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Administrative and Field Risk Analysis in the PGN Sales Division Using the FMEA Method

Ainur Zaki Yamami[1]*, Sumiati[2]

[1,2]*UPN Veteran Jawa Timur*
22032010180@student.upnjatim.ac.id[1*], Sumiatiroyanawati04982@gmail.com[2]

Abstract

This study analyzes administrative and field operational risks in the Sales Operation Regional (SOR) III of PT Perusahaan Gas Negara (PGN) using the Failure Mode and Effect Analysis (FMEA) method. The objective of this research is to identify potential failure modes in customer service processes and determine risk priorities that may affect service quality and operational safety. Data were collected through observations, interviews, and documentation during an internship period, covering administrative activities and gas pipeline installation processes. The analysis shows that potential failures are concentrated in three main stages: customer data input, data verification at the head office, and gas pipeline installation. The results indicate that the data input stage has the highest risk level, with the loss of customer data forms recording the highest Risk Priority Number (RPN) value. Technical constraints during data verification and safety-related issues during gas installation were also identified, although with relatively lower RPN values. Overall, the application of the FMEA method provides effective insights for prioritizing corrective actions and improving the reliability, safety, and efficiency of natural gas service operations.

Keywords: *Failure Mode and Effect Analysis; Natural Gas Service; Risk Analysis; Service Quality*

1. Introduction

Natural gas is a vital component of the global energy supply and one of the most strategic energy sources due to its high efficiency and lower environmental impact compared to other fossil fuels. In Indonesia, natural gas is produced not only to meet export demand as a source of national revenue, but also to support domestic energy needs across industrial, commercial, and household sectors. PT Perusahaan Gas Negara Tbk (PGN), as the largest state-owned enterprise in the transportation and distribution of natural gas, plays a central role in ensuring the continuity of this energy supply. To fulfill this role, PGN's business activities—particularly within the Sales Division—require accurate administrative processes and safe, effective field operations. However, in practice, both processes involve potential risks that can affect service quality and operational continuity. Therefore, a structured risk analysis is required to identify, evaluate, and minimize potential process failures, one of which can be conducted using the Failure Mode and Effect Analysis (FMEA) method.

Administrative problems arise from various activities that demand high accuracy and attention to detail. These activities include customer data management, document verification processes, data entry into internal systems, report preparation, and inter-unit communication. In practice, during the internship period, several issues were identified, such as delays in document processing, discrepancies between field data and administrative records, errors in customer data entry, and a lack of standardization in document handling workflows. These issues create risks such as delays in contract processing, slow responses to customers, and the potential for incorrect decision-making due to inaccurate data. In addition, field-related risks are also a major concern. Field activities such as site surveys, gas installation inspections, pipeline supervision, and delivery point verification require strong coordination and strict adherence to occupational safety procedures. Based on observations, several risks were identified, including incomplete technical information from the field, inconsistencies between actual conditions and documented data, potential hazards during site surveys, and ineffective communication between field teams and administrative staff. These risks may result in delays in infrastructure installation, incorrect technical recommendations, and an increased likelihood of workplace accidents.

The urgency of this risk analysis is further heightened by the unique characteristics of the gas industry compared to other sectors. Minor errors in administrative processes can significantly affect technical field activities, while inaccuracies in surveys or data collection may compromise safety, continuity of gas distribution, and customer satisfaction. Moreover, PGN is currently promoting operational digitalization and improvements in customer service quality, making the identification of potential failures in both administrative and field processes essential to maintaining consistent corporate performance.

To systematically understand the sources of risk, this study employs the Failure Mode and Effect Analysis (FMEA) method. The FMEA approach enables researchers to identify potential failure modes, analyze their causes and effects, and assign quantitative ratings related to

severity, occurrence, and detection. These ratings are then used to calculate the Risk Priority Number (RPN), which helps determine the most critical risks that require immediate attention. Through the application of FMEA, the risk analysis of administrative and field activities in the Sales Division of PGN is expected to produce more targeted recommendations, such as the need for standardized procedures, improved coordination quality, enhanced field risk mitigation, and increased accuracy of administrative data. Ultimately, this study is intended to support the Sales Division in improving safety, operational reliability, and the effectiveness of customer service.

