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# Analysis of the Multi Objective Optimization by Ratio Analysis (MOORA) Method Model in Determining Pilot Areas at PT. XYZ

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## ABSTRACT

This research analyzes the application of the Multi Objective Optimization by Ratio Analysis (MOORA) method model in determining the Pilot Area at PT XYZ. This method is used to evaluate various performance criteria, including customer satisfaction, productivity, service quality, and operational efficiency. Currently, the Pilot Area assessment and selection process at PT XYZ is still done manually, which causes a lack of accuracy and efficiency. MOORA was chosen for its ability to handle multi-criteria decision-making problems more systematically and objectively. The analysis results showed that Alternative Area 7 obtained the highest final score of 0.39, placing it as an area with superior performance. The application of MOORA is proven to improve accuracy and efficiency in the Pilot Area determination process, providing a more objective basis for decision-making. By using MOORA, PT XYZ can evaluate area performance more comprehensively and accountably. This research recommends that PT XYZ implement the MOORA method thoroughly and conduct periodic evaluations of the methods used. For theory development, PT XYZ can add specific evaluation criteria according to company needs. The implementation of these suggestions is expected to improve the quality of service and competitiveness of PT XYZ in the global market. Further research is expected to compare MOORA with other methods to strengthen the validity of the results. Thus, this research not only provides a practical contribution to PT XYZ but also adds academic insight into the application of multi-criteria optimization methods in the context of performance management and service improvement.

**Keywords:** Pilot Area; Decision Support System; MOORA; Accuracy.

## 1. INTRODUCTION

In the era of globalization and increasingly fierce business competition, PT XYZ is committed to continuously improving the quality of services provided to clients. The company realizes that one of the main keys to achieving competitive advantage is through improving employee performance and operational efficiency. Therefore, PT XYZ has implemented various initiatives to ensure each operational area can achieve and maintain the highest service standards.

One of the strategic initiatives taken by PT XYZ is the Pilot Area determination program. This program aims to identify and recognize areas that demonstrate superior performance, so that they can serve as examples and standards for other areas. Pilot Areas are selected based on various performance criteria, including customer satisfaction, productivity, service quality, and operational efficiency. The determination of these areas is critical because the selected areas will be the benchmark for the entire organization, so the selection process must be done carefully and accurately.

However, the Pilot Area assessment and selection methods used today are still manual and simple. This approach is often time-consuming and can result in inaccurate decisions that are difficult to account for. Therefore, PT XYZ needs a more effective and efficient method to ensure the Pilot Area selection process can be done objectively and in a timely manner.

This research tested the Multi Objective Optimization by Ratio Analysis (MOORA) method model to help PT XYZ in determining the Pilot Area. MOORA is a method that has proven effective in handling decision-making problems involving multiple criteria. By using MOORA, PT XYZ can evaluate area performance more systematically

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and comprehensively, resulting in more accurate and accountable decisions (Emovon et al., 2021; Feizi et al., 2021; Hakim Lubis & Fitrianto Rahmad, 2022; Hamurcu & Eren, 2022; Satoglu & Türkekul, 2021; Shahzadi et al., 2022; Simaremare et al., n.d.; Utama et al., 2021).

The focus of this research is on the pilot test of the MOORA model and its advantages in resolving the results. The MOORA application is expected to not only improve accuracy and efficiency in the Pilot Area determination process, but also drive improvements in overall performance and service quality. The results show that the MOORA method is able to provide a more objective and transparent assessment, making it reliable in strategic decision-making at PT XYZ.

Thus, this research not only provides a practical contribution to PT XYZ, but also adds academic insight into the application of multi-criteria optimization methods in the context of performance management and service improvement. It is expected that this research becomes a solid foundation for the development of more effective performance improvement strategies in the future, so that PT XYZ can continue to compete and thrive in a dynamic industry.

