

# Multi Attribute Utility Theory (MAUT) Method in Determining Cinemas with the Best Facilities in Balikpapan City

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## Abstract

Cinema is one of the entertainment destinations that are often visited. In Balikpapan city, there are five cinemas that can be chosen by people as a source of entertainment or just to enjoy the weekend. However, each person can only watch in one of the available cinemas. The number of cinemas makes people confused in choosing a place to watch, everyone certainly chooses a cinema with the best facilities, in determining the cinema with the best facilities people need to consider several criteria such as ticket prices, number of films, availability of audience seats, and supporting facilities (offline ticket purchase counters, online ticket pick-up counters, waiting rooms, waiting room seats, trash cans, toilets, etc.). These criteria can be used in the Decision-making system. This study uses Multi Attribute Utility Theory (MAUT) to make it easier to choose a cinema with the best facilities. In the process of using the MAUT method, it is to determine the criteria that are beneficial (benefit) and detrimental (cost), determine the weight of the criteria, determine alternatives, collect data, conduct assessments, normalize, and sort alternatives based on the final results to find out the highest value. From the process that has been carried out, the final result of using the MAUT method in making decisions to choose a cinema with the best facilities in Balikpapan city is that CGV Plaza Balikpapan is in first place with the highest score.

**Keywords:** Cinemas; Decision making; Determining; facilities; Multi Attribute Utility Theory (MAUT);

## 1. Introduction

In this modern era, cinema is one of the sources of entertainment with very rapid development, almost every city in Indonesia has a cinema as a public facility for the community to get entertainment. In the city of Balikpapan itself, there are five cinemas that actively show films every day. Generally, these cinemas are located in shopping centers or malls which are one of the places that are crowded with visitors. Everyone is free to choose which cinema they will visit to watch a movie, with so many cinemas that sometimes confuse people in determining which cinema they want to visit[1].

In determining the choice it is important to pay attention to things that can benefit the audience in choosing a cinema, for example by paying attention to the quality of service that can satisfy customers to be loyal to choosing the cinema for a long period of time[2]. Other things such as the facilities available in the cinema can also determine the level of customer comfort when using the cinema, such as the availability of toilets, trash cans, waiting rooms, ticket purchase counters, online ticket retrieval counters, number of studios, etc.

These things can be used as assessment criteria that can be used in a decision-making system. A system that uses a collection of objects as criteria and considers the value of benefits and costs to determine the weight of the criteria used[3]. using Multi Attribute Utility Theory (MAUT) as a method for calculating and simplifying values to help make decisions choosing one of several alternatives by comparing several criteria.

The MAUT method is part of the Multi-Criteria Decision Making in the Decision-Making System. The MAUT method performs quantitative comparisons that combine measurements of the cost and benefit values of unbalanced criteria. Each criterion may have a different way of providing a solution[4]. MAUT is used to change several interests into numerical values using a scale of 0-1 with 0 representing the worst option and 1 the best.

This study aims to determine the cinema with the best facilities in Balikpapan city, using the Multi Attribute Utility Theory (MAUT) method decision-making system by calculating the value of each criterion on all existing alternatives to produce a sequence of choices starting from the best essence and other choices below it.

## 2. Research Methodology

In conducting this research, systematic steps are needed to obtain relevant data and information. This stage involves various activities ranging from planning, problem analysis, data collection, and data processing to obtain the final results. The stages carried out are structured, logical, and systematic as seen in Fig 1.



Fig. 1: Research Methodology

### 2.1. Literature Study

Literature study or commonly called literature review, is a process where researchers will collect, evaluate, and analyze the information needed in conducting a study. The information collected comes from books and existing scientific journals. The purpose of collecting this information is to find the right solution to the problem by analyzing the results of existing research.

### 2.2. Problem Identification

Problem identification is the stage where researchers conduct analysis and understand the problems that are occurring. In the identification process, planning is needed because the results of the identification will affect the use of methods, and determine the next steps. The purpose of identification is to gain a basic understanding of the problem at hand, for example to find out the causes and effects of the problem.

### 2.3. Data Collection

Data collection is the stage where researchers collect data in the form of information or evidence that can support research or can be processed to produce an assessment. The data collected must be relevant and can be proven true. Data can come from historical records of an event, observations, interviews, and surveys.

