Reduction of Failed Products at PT. XYZ Using Analytical Hierarchy Process Method

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Abstract

Companies that produce goods in a large capacity, if there is no good control will cause a risk. The purpose of this research is to identify operational risks that occur and provide strategies to reduce failed products that can be applied by PT. XYZ. The research method used is to use the Analytical Hierarchy Process (AHP) and the calculation uses Generalized Pareto Distribution and uses the Root Cause Analyze strategy. So, companies must pay more attention to the condition of raw materials and check the inventory of raw materials that have been damaged before processing in order to avoid greater losses in the future.

Keywords
Operational Risk Management, Analytical Hierarchy Process, Generalized Pareto Distribution, Root Cause Analyze, and descriptive method research.

1. Introduction
1.1 Background of the Problem
One of the companies that continues to grow and succeed in the ceramics industry is PT. XYZ, located in Penjaringan - North Jakarta. PT. XYZ since 1996 through the KITA brand has always been serving customers to meet the needs of modern lifestyles, through products for floor tiles, wall tiles, and quality, innovative, granite flooring at more affordable prices.

Each company will have a variety of risks, including operational risks, which comprises seven types i.e., errors in manual bookkeeping (Manual Risk), Computer Risk, Outsourcing Employee, Accident in Work, Globalization in Concepts and Products, Error in production of Goods and there is no agreement that purchase items cannot be exchanged, and damage to factory maintenance, (Fachrudin 2008, Hanafi 2010, Kastowo 2008).
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PT. XYZ in running its business activities is faced with several operational risks in dealing with problems regarding production results that experience a discrepancy. This can be seen from the process to produce ceramics that can cause operational risks. The indicator is damage to factory maintenance (KMP) where the machine is carried out continuously, sometimes damage can occur both from the mower and generator engine that will slow down the completion of a project (Aminbakhsh et al. 2013, Altman and Hotchkiss 2005, BUMN 2019, APJII, 2017) , damage to raw materials (KBB) where employees do not check back the raw materials that have accumulated in the warehouse and cause expired , suppliers providing wrong material (SMB) where the employee does not check carefully when raw material delivered by the supplier cannot know right or wrong before mixing with other ingredients , risks in errors in manual bookkeeping (MR) that occurs every time a project is started and completed, the company writes every number of production units per day on the blackboard manually so that when an employee is accidentally deleted every amount of production it is feared that there will be an error in the information in the amount of production and it is difficult to recalculate and error the goods production process (KPPB) where there is an error in the process of mixing ceramic materials or cutting ceramics so as to produce some damaged goods or paint results that are not good and below quality 1(Kunjana 2020, Mustafa and AL Bahar 1991, Saaty, 1987, Subana 2001, Wandebori 2019).

1.2 Formulation of the Problem
With reference to the object of research that will be discussed, the authors formulate the problem as follows:
1.What operational risks most affect PT. XYZ in the process of making products?

2.How do the proposed operational risk management that can be applied to PT. XYZ?

1.3 Research Purpose
Based on the existing problems, this study aims to:
1.Analyzing the most dominant operational risk at PT. XYZ.
2.Providing alternative handling of operational risk at PT. XYZ.

1.4 Research Benefits
1.For the company
The results of this study can be used by companies as useful information and input to determine operational risks that occur within the company and as a material consideration for companies in taking an appropriate policy to reduce operational risks arising from production failures.
2. For author
a. The author can find out how to analyze operational risks that occur at PT. XYZ.
b. As a medium to developing and applying theoretical knowledge that has been taken while in college.
c. Can be useful as input and learning in the world of work.
3. For the development of science
a. The results of this study can be used as a reference material (references) that can be used as a reference for further research with the same focus of study.
b. Can provide ideas for further research.

1.5 Research Scope
The scope of this research is an analysis of companies engaged in the manufacturing and distribution of ceramics. The study covers operational risks at PT. XYZ and its handling. In this study, the authors used ES 2000 with the AHP method.

