operator error in writing the code and the number of items on the Goods Expenditure Bill (BPB) with an RPN value of 75 consisting of Severity 3, Occurrence 5, and Detection 5 values, in this case, improvements can be made by prevention, namely the warehouse SPV is more active in reminding operators to be more aware of work, especially when documenting the writing of goods receipts, communication between warehouse operators per shift to better ensure the suitability of the work that has been done in the previous shift to minimize or even eliminate potential failures.

Conclusions

Based on the FMEA results table, it is found that the largest RPN value is 336, namely for potential failure of borrowing goods by users which results in differences in stock of goods. This potential failure has a Severity value of 6 because if this happens it will have a significant impact on the smooth operation of the company. The Occurrence value for this potential failure is 8 because the frequency of occurrence is frequent, and this occurrence is more frequent than other potential failures. The Detection value for this potential failure is quite low, namely 7, supervision is more likely not to detect errors. From the results of discussions with the warehouse PIC and after observing the existing system directly, it was found that the cause of the error was the negligence of the warehouse operator and user in communication regarding the status of borrowed goods. Therefore, the author proposes an action plan by making improvements to the warehouse SOP in the form of making a Log Book of borrowing goods from the user to the warehouse so that the activity of borrowing goods can be recorded properly. This is intended to minimize or even eliminate the occurrence of discrepancies in stock of goods or the lack of stock accuracy.

From the results of discussions with the warehouse PIC and after observing the existing system directly, it was found that the cause of the error was the negligence of the warehouse operator and user in communication regarding the status of borrowed goods. Therefore, the author proposes to eliminate the process of borrowing goods by making a policy or standard operating procedure related to the Work Order Form (WO). This WO serves to become a record issue for warehouse documentation, if there is a difference in the stock of goods in the warehouse, the cause of the difference will be known from the WO which is integrated with the CWorks system, the process of finding the cause and effect of stock differences will make it easier for warehouse PIC. For users or other departments, there is a distinct advantage that they have a good history of corrective or preventive actions taken by the engineering division. It is hoped that this policy will minimize and even eliminate the occurrence of discrepancies in stock of goods or the lack of stock accuracy.

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