## 2. LITERATURE REVIEW

**Studi Literatur**

In the literature study, this research utilizes various reference sources which include Sinta accredited journals, national journals, local journals, and international journals. This diverse composition of literature is expected to make a significant contribution to researchers in solving the problems faced by PT XYZ related to the Determination of Pilot Areas. Given that this research uses an experimental approach, the following is the method applied:

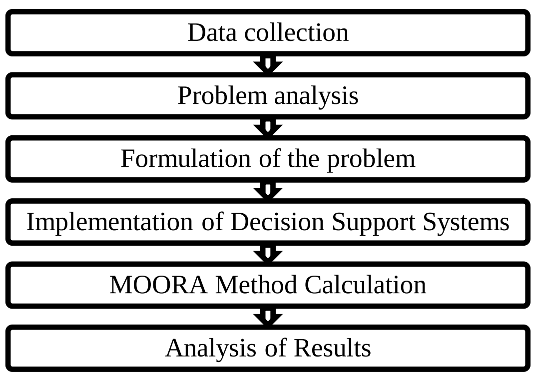


Fig.1 Research method

Based on Figure 1 above, the stages can be explained as follows:

1. Data Collection
   At this stage, data collection is carried out directly with the company concerned, namely PT. XYZ.
2. Problem Analysis
   In this stage, namely analyzing the problems that occur so that it can be concluded what problems occur at PT. XYZ.
3. Problem Formulation
   At this stage, namely formulating every problem that exists at PT. XYZ so that solutions and solutions can be found.
4. Implementation of the Decision Support System
   At this stage, namely implementing a Decision Support System to solve problems that exist at PT. XYZ.
5. MOORA Method Calculation
   At this stage, namely applying the calculation of the MOORA method to obtain accuracy results on the data processed as a reference for decisions.
6. Analysis of Results
   At this stage, namely analyzing the results of the implementation of the Decision Support System using the MOORA method related to problems that occur at PT. XYZ so that a decision reference can be taken from the

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settlement.

**Application of MOORA Method**

In determining the Pilot Area Determination using the MOORA method at PT. XYZ, the stages in completing the calculation are as follows (Aranda & Witanti, n.d.; Daulay et al., 2021; Handayani et al., 2023; Hasirun et al., 2023; Miftakhun Nizar et al., n.d.; Ramadhan, 2023; Rizal et al., n.d.; Sintaro, 2024; Sirait et al., 2021; Siregar et al., 2022; Susanto et al., 2022; Yunianto et al., 2021):

1. Creating a Decision Matrix
2. Normalizing the Decision Matrix
3. Normalized Performance Matrix
4. Calculating Yi Value
5. Ranking

**Framework**

A framework is a basic structural concept that is used to understand or deal with complex problems. This term is often used, among others, in the field of reusable software, as well as in the field of management to describe a concept that allows handling various types or business entities homogeneously. This framework is the steps that will be taken to solve the problems to be discussed.

The research framework can be explained in the following figure:

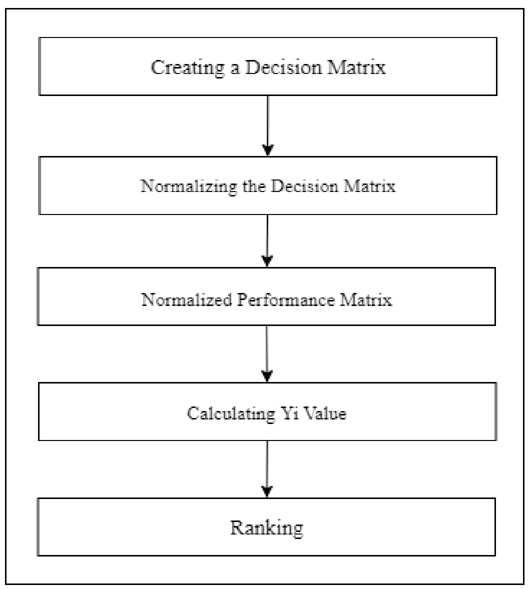


Fig. 2 MOORA Method Framework

A literature review is a critical, analytical summary and synthesis of the current knowledge of a topic. It should compare and relate different theories/research, findings, and so on, rather than just summarize them individually. It should also have a particular focus or theme to organize the review. In this section, the researcher can describe some of the related previous studies. Researchers can review the gaps in the research, then it can be used as a basis for research to be carried out

## 3. METHOD

1. Creating a Decision Matrix.
   In calculations using the MOORA method, the values used must be in numerical form. Furthermore, all the information obtained is converted into weighted values for each relevant base.