2. Literature Review

2.1. Operational Risk and Operational Risk Management

Operational risk is the potential occurrence of events that can hinder the achievement of organizational objectives due to failures in internal processes, human error, system disruptions, or external factors. In the context of service and energy companies, operational risks often arise in administrative activities and field operations that involve multiple stages and related parties. According to Huang et al., unsystematic risk management can lead to increased operational costs, a decline in service quality, and a higher potential for workplace accidents [1]. Therefore, the company needs to implement structured risk management to identify, analyze, and control risks from an early stage. Risk management aims to minimize the negative impact of risk by determining handling priorities based on the level of severity and the probability of occurrence. Zuniawan states that an analytical approach in risk management is highly necessary for processes that are complex and repetitive, such as customer service and field operational activities [2]. With good risk management, the company can improve process effectiveness and maintain operational reliability.

2.2. Customer Administration in the Service Process

Customer administration is an important part of the service delivery process, as it serves as the basis for decision-making and the smooth continuation of subsequent processes. Errors at the administrative stage, such as data entry errors, incomplete documents, or data duplication, can pose risks in the form of service delays and decreased customer satisfaction. Sutopo and Grasella state that most service process failures are caused by human error in routine administrative activities [3]. In the energy services industry, customer administration plays a crucial role because it is related to technical and safety aspects. Inaccurate data can lead to errors in the survey process as well as installation activities in the field. Therefore, an administrative control system is needed that is able to minimize errors and improve the reliability of customer data.

2.3. Field Activities and Technical Risks

Field activities in the energy industry, particularly gas distribution, involve technical operations that carry a high level of risk. Activities such as site surveys, pipeline installation, and gas installation testing have the potential to cause hazards if not carried out in accordance with procedures. Azzahra explains that technical risks in the field are often related to non-compliance with SOPs, lack of supervision, and non-ideal working environment conditions [4]. Risks in field activities not only impact service delays but also have the potential to threaten the safety of customers and technicians. Therefore, companies need to carry out systematic identification of field risks so that potential failures can be minimized before causing greater impacts.

2.4. Failure Mode and Effect Analysis (FMEA)

Failure Mode and Effect Analysis (FMEA) is a risk analysis method used to identify potential failures (failure modes) in a process and to analyze their causes and resulting effects. FMEA is widely applied across various industrial sectors because it provides a systematic and structured approach. Sharma and Srivastava state that FMEA is effective for identifying critical points in operational processes and assisting companies in determining improvement priorities [5]. In addition, FMEA is considered flexible because it can be applied to both administrative and technical processes. In the context of customer service and field activities, FMEA can be used to map risks arising from human error, systems, as well as non-standard work procedures. FMEA is based on the use of three main parameters, namely Severity, Occurrence, and Detection, which are used to quantitatively evaluate the level of risk of a failure [6].

2.5. Parameter Severity, Occurrence, and Detection

Risk assessment in the FMEA method is carried out using three main parameters, namely Severity (S), Occurrence (O), and Detection (D). Severity indicates the level of impact severity if a failure occurs, Occurrence indicates the frequency or likelihood of a failure occurring, while Detection indicates the system's ability to detect a failure before it has further impact. According to Huang et al., the combination of these three parameters provides a quantitative overview of the risk level of a failure [7]. The use of the S, O, and D parameters allows companies to assess risks objectively and consistently, so that the analysis results can be used as a basis for decision-making in process improvement.

2.6. Risk Priority Number (RPN)

Risk Priority Number (RPN) is a value obtained from the multiplication of Severity, Occurrence, and Detection. The RPN value is used to determine the priority level of risk handling, where risks with the highest RPN values should become the main focus of improvement. Zuniawan states that RPN helps companies allocate resources more effectively because attention

is focused on the most critical risks [8]. In practice, the use of RPN allows companies to develop more targeted and data-driven improvement recommendations. This method is widely used in operational risk analysis because it is simple yet capable of providing informative results.

3. Completion Methodology

3.1. Internship Position

The internship position at PT Perusahaan Gas Negara, Sales Division was assigned as an administrative assistant and field operation support. The main responsibilities included managing customer data, verifying information through the PGN database, and participating in field survey activities related to household gas installation. This position provided an opportunity to directly observe the relationship between back-office administrative processes and technical field activities. In addition, the author was involved in collecting data related to potential operational risks, which were subsequently used in the analysis process using the Failure Mode and Effect Analysis (FMEA) method.