### 2.4. Data Processing

Data Processing is a stage where researchers assess the data that has been collected so that it produces a value that can be processed using a certain method to obtain the final result. In the Decision-making system, there are several methods that can be used, one example is the Multi Attribute Utility Theory (MAUT) method which normalizes the assessment results so that the final result is a number 1 for the highest value and 0 for the lowest value.

### 2.5. Final Result

At this stage the final results of the research will be presented in the form of tables and conclusions that can be used as evaluation and analysis materials for solving the problems carried out. The final results are not only used as absolute values, but can also be used to evaluate the performance of the methods used in the research, and can also be used to compare the effectiveness of using existing methods with other methods.

## 3. Result and Discussion

### 3.1. collecting data

The data collected comes from the results of survey observations and interviews. Observation data is obtained from the TIX ID application related to prices, number of films, number of studio rooms, and number of seats available in each cinema. Then data related to supporting facilities in each cinema is obtained through filling out a questionnaire filled out by people who have responsibility for the cinema (staff, manager, stars, cashier, security).

### 3.2. Alternative

There are 5 cinemas in Balikpapan City, where all five will be used as alternatives, considering that some cinemas have premiere classes and some others do not, then only the economy class of each cinema is used in making the assessment. The following cinemas used as alternatives can be seen in Table 1.

Table 1: Alternative

| No. | Code | Cinema Name |
|-----|------|-------------|
|-----|------|-------------|

|   |    |                              |
|---|----|------------------------------|
| 1 | A1 | STUDIO XXI E-WALK            |
| 2 | A2 | STUDIO XXI PENTACITY         |
| 3 | A3 | STUDIO XXI PASAR BARU SQUARE |
| 4 | A4 | CGV PLAZA BALIKPAPAN         |
| 5 | A5 | CINEPOLIS LIVING PLAZA       |

### 3.3. Criteria

determining the criteria it is important to look at the things that consumers pay most attention to in choosing a cinema. The important things are price, film selection, seat selection, and facilities available at the cinema (ticket counter, waiting room, toilet, trash can, etc.). Based on this and the research data collected, the criteria and their weights are determined, which can be seen in Table 2.

**Table 2:** Criteria Weight

| No. | Criteria                                                                                                                                                   | Code | Weight | Characteristic |
|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------|------|--------|----------------|
| 1   | Price of 1 ticket                                                                                                                                          | K1   | 0,35   | Cost           |
| 2   | Number of active studios (number of films showing)                                                                                                         | K2   | 0,25   | Benefit        |
| 3   | Number of audience seats                                                                                                                                   | K3   | 0,10   | Benefit        |
| 4   | Number of facilities (offline ticket purchase counters, online ticket collection counters, waiting rooms, waiting room seating, trash bins, toilets, etc.) | K4   | 0,30   | Benefit        |

Next, determine the assessment indicators for each criterion based on the nature of the criteria data, where the Cost data is the smaller the value, the better, and the Benefit data is the larger the value, the better, then the criteria assessment indicators are obtained using a scale of 5 which can be seen in the Table 3.

**Table 3:** Value Scale

| No. | Criteria                                                                                                                                                   | Code | Value     |                     |                     |                     |             |
|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-----------|---------------------|---------------------|---------------------|-------------|
|     |                                                                                                                                                            |      | 1         | 2                   | 3                   | 4                   | 5           |
| 1   | Price of 1 ticket                                                                                                                                          | K1   | >Rp.55000 | Rp.51000 - Rp.55000 | Rp.46000 - Rp.50000 | Rp.41000 - Rp.45000 | <= Rp.40000 |
| 2   | Number of active studios (number of films showing)                                                                                                         | K2   | < 4       | 4                   | 5 - 6               | 7                   | > 7         |
| 3   | Number of audience seats                                                                                                                                   | K3   | < 100     | 100-150             | 150-200             | 200-250             | > 250       |
| 4   | Number of facilities (offline ticket purchase counters, online ticket collection counters, waiting rooms, waiting room seating, trash bins, toilets, etc.) | K4   | < 3       | 3                   | 4                   | 5                   | > 5         |

|                     |   |   |           |
|---------------------|---|---|-----------|
| Value Description : | 1 | = | Very bad  |
|                     | 2 | = | Not good  |
|                     | 3 | = | Enough    |
|                     | 4 | = | Good      |
|                     | 5 | = | Very Good |

### 3.4. MAUT method calculation process

Multi Attribute Utility Theory (MAUT) is a scheme in which the final evaluation,  $v(x)$  of an object  $x$  is defined as the weights summed up with relevant values to its dimensions, commonly called utility values, MAUT is used to convert several interests into numerical values on a scale of -1 with 0 being the worst value and 1 being the best. The final result is a ranking order of evaluations that can describe the choices of the Decision maker.