2. Methods
2.1 Research Design
The author uses a descriptive method of research that tells and interprets data that is pleased with the facts, circumstances, variables, and phenomena that occur when the research takes place and presents what it is (Subana and Sudrajat, 2001). The object of this research is PT. XYZ and the products to be analyzed are the types of ceramic brands, namely KITA. This research was conducted to identify and map operational risks that occur in the company and provide alternative operational risk management at PT. XYZ.

2.2 Determination of Optimization Criteria
To optimize operational risk at PT. XYZ writer uses the Generalized Pareto Distribution method. According to Muslich (2007), in general, observations that are interesting to know are those that exceed a threshold level. To find out operational loss data above a threshold level, the theory of Picklands, Dalkema, de Hann is used. The theory of Picklands, Dalkema, de Hann states that the distribution function or what is called the condition distribution function is more formulated as a generalized Pareto distribution. The following are 4 steps of operational risk management for PT. XYZ:

1.Determine the Operational Risk of PT. XYZ
At this stage a dominant operational risk will be sought which is the main problem of PT. XYZ. By using the AHP (Analytical Hierarchy Process) method, the Area Manager of PT. XYZ will be given a questionnaire, which will later be processed using Expert Choice 2000 software.

2.Analyze and Determine the Impact of Operational Risk
At this stage, we will discuss the impact of operational risk at PT. XYZ. Because if the value of the loss is found to exceed the ability of the company, the company must further analyze the extent of the impact and provide further action.

3.Determine Probability

This stage is the most important stage because the probability or likelihood of operational risk will be determined. In addition, the Value at Risk and Expected Short-fall value will be sought using the Generalized Pareto Distribution method to obtain potential losses faced by PT. XYZ. For this reason, historical data on operational risks that will occur during January 2015 - December 2015 will be needed.

4.Management and Risk Management of PT. XYZ

This stage is the stage for managing or managing operational risk. This can also be used by the company as a medium for the company itself in determining the policy steps to be taken in connection with operational risks that have occurred during January 2015 - December 2015.

2.3 Data Sources

The author uses two types of sources, namely primary and secondary.

1.Primary Data

Primary data can be obtained individuals, obtained from the results of field research, which is a direct visit to the company. Primary data is done through direct interviews with the parties at PT. XYZ and through the distribution of questionnaires.

2.Secondary Data

Secondary data obtained from books, internet related to research so that it becomes a reference in writing.

2.4 Data Collection Techniques

Data collection techniques used by the author in this paper are:

1.Observation

Researchers make direct observations in the company, carried out to see what the risks that occur are operational risks in the company.

2.Interview

Conducting initial interviews with related parties to the company through direct visits to the company to obtain information that is company profile, organizational structure, job descriptions, company business activities, production processes.

3.Questionnaire

The questionnaire is a list of pre-formulated written questions that the respondent will answer, usually in clearly defined alternatives. The questionnaire is in the form of a dominant operational risk weighting using a comparative scale of analytical hierarchy process.

2.5 Development of Operational Models

2.5.1 Analytical Hierarchy Process

According to Kastowo (2008), the AHP method was developed by Thomas L. Saaty (1987) a mathematician. This method is a framework for making effective decisions on complex problems by simplifying and accelerating the decision-making process by breaking the problem into its parts, arranging these parts or variables in a hierarchical arrangement, assigning numerical value to subjective judgments about the importance of each variable. and synthesize these considerations to determine which variable has the highest priority and act to influence the outcome of the situation.

Analytical Hierarchy Process (AHP) is a method for solving an unstructured complex situation into several components in a hierarchical arrangement, by giving a subjective value about the relative importance of each variable, and determining which variable has the highest priority to influence the outcome of the situation. For calculations using Expert Choice is software that supports hardware systems that facilitate group decision making that is more efficient, analytical, and justifiable.

2.5.2 Analysis of Operational Risk Management Policies

Analytical Hierarchy Process (AHP) is one of the strategic management analyzes with a systems approach. AHP is a method that can be used in decision making to understand the condition of a system and help make predictions and

decision making. In relation to determining alternative priorities for sustainable private label management policies, this analysis uses AHP in order to assess the overall interaction of all related components.