3.2. Problem Solving Strategy

a. Data Collection

Based on the sequence of administrative processes and field activities, several types of errors were identified as occurring quite frequently. In the administrative section, errors generally arise during the customer data entry process. These include mistakes in recording customer names, incomplete documents such as missing identity cards (ID), and the absence of reachable contact phone numbers. In addition, there are cases of duplicate customer data and missing BAKKP forms during the input process, which result in the data being unable to be processed further. Other administrative issues occur during the data verification process at the head office. Common errors include incorrect Excel file formats during upload, uploading the wrong ID card or BAKKP files, and disruptions in the central database system. Furthermore, unstable internet connections often cause delays in the verification process because data cannot be transmitted properly. In the field operations, the identified errors are mainly related to the technical aspects of gas pipeline installation. Examples of these issues include stoves producing insufficient gas flow after installation, gas leaks in customers' household pipelines, and technicians failing to follow the standard operating procedures (SOP) correctly. These problems are critical as they are directly related to customer safety and therefore require stricter supervision and inspection. All of these findings were obtained from observations and interviews with employees of PGN's Sales Division and have been summarized in the FMEA table as the basis for risk analysis. The following table presents the errors that have occurred:

Table 1: Error Data

NO	Causes of Failure
1	Error in Entering Customer Name
2	Incomplete Identity Card (ID) Documents
3	Lack of Reachable Contact Phone Number
4	Duplicate Customer Data
5	Missing Forms During Office Handling or Data Entry Process
6	Incorrect Excel File Format for Upload to Central Verification
7	Incorrect Upload of BAKKP and ID Card (Personal Data) Files
8	Central Database System Issues or Server Downtime
9	Network / Internet Connectivity Disruptions
10	Low Gas Flow from Stove
11	Gas Leakage in Customer's Household Pipeline
12	Technician's Non-Compliance with Established Procedures (SOP)

b. Data Classification

To understand the patterns of errors occurring during the service process in PGN's Sales Division, the next step is to classify the various types of errors based on their characteristics. With clear classification, the company can identify the relationship between the sources of problems, the impacts generated, and the position of each error within the service flow. This classification also facilitates the risk analysis process using the FMEA method, as each group of errors represents different potential failures from both administrative and technical perspectives. Based on observations and data obtained during the internship period, the errors that occurred can be categorized into three main groups. The first group consists of errors at the data input stage, such as mistakes in entering customer names, incomplete documents, or missing BAKKP forms. The second group includes errors at the data verification stage, such as incorrect uploading of ID card or BAKKP files, incompatible Excel file formats, central system disruptions, and network connectivity issues. The third group comprises errors at the field installation stage, including low gas pressure at the stove, gas pipeline leaks, and technicians' non-compliance with installation standard operating procedures (SOP)

Table 2: Error Grouping Data

No.	Type of Error	Cause of Error
1.	Errors in Data Input at the Surabaya Regional Database	Error in Entering Customer Name Incomplete Identity Card (ID) Documents Lack of Reachable Contact Phone Number Duplicate Customer Data Missing Forms During Office Handling or Data Entry Process
2..	Errors in Data Verification to the Head Office	Incorrect Excel File Format for Upload to Central Verification Incorrect Upload of BAKKP and ID Card (Personal Data) Files

No.	Type of Error	Cause of Error
3.	Errors in Gas Pipeline Installation	Central Database System Issues or Server Downtime Network / Internet Connectivity Disruptions Low Gas Flow from Stove Gas Leakage in Customer's Household Pipeline Technician's Non-Compliance with Established Procedures (SOP)

4. A step before the final submission

4.1. FMEA Resolution Method

a. Severity, Occurrence, and Detection Scales

The following table presents the Severity (S) scale used in this study:

Table 3: presents the Severity (S)

