MECOMARE, 13 (2) (2024) pp. 42-49

Published by: TRIGIN Publisher

International Journal of Mechanical Computational and Manufacturing Research

Journal homepage: www.trigin.pelnus.ac.id

Implementation of the Simple Multi-Attribute Rating Technique for Determining Home Ownership Loan Housing

Ahmad Jurnaidi Wahidin[1], Marhani Nabila Sari [2]

[1,2] Faculty of Engineering and Informatics, Bina Sarana Informatika University, Jakarta, Indonesia

ARTICLE INFO

Article history:

Received May 27, 2024
Revised Jun 04, 2024
Accepted Jul 23, 2024

Keywords:

Decision Support System;
Home Ownership Loans;
Housing Evaluation;
SMART Method.

ABSTRACT

This study applied the Simple Multi-Attribute Rating Technique (SMART) to determine the best housing option based on Home Ownership Loans. Five criteria were identified as crucial for Home Ownership Loans housing evaluation: price, location, facilities, land area, and building area. Each criterion was assigned a weight reflecting its relative importance in the decision-making process. Four housing alternatives were evaluated using a rating scale to measure how well each met the criteria. The evaluation showed that Magnolia Residence was the top-ranked housing option with a total score of 0.73, followed by Puri Jaya, Widari Village, and CitraRaya Tangerang. The SMART method proved effective in assisting prospective buyers in making informed and objective decisions when selecting Home Ownership Loans housing. Future research is recommended to include additional criteria, expand housing alternatives, involve more respondents, and develop web-based or mobile applications to facilitate the use of the SMART method.

Corresponding Author:

Ahmad Jurnaidi Wahidin,
Faculty of Engineering and Informatics,
Bina Sarana Informatika University,
Kramat Raya Street No.98, RT.2/RW.9, Kwitang, Senen District, Central Jakarta City, Special Capital Region of Jakarta, 10450, Indonesia.
Email: ahmad.ajn@bsi.ac.id

1. INTRODUCTION

The need for adequate housing is one of the fundamental human necessities (Manullang, 2016), a house serves to provide security, protection from threats posed by wild animals and the weather, and functions as a residence for a certain period (Service, 2024), as well as a place for rest (Dimyati, 2023). The selection of housing is a crucial process in the lives of many individuals and families (Silaban & Losi, 2023). However, choosing a home is not a simple task. With the myriad of housing options available on the market, prospective buyers often face difficulties in determining which home best meets their needs and preferences. In this modern era, many people purchase homes either in cash or through credit. Factors such as location, price, amenities, and the surrounding environment become important criteria in this decision-making process. Therefore, tools that can assist prospective buyers in making better-informed decisions are needed.

With the continuous rise in house prices, many people, especially those in the lower to middle-income groups, find it difficult to own a home. Banks, as financial institutions, play a role in helping the government address the economic challenges faced by society in this regard. As financial institutions authorized by the financial services authority to provide credit, banks inevitably face risks inherent in every lending activity they undertake (Ikatan Bankir Indonesia, 2018). Home Ownership Loans are financing facilities offered by banks to assist in the purchase of homes (Academy, 2019). Home Ownership Loans is a long-term loan provided by financial institutions to

borrowers for building homes on land with the collateral being the ownership certificate of the house and the land. Home Ownership Loans can also be used to purchase a home or for other consumer needs with the house serving as collateral (Lestari et al., 2022). The financing services provided by banks through Home Ownership Loans are very beneficial for the community.

In this context, researchers need to optimize system-based testing to aid in decision-making regarding affordable and relevant home ownership loans. Decision Support Systems (DSS) facilitate faster and smarter decision-making based on objective data rather than subjective criteria or personal intuition (Andoyo et al., 2021). DSS provides highly effective tools for management and quickly becomes an integral part of managerial tasks (Kharisma et al., 2023). According to MeLod (1998), a decision support system is a system that generates information designed to solve specific problems faced by the parties involved (Tanzil et al., 2021). This decision support system is also an information system aimed at assisting in solving the problems encountered (Pratiwi, 2020).