The first step taken is to determine the alternative cinemas in Balikpapan City which can be seen in Table 1. Next, determine the criteria that function as a basic reference in decision making whose weight information can be seen in Table 2. Next, use the criteria assessment indicator using a scale of 1-5, with an explanation of the criteria assessment indicators that can be seen in Table 3. After knowing the criteria assessment indicators, the assessment data will be carried out in Table 4.

**Table 4:** Cinema Value Data

| No. | Alternative                  | Code | Criteria |    |    |    |
|-----|------------------------------|------|----------|----|----|----|
|     |                              |      | K1       | K2 | K3 | K4 |
| 1   | STUDIO XXI E-WALK            | A1   | 2        | 3  | 5  | 5  |
| 2   | STUDIO XXI PENTACITY         | A2   | 3        | 3  | 1  | 5  |
| 3   | STUDIO XXI PASAR BARU SQUARE | A3   | 5        | 2  | 3  | 5  |
| 4   | CGV PLAZA BALIKPAPAN         | A4   | 4        | 4  | 3  | 5  |
| 5   | CINEPOLIS LIVING PLAZA       | A5   | 3        | 5  | 3  | 4  |

Next, the normalization calculation is carried out by entering the cinema value data into the formula:

$$U_{(x)} = \frac{x - x_i^-}{x_i^+ - x_i^-}$$

X = Alternative weights

$x_i^-$  = The highest (minimum) weight of the Xth criterion

$x_i^+$  = The lowest (maximum) weight of the Xth criterion

The following is the calculation of the normalization matrix:

(A1)

$$A1_{(1)} = \frac{2-2}{5-2} = \frac{0}{3} = 0$$

$$A1_{(2)} = \frac{3-2}{5-2} = \frac{1}{3} = 0,33$$

$$A1_{(3)} = \frac{5-1}{5-4} = \frac{4}{1} = 1$$

$$A1_{(4)} = \frac{5-4}{5-4} = \frac{1}{1} = 1$$

(A2)

$$A2_{(1)} = \frac{3-2}{5-2} = \frac{1}{3} = 0,33$$

$$A2_{(2)} = \frac{3-2}{5-2} = \frac{1}{3} = 0,33$$

$$A2_{(3)} = \frac{1-1}{5-4} = \frac{0}{1} = 0$$

$$A2_{(4)} = \frac{5-4}{5-4} = \frac{1}{1} = 1$$

(A3)

$$A3_{(1)} = \frac{5-2}{5-2} = \frac{3}{3} = 1$$

$$A3_{(2)} = \frac{2-2}{5-2} = \frac{0}{3} = 0$$

$$A3_{(3)} = \frac{3-1}{5-4} = \frac{2}{1} = 0,5$$

$$A3_{(4)} = \frac{5-4}{5-4} = \frac{1}{1} = 1$$

(A4)

$$A4_{(1)} = \frac{4-2}{5-2} = \frac{2}{3} = 0,67$$

$$A4_{(2)} = \frac{4-2}{5-2} = \frac{2}{3} = 0,67$$

$$A4_{(3)} = \frac{3-1}{5-4} = \frac{2}{1} = 0,5$$

$$A4_{(4)} = \frac{5-4}{5-4} = \frac{1}{1} = 1$$

(A5)

$$A5_{(1)} = \frac{3-2}{5-2} = \frac{1}{3} = 0,33$$

$$A5_{(2)} = \frac{5-2}{5-2} = \frac{3}{3} = 1$$

$$A5_{(3)} = \frac{3-1}{5-4} = \frac{2}{1} = 0,5$$

$$A5_{(4)} = \frac{4-4}{5-4} = \frac{0}{1} = 0$$

The results of the normalization will be presented again in the form of a table which can be seen in Table 5.