Saverity		
Level	**Description**	**Ranking**
Very Hazardous	Errors Cause Serious Safety Risks, Including Potential Fire or Gas Leakage, Injuries, or Legal Violations. Operations Cannot Continue	10
Hazardous	Errors Cause Major Operational Disruptions, Data Rejection, Failure to Deliver Services, or High Technical Risk	9
Extremely High	Errors Result in Total Process Failure, Requiring the Process to Be Repeated from the Beginning or Causing Complete Service Interruption	8
High	Errors Cause Significant Delays, Temporary Verification Failure, or Customers Cannot Be Contacted or Served	7
Moderately High	Errors Cause Customer Inconvenience, Data Inconsistencies, or Require Moderate Manual Corrections	6
Medium	Errors Affect Administrative Processes but Can Still Be Corrected Without Disrupting the Main Process	5
Low	Minor Errors That Do Not Affect the Main Output and Only Require Small Corrections	4
Very Low	Minor Errors in File Format or Data Naming That Do Not Hinder the Process.	3
Almost No Effect	Errors Have No Impact on Output and Only Require Minimal Adjustments	2
No Effect	No Impact on Customers, Operations, Or Safety	1

The following table presents the Occurrence (O) scale used in this study:

Table 4: Occurrence (O) Rating Scale

Occurance		
Level	**Description**	**Ranking**
Almost Certain	Errors Occurin Almost Every Process or on a Daily Basis. Controls are Minimal or Ineffective	10
Very High	Errors Occur Very Frequently, Even Though Standard Operating Procedures (Sop) Are in Place	9
High	Errors Occur Regularly, But Not on A Daily Basis	8
Moderately High	Errors Occur in Many Specific Cases or Among Certain Workers	7
Medium	Errors Occur, But Not Very Frequently	6
Moderately Low	Errors Occur Occasionally, Usually Due To Minor Human Errors or Special Conditions.	5
Low	Errors Rarely Occur Due To Fairly Effective Control Measures	4
Very Low	Errors Occur Very Rarely; Processes Run in a Stable Manner	3
Almost Never	Errors Almost Never Occur Because Sop and Control Systems Are Strong.	2
Extremely Rare	Errors Are Practically Impossible Because the System is Automated and Highly Controlled	1

The criticality level of each failure mode is determined based on the values of the severity, occurrence, and detection criteria. The analysis of priority levels is calculated by multiplying these three criteria, which is referred to as the Risk Priority Number (RPN). A failure with a high frequency of occurrence, significant impact on system performance, and low detectability is typically characterized by a high RPN value. The magnitude of the RPN serves as an important consideration for the company in determining which failure modes should be prioritized for immediate corrective action.

b. Risk Priority Number (RPN) Calculation and Ranking

The Risk Priority Number (RPN) is calculated by multiplying the values of Severity (S), Occurrence (O), and Detection (D). The following table presents the RPN calculation:

Table 5: Risk Priority Number (RPN) Calculation Results

No.	Failure Mode	Effect of Failure	Cause of Failure	S	O	D	RPN	Recommended Actions
1.	Input On The Surabaya Regional Database	Results In The Customer Not Being Registered As A Prospective Customer	Error In Entering Customer Name	6	6	5	180	Review The Forms And Database After Completing Data Entry Or Conduct A Double-Check Before Submission
			Incomplete Identity Card (ID) Documents	5	5	4	100	Confirm The Customer's Identity Card (ID) To Accurately Input The Customer's Personal Data.
			Lack Of Reachable Contact Phone Number	6	6	5	180	Ask The Neighborhood Head (RT) Or Local Residents To Obtain A Reachable Contact Number For The Customer
			Duplicate Customer Data	3	4	4	48	Perform A Double-Check When A Red Indicator Appears In Duplicated Fields; If The Duplication Involves The Address, Confirm With The Customer Whether The Registration Is For A Different Residence Or An Actual Duplicate Entry
2..	Data Verification to The Head Office	Results In the Customer Not Being Registered As An Active Customer.	Missing Forms During Office Handling Or Data Entry Process	7	4	7	196	Conduct Confirmation With The Local RT Or RW Administrators In The Area
			Incorrect Excel File Format For Upload To Central Verification	5	6	2	60	Verify That The Excel File Has Been Formatted According To The Specified Template Before Uploading To The System
			Incorrect Upload Of BAKKP And ID Card (Personal Data) Files	3	6	1	18	Check The Naming And Accuracy Of The Customer's BAKKP And ID Card Files Before Uploading.
			Central Database System Issues Or Server Downtime	5	4	3	60	Refresh The System Or Website Periodically When Technical Issues Are Suspected
			Network / Internet Connectivity Disruptions	5	6	5	150	Install High-Quality Routers And Access Points That Support The Administrative Workload
3.	Gas Pipeline Installation	Causes Errors In Gas Pipeline Distribution Within The Affected Area.	Low Gas Flow From Stove	5	5	3	75	Check Whether The Gas Pressure Meets The Required Standards.
			Gas Leakage In Customer's Household Pipeline	6	4	3	72	Perform Routine Monthly Maintenance To Prevent Gas Leakage
			Technician's Non-Compliance With Established Procedures (SOP)	10	3	2	60	Conduct Regular SOP Audits To Ensure That Technicians Comply With Established Procedures