Previous research has explored the use of Decision Support Systems (DSS) in various contexts, including housing selection, with examples such as the TOPSIS method (Nurelasari & Purwaningsih, 2020), AHP (Wahyuni et al., 2021), MOORA (Lubis et al., 2023), SAW (Supriyadi, 2024), WP (Hermansyah et al., 2023), WASPAS (Huda & Hadikurniawati, 2022), and ARAS (Prayoga & Susanti, 2022). These studies have demonstrated that analytical methods in DSS can enhance the accuracy and efficiency of decision-making. However, research on the use of the SMART method in the context of housing selection for Home Ownership Loan is still relatively limited, especially in the development of DSS for this purpose. This study will use the Simple Multi-Attribute Rating Technique (SMART), a method of decision-making involving multiple attributes (Harahap et al., 2021). It is based on a theory that assesses the importance of criteria relative to others. This weighting is used to evaluate alternatives to determine the best option. The SMART method has simple computation and is easy to implement (Rahayu et al., 2021), offering a comprehensive decision-making approach that accounts for both qualitative and quantitative factors (Aji & Dermawan, n.d.) (Muharamah et al., 2024). The advantages of this method lie in its simplicity and its ability to integrate various criteria into a single assessment model that is easy to apply and understand.

This research introduces the novelty of applying the SMART method to develop a Decision Support System (DSS) aimed at determining the best Home Ownership Loan housing based on predetermined criteria. By integrating the SMART method into the DSS, this study offers a more flexible and adaptive approach to various criteria relevant to prospective buyers. The results of this research are expected to make a significant contribution to the literature on the use of the SMART method in DSS, as well as provide a practical tool useful for prospective buyers and housing developers.

The primary objective of this research is to implement a Decision Support System based on the SMART method that can assist prospective buyers intending to use a home ownership loan from BCA in determining the best housing option in the Tangerang area. This system will be evaluated based on various criteria such as price, location, building quality, and supporting facilities. With the results obtained, it is hoped that this research can provide practical guidance for prospective buyers in selecting housing that meets their needs and preferences.

2. RESEARCH METHOD

This research is conducted through several systematic stages to develop and test a Decision Support System (DSS) based on the Simple Multi-Attribute Rating Technique (SMART) method in determining housing. The following are the stages of the research conducted:

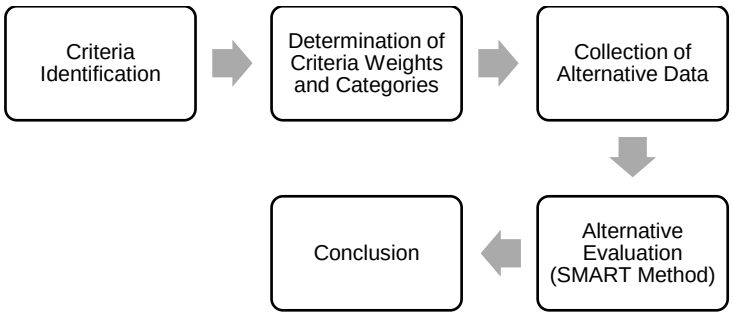

Figure 1. Research Steps

a) Criteria Identification

The first stage of this research is to identify the relevant criteria for the evaluation of alternatives.

b) Determination of Criteria Weights and Categories

After the criteria are determined, the next step is to assign weights to each criterion. These weights reflect the relative importance of each criterion in the decision-making process. These criteria are then categorized into two types (Mufarroha, 2022), namely: Cost: Criteria that are desired to be minimized; the lower the value, the better the alternative. Benefit: Criteria that are desired to be maximized; the higher the value, the better the alternative

.

c) Collection of Alternative Data

The next stage is to collect data on the alternatives to be evaluated. This data includes detailed information about each alternative based on the established criteria.

d) Evaluation of Alternatives Using the SMART Method

At this stage, each alternative is evaluated based on the established criteria using the SMART method. The steps in the SMART method include (Aprianto et al., 2024)(Citra & Satria, 2024)(Fadhlullah et al., 2024):

1) Weight Normalization

Perform the calculation of the normalized value from each result by comparing the weight values of each criterion with the total weight values of the criteria, using equation (1).

$$wi: \frac{wi}{\sum_{j=1}^{w} wj} \quad \text{.....(1)}$$

Where wi represents the weight value of the iii-th criterion, and xxxxx is the sum of the weights of the criteria.