AHP analysis is expected to know the priorities of alternative operational risk management policies, along with the stability or sensitivity of these alternatives in their actual application to operational risk management.

Some alternative stages of analysis of sustainable operational risk management policies are:

1.Defining Components

All components or variables relating to operational risk management policies are continuously defined. The defined scope of components includes the focus or objectives of operational risk management.

2. Structuring the Hierarchy Structure

All interaction components or variables that have been defined are arranged in stages in the form of AHP hierarchical structure starting from the top level of (Figure 1):

•Level 1: Focus or goal
•Level 2: Dimensions
•Level 3: Criteria
•Level 4: Alternative operational risk policies on an ongoing basis (the lowest level of the hierarchy)
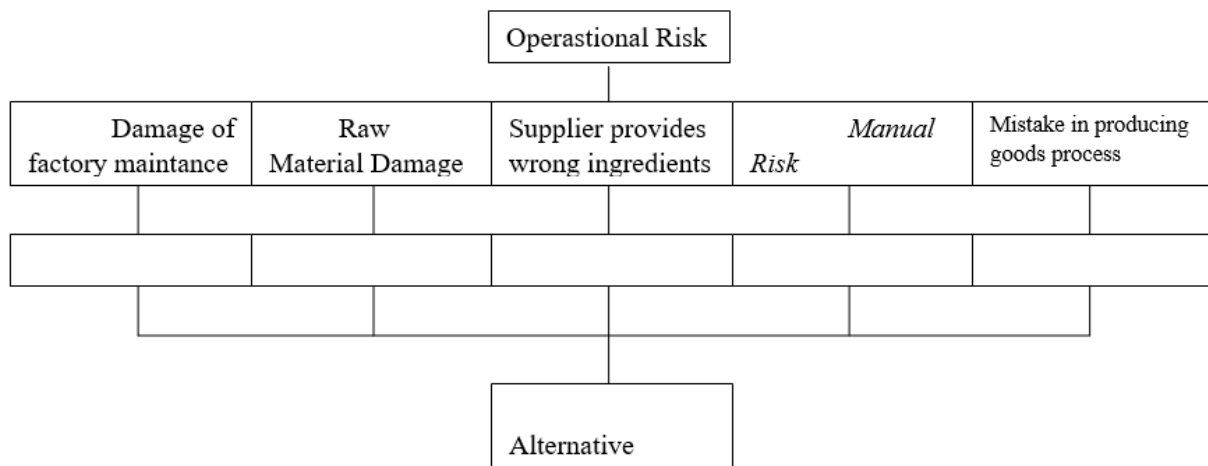

Figure 1. Illustration of hierarchical structure of operational risk policy analysis

3. Determination of Appeal and Weighting Scale

Scale of comparison between components or variables is determined. Assessment in AHP is done by pairwise comparison technique on the criteria used. Assessment is done by giving numerical weights and comparing one criterion with other criteria. The numerical weights use a comparative scale in pairs between the criteria being compared. Determination of the scale of this appeal and the weighting system refers to a scale of pairwise appeals (Table 1 and Figure 2).

Table 1. Scale Appeal Couples in AHP

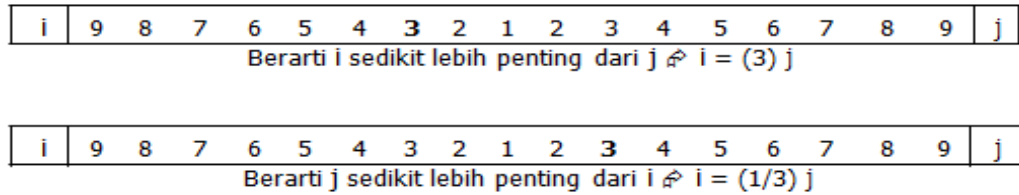| Tingkat	Keterangan
1	Kedua elemen sama pentingnya.
3	Elemen yang satu "sedikit lebih penting" daripada elemen
5	Elemen yang satu "lebih penting" daripada elemen yang
7	Elemen yang satu "jelas lebih penting" daripada elemen
9	Elemen yang satu "mutlak lebih penting" daripada elemen
2,4,6,8	Nilai-nilai antara dua nilai pertimbangan yang berdekatan.