Below can be seen Tables 1 - 3 which contain Pilot Area data, criteria, and assessment scores. These tables are used to analyze the performance of various areas in PT XYZ using the MOORA method :

* Corresponding author

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Table 1
Pilot Area Data

| Alternative | Customer Satisfaction | Productivity | Service Quality | Operational Efficiency |
|---|---|---|---|---|
| Alternative Area 1 | Satisfied | Very Productive | Not good | Pretty good |
| Alternative Area 2 | Very satisfied | Productive | Good | Pretty good |
| Alternative Area 3 | Satisfied | Very Productive | Good | Not good |
| Alternative Area 4 | Not satisfied | Productive | Good | Good |
| Alternative Area 5 | Quite satisfied | Very Productive | Good | Good |
| Alternative Area 6 | Satisfied | Productive | Enough | Good |
| Alternative Area 7 | Very satisfied | Productive | Very good | Good |
| Alternative Area 8 | Quite satisfied | Quite Productive | Good | Good |
| Alternative Area 9 | Very satisfied | Productive | Good | Very good |
| Alternative Area 10 | Satisfied | Productive | Enough | Good |

Table 2
Criteria

| No | Criteria Code | Criteria Name | Weight | Criteria Type |
|---|---|---|---|---|
| 1 | C1 | Customer Satisfaction | 0.45 | Benefit |
| 2 | C2 | Productivity | 0.25 | Benefit |
| 3 | C3 | Service Quality | 0.2 | Benefit |
| 4 | C4 | Operational Efficiency | 0.1 | Benefit |

Table 3
Number Score Data

| No | Alternative Code | C1 | C2 | C3 | C4 |
|---|---|---|---|---|---|
| 1 | PA01 | 3 | 4 | 1 | 2 |
| 2 | PA02 | 4 | 3 | 3 | 2 |
| 3 | PA03 | 3 | 4 | 3 | 1 |
| 4 | PA04 | 1 | 3 | 3 | 3 |
| 5 | PA05 | 2 | 1 | 3 | 3 |
| 6 | PA06 | 3 | 3 | 2 | 3 |
| 7 | PA07 | 4 | 3 | 4 | 3 |
| 8 | PA08 | 2 | 2 | 3 | 3 |
| 9 | PA09 | 4 | 3 | 3 | 4 |
| 10 | PA10 | 3 | 3 | 2 | 3 |
| **OPTIMUM** | | **MAX** | **MAX** | **MAX** | **MAX** |

$$\text{Decision Matrix Xij} \begin{Bmatrix} 3 & 4 & 1 & 2 \\ 4 & 3 & 3 & 2 \\ 3 & 4 & 3 & 1 \\ 1 & 3 & 3 & 3 \\ 2 & 1 & 3 & 3 \\ 3 & 3 & 2 & 3 \\ 4 & 3 & 4 & 3 \\ 2 & 2 & 3 & 3 \\ 4 & 3 & 3 & 4 \\ 3 & 3 & 2 & 3 \end{Bmatrix}$$

2. Perform Matrix Normalization

* Corresponding author

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The following is a normalization matrix of alternative values based on the type of criteria with the following conditions:

$$X_{ij}^{*} = Xij / \sqrt{[\sum_{i=1}^{m} X_{ij}^{2}]}$$

Normalized Performance Matrix
Looking for customer satisfaction (C1) :

$= \sqrt{3^2 + 4^2 + 3^2 + 1^2 + 2^2 + 3^2 + 4^2 + 2^2 + 4^2 + 3^2} = 9.64$
PA11 = 3/9.64 = 0.31
PA21 = 4/9.64 = 0.41
PA31 = 3/9.64 = 0.31
PA41 = 1/9.64 = 0.10
PA51 = 2/9.64 = 0.21
PA61 = 3/9.64 = 0.31
PA71 = 4/9.64 = 0.41
PA81 = 2/9.64 = 0.21
PA91 = 4/9.64 = 0.41
PA101 = 3/9.64 = 0.31

Looking for Productivity (C2) :

$= \sqrt{4^2 + 3^2 + 4^2 + 3^2 + 1^2 + 3^2 + 3^2 + 2^2 + 3^2 + 3^2} = 9.54$
PA12 = 4/9.54 = 0.42
PA22 = 3/9.54 = 0.31
PA32 = 4/9.54 = 0.42
PA42 = 3/9.54 = 0.31
PA52 = 1/9.54 = 0.10
PA62 = 3/9.54 = 0.31
PA72 = 3/9.54 = 0.31
PA82 = 2/9.54 = 0.21
PA92 = 3/9.54 = 0.31
PA102= 3/9.54 = 0.31