2) Determining the Rating Scale for Each Criterion

Establish a rating scale for each criterion to ensure a consistent evaluation of all housing alternatives. This scale quantifies the performance of each alternative against the criteria.

3) Evaluating Each Housing Alternative Based on the Rating Scale

Assess each housing alternative according to the established rating scale. This involves assigning scores to each alternative for each criterion based on their performance.

4) Determining the Utility Value

Calculate the utility value for each alternative by combining the normalized weights and the scores assigned during the evaluation. The utility value represents the overall performance of each alternative across all criteria.

The steps to convert each value for each criterion into a standardized criterion value, which will then be the Utility result, are as follows. The values will be calculated using equations (2) and (3).

Benefit $ui(ai) = \frac{(\text{Cout}-\text{Cmin})}{(\text{Cmax}-\text{Cmin})}$ .....(2)

Cost $ui(ai) = \frac{(Cmax-Cout)}{(Cmax-Cmin)}$ .....(3)

5) Determining the Final Value

Multiply each utility value obtained by the normalized weight value. Then, the results of these multiplications must be summed. To obtain the final value, use equation (4).

$$u(ai) = \sum_{J}^{m} = W_J \,.\, ui(ai) \quad \text{.....(4)}$$

6) Determining the Ranking

After multiplying all criterion values by their respective weights, the next step is to sum these values for each housing alternative. The total scores obtained for each alternative are then used to determine the ranking of the housing options. The alternative with the highest score is considered the best housing option based on the established criteria.

e) Conclusions

The final stage is to draw conclusions based on the results of the evaluations and rankings obtained. This conclusion includes identifying the best housing option recommended for prospective buyers. This involves summarizing the findings and providing actionable recommendations based on the highest-ranked alternatives. The conclusions should highlight the most suitable housing options considering all the criteria and the analysis conducted using the SMART method.

3. RESULTS AND DISCUSSIONS

In this research, the design of a decision support system using the Simple Multi-Attribute Rating Technique (SMART) method for selecting the best Home Ownership Loan involves several essential tasks. These tasks include performing calculations using specific formulas, with the aim of providing clearer and more optimal prediction results.

a) Identification of Evaluation Criteria

The first stage in this research is to identify the relevant criteria for evaluating Home Ownership Loan housing. These criteria are selected based on literature studies from the RumahSaya BCA website, interviews with experts, and surveys of prospective homebuyers. The criteria used in this study include price, location, facilities, land area, and building area.

b) Determination of Criteria Weights and Categories

To clarify the criteria used in this research, the technique for determining these weights involved surveys of prospective homebuyers and discussions with real estate experts. The collected data was analyzed to establish the weights to be used in the SMART method. Table 1 lists the criteria, weights, and categories of each identified criterion.

Table 1. Criteria Weights and Categories

Criteria	Code	Weight	Category
Price	C1	20	Cost
Location	C2	15	Cost
Facilities	C3	20	Benefit
Land Area	C4	25	Benefit
Building Area	C5	20	Benefit

Table 1 provides information on the relative importance of each criterion in the decision-making process, as well as the category indicating whether the criterion is classified as a cost or a benefit.

c) Collection of Housing Alternative Data

Housing alternative data is obtained through literature studies from the RumahSaya BCA website. The collected data includes detailed information about each housing option based on the established criteria, such as price, location, facilities, land area, and building area. This information is used to evaluate each housing alternative within the decision support system. The data is shown in Table 2.