Figure 2. Appeal Scale

4. Data Formulation

Data formulation is an activity of inputting the results of pairwise scale comparison analysis results into a hierarchical structure. The creation of the hierarchy and data input is done using Expert Choice software.

5. Simulation

Simulation is an activity of analyzing and comparing data of all existing components with the principle of the results of comparisons between two pairs of components compared with the results of comparisons between two other pairs of components at the same level and the results of the comparison are continued to the above level until it ends at level 1.

6. Consistency Testing

This stage aims to test the consistency of the results of simulations that have been carried out. If the results of the simulation are obtained inconsistency ratio of 0.1 or more, it means that the data used is not consistent and data retrieval must be done.

7. Interpretation of Results

The interpretation of results phase is the stage of using AHP analysis results in explaining and providing priority recommendations for alternative operational risk management policies that are sustainable and the stability or sensitivity of these priorities to changes that occur significantly.

3. Results and Discussion

3.1 Results of Operational Risk Identification with Analytical Hierarchy Process

PT. XYZ suffered an operational loss that exceeded the threshold of 31,701pcs

paramater μ (location) is 1.761,167 pcs.

paramater Ψ (scale) amounted to 219,755 pcs.

The amount of tail index with Hill method approach 1 is $\xi = 1,9078 / 18 = 0,1059$ pcs.

Value at Risk (VaR), operational risk or potential losses incurred by PT. XYZ in January 2013-December 2015 with a confidence level of 95% is 5,455,825 pcs

Operational risk or potential cumulative operational loss that exceeds the value at Risk (VaR) or the maximum loss that will be experienced by PT. XYZ in January 2013 - December 2015 amounted to 6,139,215 pcs.

Compared to the VaR value of 5,455,825 pcs, the company is feared that it will get a high enough risk if there is no further handling from the company (Figure 3).
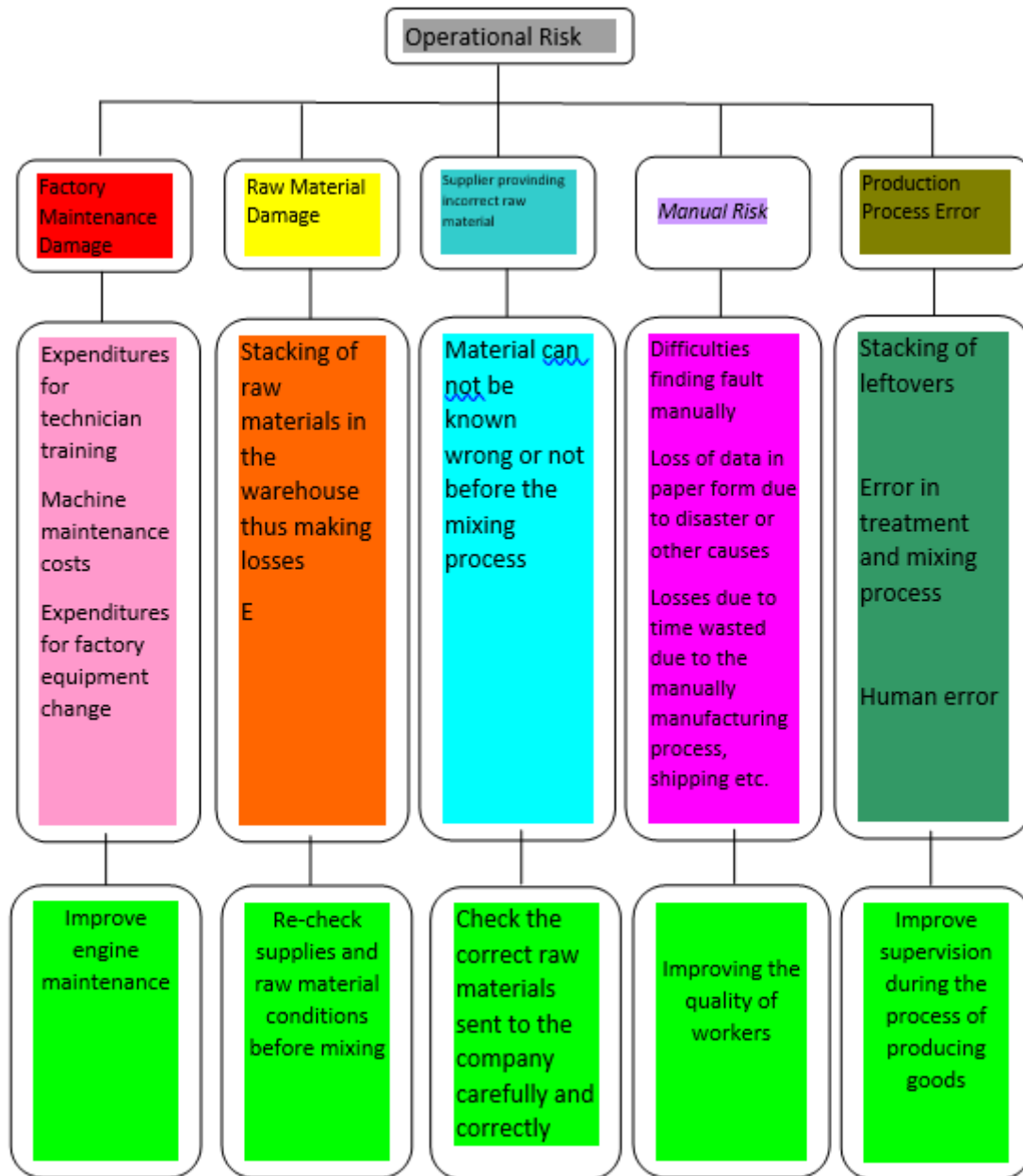
Figure 3. Process Hierarchy of PT. XYZ