**Table 5:** Normalization of Cinema Values

| No. | Alternative                  | Code | Criteria |      |     |    |
|-----|------------------------------|------|----------|------|-----|----|
|     |                              |      | C1       | C2   | C3  | C4 |
| 1   | STUDIO XXI E-WALK            | A1   | 0        | 0,33 | 1   | 1  |
| 2   | STUDIO XXI PENTACITY         | A2   | 0,33     | 0,33 | 0   | 1  |
| 3   | STUDIO XXI PASAR BARU SQUARE | A3   | 1        | 0    | 0,5 | 1  |
| 4   | CGV PLAZA BALIKPAPAN         | A4   | 0,67     | 0,67 | 0,5 | 1  |
| 5   | CINEPOLIS LIVING PLAZA       | A5   | 0,33     | 1    | 0,5 | 0  |

After obtaining the results of the normalization of the criteria for each alternative, the next step is to multiply the normalization matrix with the preference weights using the formula:

$$V_{(x)} = \sum_{t=1}^n W_j.X_{ij} \dots \dots \dots (1)$$

The following is the calculation of normalized matrix multiplication using equation (1):

$$\begin{aligned} A1 &= (0,35 * 0) + (0,25 * 0,33) + (0,10 * 1) + (0,30 * 1) &= 0,483 \\ A2 &= (0,35 * 0,33) + (0,25 * 0,33) + (0,10 * 0) + (0,30 * 1) &= 0,500 \\ A3 &= (0,35 * 1) + (0,25 * 0) + (0,10 * 0,5) + (0,30 * 1) &= 0,700 \\ A4 &= (0,35 * 0,67) + (0,25 * 0,67) + (0,10 * 0,5) + (0,30 * 1) &= 0,750 \\ A5 &= (0,35 * 0,33) + (0,25 * 1) + (0,10 * 0,5) + (0,30 * 0) &= 0,417 \end{aligned}$$

From the matrix multiplication, the final value or result of the calculation process using the MAUT method will be obtained. The result of this study is a ranking decision that can determine the cinema with the best facilities in Balikpapan city which is shown in Table 6.

**Table 6:** Decision

| No. | Alternative                  | Code | Final Result | Rank |
|-----|------------------------------|------|--------------|------|
| 1   | STUDIO XXI E-WALK            | A1   | 0.483        | 4    |
| 2   | STUDIO XXI PENTACITY         | A2   | 0.500        | 3    |
| 3   | STUDIO XXI PASAR BARU SQUARE | A3   | 0.700        | 2    |
| 4   | CGV PLAZA BALIKPAPAN         | A4   | 0.750        | 1    |
| 5   | CINEPOLIS LIVING PLAZA       | A5   | 0.417        | 5    |

The final result shows that the cinema with the best facilities in Balikpapan city is CGV PLAZA BALIKPAPAN with a score of 0.750, then in second place is STUDIO XXI PASAR BARU SQUARE with a score of 0.700, the third position is occupied by STUDIO XXI PENTACITY with a score of 0.500, the fourth position is occupied by STUDIO XXI E-WALK with a score of 0.483, and in the last position is occupied by CINEPOLIS LIVING PLAZA with a score of 0.417.

## 4. Conclusion

Based on the analysis and calculation using the Multi Attribute Utility Theory (MAUT) method in this study, it can be concluded that in choosing a cinema with the best facilities, it is necessary to determine criteria with certain weights. The weight of these criteria can vary depending on each person's preferences, so the obstacle faced in using the MAUT method is the different final results because each person's criteria weight preferences are different. However, this method is still very effective in helping to determine decisions because the calculation and assessment process to get the final results is still the same.

then this research also provides a clear picture regarding examples of selecting suitable criteria to help make decisions. In the case of choosing a cinema with the best facilities, the criteria used are things related to cinema facilities such as the number of rooms, availability of waiting rooms, offline ticket purchase counters, online ticket pick-up counters, as well as trash bins and toilets, in addition to that, criteria related to services such as ticket prices and the number of film choices shown can also be added. from this research, the final result was that the cinema with the best facilities in Balikpapan city was CGV PLAZA BALIKPAPAN with a score of 0.750.

The MAUT method is an easy-to-use method to help make decisions because it simplifies the assessment by normalizing data into numeric numbers, namely 0 and 1, where 0 is the worst value and 1 is the best, so that the scale required in making the assessment is not too broad. In its implementation, the MAUT method can also be created or integrated into a system so that the calculations are carried out automatically and users only need to enter the weight and value of each criterion. The simplest example of implementation is using number processing applications such as Spreadsheet and Ms. Excel.

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