Table 2. Housing Alternatives Data

Alternative	Price	Location	Facilities	Land Area	Building Area
Magnolia Residence	Rp. 770.000.000	4,5 km	Very Complete	75 m2	35 m2
CitraRaya Tangerang	Rp. 672.000.000	12,5 km	Incomplete	72 m2	32 m2
Puri Jaya	Rp. 747.378.609	10 km	Somewhat Complete	72 m2	61 m2
Widari Village	Rp. 859.400.000	17,5 km	Less Complete	72 m2	67 m2

d) Evaluation of Alternatives Using the SMART Method

1) Weight Normalization

In this step, the weights of the criteria are normalized by dividing each weight by the total sum of the weights, converting them into decimal form. The results are presented in Table 3.

Table 3. Normalized Weights

Criterion Code	Weight	Normalized Weight
C1	20/100	0,2
C2	15/100	0,15
C3	20/100	0,2
C4	25/100	0,25
C5	20/100	0,2

2) Determining the Rating Scale for Each Criterion

Determining the rating scale is a crucial step in this research. The rating scale is used to evaluate each housing alternative based on the established criteria. This scale helps measure the extent to which each alternative meets a specific criterion and provides numerical values that can be compared across alternatives. For this research, the rating scale used is shown in Table 4.

Table 4. Rating Scale

Score	Description
1	A bit
2	Less
3	Enough
4	Very

3) Evaluating Each Housing Alternative Based on the Rating Scale

This step involves evaluating each housing alternative using the rating scale determined in the previous step. The rating scale provides numerical values that indicate the extent to which each alternative meets the established criteria. Table 5 shows the evaluation for each housing alternative based on the given rating scale.

Table 5. Evaluation of Housing Alternatives

Alternative	C1	C2	C3	C4	C5
A1	3	1	4	4	2
A2	1	3	1	3	1
A3	2	2	3	3	3

A4	4	4	2	3	4

4) Determining the Utility Values
In this section, the researcher explains that benefit criteria are those where the decision-maker desires the maximum value among all the alternative values. Conversely, cost criteria are those where the decision-maker desires the minimum value among all the alternative values.

To find the utility values, we use equation (2). The utility value calculation is based on the category of the criterion, whether it is a cost or a benefit. The results of the utility value calculation are shown in Table 6.

Table 6. Utility Values

Alternative	C1	C2	C3	C4	C5
A1	0,33	1,00	1,00	1,00	0,33
A2	1,00	0,33	0,00	0,00	0,00
A3	0,67	0,67	0,67	0,00	0,67
A4	0,00	0,00	0,33	0,00	1,00

5) Determining the Final Value
The next step in the SMART method is to determine the final value for each alternative. This involves calculating the final value for each alternative using equation (2). The results of these calculations are shown in Table 7.

Table 7. Final Values from Weight and Utility Calculations

Alternative	C1	C2	C3	C4	C5	Total
A1	0,07	0,15	0,20	0,25	0,07	0,73
A2	0,20	0,05	0,00	0,00	0,00	0,25
A3	0,13	0,10	0,13	0,00	0,13	0,50
A4	0,00	0,00	0,07	0,00	0,20	0,27

6) Determining the Ranking
After the final values for each housing alternative have been calculated, the next step is to determine the ranking for each alternative. This ranking is based on the total scores obtained by each alternative, with the alternative having the highest total score receiving the highest rank. The ranking results are shown in Table 8.

Table 8. Ranking

Alternative	**Total**	**Ranking**
A1	0,73	1
A3	0,5	2
A4	0,27	3
A2	0,25	4

e) Conclusion
Based on the total scores, the highest-ranking alternative is the one with the largest final value. Therefore, A1, with a score of 0.73, is the top-ranked alternative, followed by A3, A4, and A2.