3.2 Result of Potential Loss Value from The Calculation of Pareto Distribution

From the results of the percentage above, it is known that the damage to raw materials gets the largest percentage of 26.76%, so companies must pay more attention to the condition of raw materials and check the inventory of raw materials that have been damaged before processing in order to avoid greater losses in the future.

Meanwhile, the results with the Generalized Pareto Distribution calculation, the results of Value at Risk (VaR) and Expected Short Fall (ES) prove that the ES value of operational risk or potential operational loss exceeds the VaR value of 6,139,215 pcs. Compared to the VaR value of 5,455,825 pcs, it is feared that the company will get a high

enough risk. With the calculation of Generalized Pareto Distribution, the company can anticipate the loss so that it does not get higher. The results of the questionnaire processing with expert choice.

3.3 Results of Questionnaire Processing with Expert Choice
i)   Raw Material Damage 26.76%
ii)   Error in Production Process of Goods 22.84%
iii)   Supplier Providing Incorrect Material 19.06%
iv)   Factory Maintenance Damage 17.86%
v)   Errors in Bookkeeping Manually (Manual Risk) 13.48%

4. Conclusion and Suggestion
4.1 Conclusion
Based on the results of research and discussion in previous chapters, several conclusions can be drawn, namely:
1.There are 5 operational risks that occur at PT. XYZ, namely:
i) Damage to Raw Materials
ii) Errors in the Production Process of Goods
iii) Supplier providing incorrect material
iv) Factory Maintenance Damage
v) Errors in Bookkeeping Manually (Manual Risk)

2. The most dominant value of potential operational risk (Value at Risk) experienced by PT. XYZ from January 2013 to December 2015 amounted to 5,455,825 pcs. The results of the Value at Risk calculation show that the operational losses suffered by the company are quite high.
The potential loss that exceeds the most dominant Value at Risk (Expected Short Fall) is experienced by PT. XYZ from January 2013 to December 2015 amounted to 6,139,215 pcs. The results of the Expected Short Fall calculation show that the maximum amount of loss experienced by the company. The company is feared that it will get a high enough risk if there is no further handling of the operational risk.