Based on the results of the FMEA analysis presented in the table, it can be concluded that potential failures in the service process of SOR III are distributed across three main stages, namely the customer data input stage, the data verification stage at the head office, and the gas pipeline installation stage. Among these three stages, the data input stage represents the area with the highest risk. This is indicated by the highest RPN value of 196, which corresponds to the failure mode involving the loss of customer data forms while at the office or during the data entry process. This condition indicates that the administrative system and document management are still highly vulnerable. In addition, several other significant risks were identified at the input stage, such as errors in entering customer names and the lack of reachable contact phone numbers, each with an RPN value of 180. These errors directly affect data validity and have the potential to hinder the continuity of the registration process. Other administrative issues, such as incomplete identity documents, were also identified, although they have lower RPN values compared to the aforementioned risks. At the data verification stage at the head office, potential failures are primarily caused by technical constraints, such as network or connectivity disruptions with an RPN value of 150, as well as central database system issues with an RPN value of 120. These risks can lead to delays in the verification process and disrupt service continuity, although their severity is not as high as that of the data input stage. In addition, several administrative errors, such as incorrect file formats or incorrect document uploads, were also identified; however, these risks have lower RPN values because they are relatively easier to detect and correct. In the gas pipeline installation stage, the identified risks are related to technical implementation in the field. The severity values for several failure modes are relatively high due to their direct relation to customer safety, although the occurrence and detection values are relatively low. For example, technician non-compliance with standard operating procedures (SOP) resulted in an RPN value of 60, while the potential for gas pipeline leakage had an RPN value of 72. In addition, low gas flow from stoves resulted in an RPN value of 75, which, although not directly related to safety hazards, still affects customer comfort and satisfaction. Overall, although the installation stage has lower RPN values compared to the data input stage, several risks still require attention due to their implications for user safety

5. Conclusion

Based on the internship activities conducted at Sales Operation Regional (SOR) III of PT Perusahaan Gas Negara (PGN) as the internship partner, it can be concluded that the natural gas customer service process consists of interrelated administrative and field operational stages that require a high level of accuracy. During the internship period, several service-related errors were identified across three main stages, namely the data input stage, the data verification stage, and the gas pipeline installation stage. These errors included mistakes in entering customer names, the absence of reachable contact phone numbers, incomplete identity documents, loss of registration forms, incorrect uploading of documents such as BAKKP files and identity data, as well as technical issues in the field such as gas leaks in installations and low gas flow from customer stoves.

The results of the FMEA calculation indicate that the data input stage represents the stage with the highest level of risk and the most frequent source of service disruptions. The most dominant risk was the loss of customer data forms, which obtained an RPN value of 196, making it the most critical risk throughout the entire service process. In addition, errors in entering customer names and the lack of reachable customer contact numbers each recorded an RPN value of 180, demonstrating that staff accuracy at this stage has a significant impact on the continuity of subsequent processes. Other risks, such as incomplete supporting documents (ID card or family card), were also identified, although with a lower RPN value of 100. At the data verification stage, several technical constraints affected service performance, including network or connectivity disruptions with an RPN value of 150, and issues with the central database system with an RPN value of 120. These constraints caused verification delays and had the potential to disrupt the overall service flow. Meanwhile, at the gas pipeline installation stage, the highest risks were related to low gas flow from stoves with an RPN value of 75, and the potential for gas pipeline leakage in new installations with an RPN value of 72. Although these risks were lower than those at the data input stage, they still require serious attention due to their implications for customer safety.

Overall, this internship activity provided a comprehensive understanding of the importance of risk control in natural gas distribution services. The implementation of the Failure Mode and Effect Analysis (FMEA) method proved effective in helping the company identify critical points and determine improvement priorities at each stage of the service process. By implementing the recommended corrective actions, it is expected that the service quality of SOR III PGN will improve, administrative processes will become more accurate, and field operational activities will be carried out in a safer and more efficient manner.

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