Looking for Service Quality (C3) :

$= \sqrt{1^2 + 3^2 + 3^2 + 3^2 + 3^2 + 2^2 + 4^2 + 3^2 + 3^2 + 2^2} = 8.89$
PA13 = 1/8.89 = 0.11
PA23 = 3/8.89 = 0.33
PA33 = 3/8.89 = 0.33
PA43 = 3/8.89 = 0.33
PA53 = 3/8.89 = 0.33
PA63 = 2/8.89 = 0.23
PA73 = 4/8.89 = 0.45
PA83 = 3/8.89 = 0.34
PA93 = 3/8.89 = 0.34
PA103= 2/8.89 = 0.23

Looking for Operational Efficiency (C4) :

$= \sqrt{2^2 + 2^2 + 1^2 + 3^2 + 3^2 + 3^2 + 3^2 + 3^2 + 4^2 + 3^2} = 8.89$
PA14 = 2/8.89 = 0.23
PA24 = 2/8.89 = 0.23
PA34 = 1/8.89 = 0.11
PA44 = 3/8.89 = 0.34
PA54 = 3/8.89 = 0.34
PA64 = 3/8.89 = 0.34
PA74 = 3/8.89 = 0.34

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PA84 = 3/8.89 = 0.34
PA94 = 4/8.89 = 0.45
PA104 = 3/8.89 = 0.34

3. Normalized Performance Matrix
Based on the above calculations, the normalized performance matrix is as follows:

$$Xij = \begin{Bmatrix} 0.31 & 0.42 & 0.11 & 0.23 \\ 0.41 & 0.31 & 0.34 & 0.23 \\ 0.31 & 0.42 & 0.34 & 0.11 \\ 0.10 & 0.31 & 0.34 & 0.34 \\ 0.21 & 0.10 & 0.34 & 0.34 \\ 0.31 & 0.31 & 0.23 & 0.34 \\ 0.41 & 0.31 & 0.45 & 0.34 \\ 0.21 & 0.21 & 0.34 & 0.34 \\ 0.41 & 0.31 & 0.34 & 0.45 \\ 0.31 & 0.31 & 0.23 & 0.34 \end{Bmatrix}$$

Optimizing attribute values:

$$Xij = \begin{Bmatrix} 0.31 & 0.42 & 0.11 & 0.23 \\ 0.41 & 0.31 & 0.34 & 0.23 \\ 0.31 & 0.42 & 0.34 & 0.11 \\ 0.10 & 0.31 & 0.34 & 0.34 \\ 0.21 & 0.10 & 0.34 & 0.34 \\ 0.31 & 0.31 & 0.23 & 0.34 \\ 0.41 & 0.31 & 0.45 & 0.34 \\ 0.21 & 0.21 & 0.34 & 0.34 \\ 0.41 & 0.31 & 0.34 & 0.45 \\ 0.31 & 0.31 & 0.23 & 0.34 \end{Bmatrix} *Wj$$

So the value of Xij*Wj is as follows:

$$Xij = \begin{Bmatrix} 0.14 & 0.10 & 0.02 & 0.02 \\ 0.19 & 0.08 & 0.07 & 0.02 \\ 0.14 & 0.10 & 0.07 & 0.01 \\ 0.05 & 0.08 & 0.07 & 0.03 \\ 0.09 & 0.03 & 0.07 & 0.03 \\ 0.14 & 0.08 & 0.05 & 0.03 \\ 0.19 & 0.08 & 0.09 & 0.03 \\ 0.09 & 0.05 & 0.07 & 0.03 \\ 0.19 & 0.08 & 0.07 & 0.05 \\ 0.14 & 0.08 & 0.05 & 0.03 \end{Bmatrix}$$

4. Calculating the Yi Value
To calculate the yi value, you can use the formula:

$$y_i^* = \sum_{j=1}^{g} wj\ x_{ij}^* - \sum_{j=g+1}^{n} wj\ x_{ij}^*$$

Table 4
Ordinal Ranking of the Ratio System

| No | Alternative Code | (C1) | (C2) | (C3) | (C4) | Yi |
|---|---|---|---|---|---|---|
| | | Max | Max | Max | Max | (C1+C2+C3+C4) |