4. Proposed Risk Reduction
A. Damage to Raw Materials:
1.Use ground transportation that is faster than ships like Container Trucks.
2.applying the FIFO system, which is the material that comes first to the factory, will be the first material to be processed into ceramics.
3.Design a storage area for special materials so that they are not easily damaged.
4.Order raw materials with a minimum amount of standard so as not to over-accumulate.
B. Mistakes in the Production Process of Goods
1.Ensuring that the composition of the material to be processed is suitable and appropriate, not exaggerated and reduced so that the product produced matches the quality of the sale value.
2.Improve supervision of materials, technicians, systems, and machinery in the production process so as to minimize the results of wasted or residual products.
3.Factory equipment is always controlled so as to prevent damage and incur costs.
4.Conduct employee training on a regular basis in an amount sufficient to avoid waste for one-on-one employee training.
C. Supplier providing incorrect material
Ensure in advance that the goods received are quality and not defective.

4.2 Suggestion
For problems or operational risks faced by PT. XYZ, the authors provide the following suggestions:
1. Companies must increase the quality of workers in doing their work so as not to add to the losses incurred in the company, such as the most dominant problem, namely damage to raw materials. To minimize the risk of loss, workers must be more careful in re-checking old raw materials for immediate use, maintaining the temperature of the room so

that raw materials are not easily damaged, double checking whether raw materials coming from suppliers are new and undamaged.

2. The company needs to re-evaluate every operational risk that occurs considering the many advantages in evaluating and implementing management in these risks. With the aim that the company can prevent greater losses, especially on the most dominant operational risk, and the company can anticipate these losses so as not to get higher.

3. By using the Generalized Pareto Distribution method, it can be used to find out or as a benchmark in measuring the level of potential operational losses that occur at PT. XYZ. It would be better if the company could implement this method on an ongoing basis in order to monitor the magnitude of operational risks in the future times.

4. With companies knowing and applying further operational risk management analysis, the company can directly support the increase in profits, can prevent the company from failure.

References

Aminbakhsh, M. Gunduz, and R. Sonmez, Safety risk assessment using analytic hierarchy process (AHP) during planning and budgeting of construction projects, J. Safety Res., vol. 46, pp. 99–105, 2013.

Altman and E. Hotchkiss, Corporate Financial Distress and Bankruptcy, 2005.

BUMN, Laporan Kinerja BUMN 2019, BUMN, Kementerian, 2019.

Asosiasi Penyelenggara Jasa Internet Indonesia, Penetrasi & Profil Perilaku Pengguna Internet Indonesia, Apjii, p. 51, 2017.

Fachrudin, Kesulitan Keuangan Perusahaan dan Personal. Medan: USU Press, 2008. Muslich, M., *Manajemen Risiko Operasional*, PT Bumi Aksara, Jakarta, 2008.

Hanafi, Manajemen Keuangan. Yogyakarta: BPFE, 2010.

Kastowo, B. *Penentuan Bobot Pada Metode Seleksi Calon Perawat Di Rumah Sakit Al-Islam Bandung Menggunakan Metode Analitycal Hierarchy Process (AHP),* Program Pascasarjana IT Telkom Bandung, Bandung, 2008.

Kunjana, GCG di BUMN, Investor Daily, https://investor.id/editorial/gcg-di-bumn, 2020.

Mustafa and J. F. Al-Bahar, Project Risk Assessment Using the Analytic Hierarchy Process, IEEE Trans. Eng. Manag., vol. 38, no. 1, pp. 46–52, 1991.

Saaty, R. W. The analytic hierarchy process-what it is and how it is used, Math. Model., vol. 9, no. 3–5, pp. 161–176, 1987.

Subana, M., Sudrajat, *Dasar- Dasar Penelitian Ilmiah*, Pustaka Setia, Bandung, 2001.

Wandebori, Manajemen Strategi Dalam Perspektif Indonesia, 1st ed. Bandung: ITB Press, 2019.

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