4. CONCLUSION

Based on the research conducted using the Simple Multi Attribute Rating Technique (SMART) to determine the best housing option for a Home Ownership Loan, it can be concluded that Magnolia Residence is the best housing alternative with a total score of 0.73. This study identifies five main criteria relevant to the assessment of Home Ownership Loans: price, location, facilities, land area, and building area. Each criterion is given a weight that reflects its importance in the decision-making process. Four housing alternatives were evaluated based on the established criteria using a rating scale designed to measure the extent to which each alternative meets these criteria. The evaluation results show that Magnolia Residence has the highest score, followed by Puri Jaya,

Widari Village, and Citra Raya Tangerang. Thus, the SMART method has proven effective in helping prospective buyers make more informed and objective decisions when choosing a Home Ownership Loan housing option that suits their needs and preferences. This research provides valuable insights into the application of the SMART method for determining the best housing option based on the specified criteria.

Future research is recommended to include additional evaluation criteria, expand the variety of housing alternatives, involve more respondents, and develop web-based or mobile applications to facilitate prospective buyers in using the SMART method.

REFERENCES

Academy, K. P. R. (2019). *KPR 101*. KPR Academy. https://books.google.co.id/books?id=m6_MDwAAQBAJ

Aji, N. S. L., & Dermawan, D. A. (n.d.). *Penerapan Metode Smart Berbasis Website Pada Sistem Pendukung Keputusan Untuk Menentukan Kelayakan Calon Penerima Bantuan Langsung Tunai (BLT) Di Kelurahan Kepanjin, Kabupaten Sumenep*.

Andoyo, A., Angraeni, E. Y., & Khumaidi, A. (2021). *SISTEM PENDUKUNG KEPUTUSAN Konsep, Implementasi & Pengembangan*. Penerbit Adab. https://books.google.co.id/books?id=YTgmEAAAQBAJ

Aprianto, M. S., Handika, M., Juliantika, R., Pane, S. F. S., Natasya, T. A., & Afrisawati, A. (2024). Analisis Perbandingan Metode SMART dan MOORA dalam Pemilihan Calon Mustahiq di Masjid Nur-Hadi. *Journal Of Computer Science And Technology (JOCSTEC)*, *2*(2), 90–100.

Citra, P., & Satria, M. N. D. (2024). Penerapan Metode Rank Order Centroid dan SMART Dalam Sistem Pendukung Keputusan Pemilihan Waitress Terbaik. *CHAIN: Journal of Computer Technology, Computer Engineering, and Informatics*, *2*(2), 77–87.

Dimyati, M. (2023). *Model Pemantauan Penggunaan Lahan dan Tutupan Lahan yang Efisien di Indonesia Berbasis Data Penginderaan Jauh*.

Fadhlullah, M. I., Pratama, A. P., Saputra, A., & Effendi, B. (2024). Sistem Pendukung Keputusan Pemilihan Duta Prestasi Menggunakan Metode SMART (Studi Kasus Smk Negeri Sumsel). *MDP Student Conference*, *3*(1), 816–823.

Harahap, A. R., Iswan, M., & Murniyanti, S. (2021). Sistem Pendukung Keputusan Reqruitment Kredit Perumahan Rakyat Bersubsidi Dengan Menggunakan Metode. *Jurnal CyberTech*, *1*(1), 63–71.

Hermansyah, D., Natasya, A. R., Mukhlis, I. R., Laga, S. A., & Suprianto, G. (2023). Sistem Pendukung Keputusan Dalam Menentukan Pemilihan Lokasi Perumahan Strategis Di Sidoarjo Dengan Metode Weighted Product. *INTEGER: Journal of Information Technology*, *8*(2).

Huda, A. F., & Hadikurniawati, W. (2022). Sistem Pendukung Keputusan Pemilihan Perumahan Menggunakan WASPAS. *MEANS (Media Informasi Analisa Dan Sistem)*, 177–180.

Ikatan Bankir Indonesia. (2018). *Bisnis Kredit Perbankan* (2nd ed.). Gramedia Pustaka Utama. https://books.google.co.id/books?id=7xhIDwAAQBAJ

Kharisma, L. P. I., Yahya, S. R., Handayanto, R. T., Gunawan, I. M. A. O., Handika, I. P. S., Hatta, H. R., Syamil, A., & Efitra, S. K. M. K. (2023). *METODE SPK FAVORIT DI MASA DEPAN : Teori dan Contoh*. PT. Sonpedia Publishing Indonesia. https://books.google.co.id/books?id=JxLAEAAAQBAJ

Lestari, C. D., Resmi, M. G., & Ramadhan, Y. R. (2022). Decision Support System For Selection Of Home Ownership Loans (KPR) Using The Smart Method. *RISTEC: Research in Information Systems and Technology*, *3*(2), 201–212.