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| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | PA01 | 0.14 | 0.10 | 0.02 | 0.02 | 0.29 |
| 2 | PA02 | 0.19 | 0.08 | 0.07 | 0.02 | 0.36 |
| 3 | PA03 | 0.14 | 0.10 | 0.07 | 0.01 | 0.32 |
| 4 | PA04 | 0.05 | 0.08 | 0.07 | 0.03 | 0.23 |
| 5 | PA05 | 0.09 | 0.03 | 0.07 | 0.03 | 0.22 |
| 6 | PA06 | 0.14 | 0.08 | 0.05 | 0.03 | 0.30 |
| 7 | PA07 | 0.19 | 0.08 | 0.09 | 0.03 | 0.39 |
| 8 | PA08 | 0.09 | 0.05 | 0.07 | 0.03 | 0.25 |
| 9 | PA09 | 0.19 | 0.08 | 0.07 | 0.05 | 0.38 |
| 10 | PA10 | 0.14 | 0.08 | 0.05 | 0.03 | 0.30 |

5. Ranking

Based on the Yi value above, the following are the results and rankings of the Project priority scale assessment, namely as follows:

Below can be seen Tables 5 and 6 which contain the priority results of the MOORA method and the ranking results of the MOORA method. These tables are used to determine the pilot area at PT XYZ based on the predetermined performance criteria.

Table 5
MOORA Method Priority Results

| Alternative | Alternative Code | Yi | Priority |
|---|---|---|---|
| Alternative Area 1 | PA01 | 0.29 | 7 |
| Alternative Area 2 | PA02 | 0.36 | 3 |
| Alternative Area 3 | PA03 | 0.32 | 4 |
| Alternative Area 4 | PA04 | 0.23 | 9 |
| Alternative Area 5 | PA05 | 0.22 | 10 |
| Alternative Area 6 | PA06 | 0.30 | 6 |
| Alternative Area 7 | PA07 | 0.39 | 1 |
| Alternative Area 8 | PA08 | 0.25 | 8 |
| Alternative Area 9 | PA09 | 0.38 | 2 |
| Alternative Area 10 | PA10 | 0.30 | 5 |

Table 6
MOORA Method Ranking Results

| Alternative | Alternative Code | Yi | Rangking |
|---|---|---|---|
| Alternative Area 7 | PA07 | 0.39 | 1 |
| Alternative Area 9 | PA09 | 0.38 | 2 |
| Alternative Area 2 | PA02 | 0.36 | 3 |
| Alternative Area 3 | PA03 | 0.32 | 4 |
| Alternative Area 10 | PA10 | 0.30 | 5 |
| Alternative Area 6 | PA06 | 0.30 | 6 |
| Alternative Area 1 | PA01 | 0.29 | 7 |
| Alternative Area 8 | PA08 | 0.25 | 8 |
| Alternative Area 4 | PA04 | 0.23 | 9 |
| Alternative Area 5 | PA05 | 0.22 | 10 |

In this section, each researcher is expected to be able to make the most recent contribution related to the solution to the existing problems. Researchers can also use images, diagrams, and flowcharts to explain the solutions to these problems.

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## 4. CONCLUSION

This research aims to improve efficiency and accuracy in determining the Pilot Area at PT XYZ using the Multi Objective Optimization by Ratio Analysis (MOORA) method. Through the application of MOORA, various performance criteria such as customer satisfaction, productivity, service quality, and operational efficiency can be evaluated systematically and comprehensively. The analysis results show that Alternative Area 7 obtained a final score of 0.39, placing it as the highest performing area among all the areas evaluated. Based on these results, it can be concluded that the MOORA method is effective in helping PT XYZ determine the Pilot Area objectively and precisely. With the application of MOORA, PT. XYZ can improve the quality of the decision-making process, so that the areas selected as Pilot Areas truly reflect superior performance. This not only encourages the improvement of service quality but also provides motivation for all employees to achieve the best performance. This research makes an important contribution to the development of performance management strategies at PT XYZ. The implementation of the MOORA method can be used as a model for future performance appraisals, ensuring that the company continues to adapt and thrive in a competitive business environment. For further development, it is recommended that the company conduct periodic evaluations of the methods used and consider the development of other methods that may better suit the specific needs of the company. Thus, PT XYZ can continue to maintain and improve its competitiveness in the global market.

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