Lubis, J. H., Mesran, M., Edrin, S., & Nasution, A. (2023). Sistem Pendukung Keputusan Rekomendasi Pembelian Perumahan Menerapkan Metode MOORA. *Journal of Computer System and Informatics (JoSYC)*, *4*(3), 655–662.

Manullang, R. (2016). *Dari tanah jadi rumah*. ANDI. https://books.google.co.id/books?id=M32gEAAAQBAJ

Mufarroha, D. R. A. F. A. (2022). *Buku Ajar Sistem Pendukung Keputusan (Konsep dan Model)*. Media Nusa Creative (MNC Publishing). https://books.google.co.id/books?id=pP6hEAAAQBAJ

Muharamah, W., Katarina, D., & Surajiyo, S. (2024). Sistem Pendukung Keputusan Pemilihan Ekstrakulikuler Menggunakan Metode Simple Multi Attribute Rating Technique (SMART). *JRKT (Jurnal Rekayasa Komputasi Terapan)*, *4*(02), 163–168.

Nurelasari, E., & Purwaningsih, E. (2020). Sistem Pendukung Keputusan Pemilihan Perumahan Terbaik Dengan Metode TOPSIS. *JUSTIN (Jurnal Sistem Dan Teknologi Informasi)*, *8*(4), 317–321.

Pratiwi, H. (2020). Penjelasan sistem pendukung keputusan. *No. May*.

Prayoga, R. A. S., & Susanti, P. (2022). Sistem Pendukung Keputusan Pemilihan Perumahan dengan Metode ARAS (Studi Kasus Kabupaten Ponorogo). *Jurnal Sains Dan Informatika*, *8*(1), 31–40.

Rahayu, N. A., Ginting, B. S., & Simanjuntak, M. (2021). Sistem Pendukung Keputusan Seleksi Penerimaan

Bantuan Program Sembako Menggunakan Metode Smart (Simple Multi Attribute Rating Technique)(Studi Kasus: Dinas Sosial Kota Binjai). *Jurnal Sistem Informasi Kaputama (JSIK)*, *5*(1), 63–74.

Service, S. A. M. (2024). *Cara Mudah Membeli Rumah Idaman untuk Pasangan Muda*. Penerbit Andi. https://books.google.co.id/books?id=z5P3EAAAQBAJ

Silaban, D., & Losi, R. V. (2023). Rancang Bangun Sistem Dalam Pemilihan Rumah Dengan Metode Smart. *JOURNAL ZETROEM*, *5*(2), 169–173.

Supriyadi, D. (2024). Penerapan Metode Simple Additive Weighting (SAW) Dalam SPK Pencarian Perumahan Residence. *KLIK: Kajian Ilmiah Informatika Dan Komputer*, *4*(4), 2307–2317.

Tanzil, F., Saepudin, S., Sembiring, F., Arianti, N. D., & Erfina, A. (2021). Sistem Pendukung Keputusan Penilaian Calon Supervisor Dengan Menggunakan Metode Fuzzy Analytical Hierarchy Process (Fahp). *Jurnal Riset Sistem Informasi Dan Teknologi Informasi (JURSISTEKNI)*, *3*(3), 32–40.

Wahyuni, D. S., Neneng, N., & Megawaty, D. A. (2021). Rancang Bangun Sistem Pendukung Keputusan Berbasis Web Untuk Pemilihan Perumahan Siap Huni Menggunakan Metode Ahp (Studi Kasus: Pt Aliquet and Bes). *Jurnal Teknologi Dan Sistem Informasi*, *2*(4), 22–28.