ABSTRACT

A business point is one of the most important factors as a place to support business activities. In determining the business location point, consideration must first be done carefully and not haphazardly wherever it is, but the location is determined based on careful consideration for reasons of sustainability in the success of the business now and in the future. The aim of this research is to build a system that can recommend determining business points by applying spatial data and implementing the AHP method and TOPSIS method for recommendations for determining housing business points in Mamuju Regency. The methods used in this research are the TOPSIS and AHP methods. Research results from the topsis method trial results with trial results from several alternatives which ranked first were Simboro sub-district with a percentage value of 0.67 and the results of the AHP method trials with several alternatives obtained the top ranking results were Binanga sub-district with a percentage of 0.11. The conclusion of this research is based on the results of a comparison of two methods between the TOPSIS method and the AHP method. The highest level of accuracy is the topsis method.

Keywords: Analysis, AHP, Business Point, Spatial, TOPSIS.

1. INTRODUCTION

Mamuju Regency is located in West Sulawesi and is the capital of the province. The growth of Mamuju City with its geographical conditions and very strategic position as well as being the center for surrounding districts and sub-districts, has an impact on increasing the population, which of course needs a place to live (Wikipedia, 2024). One indication is an increase in housing demand. The population growth in Mamuju Regency is increasing, causing the demand for housing to be increasingly high. Based on data from the Central Statistics Agency (BPS), the population in Mamuju as of 2019 is 293,326 Update 2022 (Statistics, 2019).

The demand for housing in Mamuju Regency is increasing due to the rapid growth of transportation facilities and facilities, especially due to regional development planning (Husain & others, 2021). The increase in demand for housing must be accompanied by regional planning to build new residential areas (Sari et al., 2021). Therefore, spatial modeling is needed for planning the development of residential areas which takes into account the suitability of the land for determining the location, which should look at several factors that can be used as parameters for selecting housing location points (Hadi et al., 2023). Housing venture point refers to the location or area for the development of a housing project (Rahayu, 2021). The choice of housing business point has a significant impact on the success of the project and the
comfort of the residents (Paryoko & Zakariya, 2023). Housing location is very important because it will affect property prices, accessibility, and occupant comfort (Maddikunta et al., 2020). The success of housing also depends on the availability of supporting infrastructure such as electricity, clean water, and reliable sewerage as well as the presence of public facilities such as schools, hospitals, shopping centers, and recreation areas which are a significant added value (Ade Herdiwansyah & Helard, 2023).

Supporting data related to the housing business is very important to support decision-making analysis related to housing business points, namely location demographic data, property market analysis, infrastructure and accessibility, security level data, and evaluation of security factors that can influence residents' decisions and social data. Economics such as data about employment, education and the socioeconomic profile of local communities (Saputra et al., 2016), (Nata, 2020).

Previously research had been carried out by (Adhiarta et al., 2021) Based on the results of the GIS and AHP integration carried out in this research, it was concluded that the calculation results with the highest weight were the environment with a value of 0.633, next was accessibility with a value of 0.26 and finally facilities with a value of 0.106. As for location, Padalarang sub-district is a suitable location to be used as an MSME location because it has the highest score, namely 3,488.

In Other Research by (Hidayah & Amin, 2021) This research aims to determine the spatial pattern of minimarket locations and analyze factors that influence the distribution of minimarkets through demographic variables and the range of minimarket services in Klaten Regency. The data collection technique uses three methods, namely field observation, secondary data observation, and documentation (Rasyid et al., 2019). The data analysis method in this research used the nearest neighbor analysis technique (ANN) with the help of the ArcGIS 10.3 application.

The results obtained from this research are that the spatial pattern of the distribution of minimarket locations in Klaten Regency is clustered. The location selection factors are seen in terms of demographics and service coverage. The conclusion of this research is that the construction of minimarkets that are close to each other causes the distribution pattern of minimarkets to be clustered. Minimarket location selection factors are influenced by demographic variables and service coverage. The demographic factor is that the denser the population, the greater the opportunity for building a minimarket. The service coverage factor is not yet able to serve the Klaten Regency area with a radius of 300 meters per minimarket unit.

In another Study by (Jun et al., 2020) The results of this research are to recommend housing search results, then the results obtained make it easier for investors to plan. Then another research by (Putri et al., 2021) It is hoped that the results of this research can be a reference for further research and can become research literature for adopting policies regarding strategic locations that can improve services to attract more consumers or visitors and give more attention to the provision of facilities in business. Study (AE Wijaya & Nurlaelah, 2019)provides a solution for selecting Android-based housing using the TOPSIS method in
Subang District, offering a comparison of manual and system calculation results with an accuracy of 89%. Decision support system for selecting boarding places specifically for students by (Sugianto et al., 2016) using the web-based AHP and TOPSIS method in Pontianak City, providing recommendations based on 6 criteria, with 83% of student respondents responding that this system helps in choosing the right boarding house. Lastly, research (Pakpahan & Simbolon, 2019) emphasized the importance of the AHP and TOPSIS methods in facilitating the selection of building locations according to the builder's criteria, with a focus on the system's strengths and weaknesses. Integration of findings from these six studies can enrich the research background, showing various methods and approaches that can be applied in developing location selection decision support systems.

Based on the problems and previous research that have been described in the background, steps are needed to determine the housing business point, therefore based on current technological developments it supports the use of spatial data which can be implemented in a web-based system. In implementing spatial data, implementing a geographic information system (GIS) is one step that can be used (Ilham et al., 2023). GIS is an appropriate tool for managing spatial data, GIS allows for fast and accurate analysis of tabulated and spatial data. So GIS can be used to build an application that can overcome the above problems. Then, this research uses a decision support system to produce recommendations for determining housing business points using the AHP (Analytic Hierarchy Process) method and the TOPSIS (Technique For Order Preference by Similarity to Ideal Solution) method.

One method that is often used in decision making is the TOPSIS method because this method has fast and simple computing. The TOPSIS method has been proven effective in overcoming multi-criteria decision making problems (Sudradjat et al., 2020). By applying this method, it is hoped that a system can be formed that is able to provide recommendations for determining optimal business points, based on relevant criteria and their weights. Apart from that, the AHP method basically helps to overcome complex problems by arranging a hierarchy of criteria, assessing them subjectively by stakeholders, then drawing various considerations to develop weights or priorities.

However, there is still a research gap regarding recommendations for housing business points in Mamuju Regency. Therefore, this research aims to fill this gap by applying spatial analysis using the AHP and TOPSIS methods through research entitled "Spatial Data Based Housing Business Point Recommendation System". introduction is typed in capital letters, containing the background described with the previous state of the art research.

2. THEORY
2.1 Geographic Information Systems
Geographic Information System (GIS), hereinafter referred to as GIS, is a computer-based information system used to process and store geographic data or information (Perrina, 2021). GIS is a computer system that has four capabilities in handling geographically referenced data, namely input, data management (storage and retrieval of data), analysis and manipulation of methods, and output (Puspitasari et al., 2019). Geographic Information System (GIS) is an information system designed using a database that has spatial references or geographic
coordinates (Alfansyuri et al., 2020). As a computer-based system, there are at least four approaches that can be used to define and divide GIS, namely the process-oriented approach, the toolbox approach, the database approach, and the application approach (Al Fauzi et al., 2022), (Baghaskara et al., 2022).

2.2 Topographic maps
Topographic maps are a type of map characterized by large scale and detail, usually using contour lines in modern mapping (YR Basuki, 2020), (Suwarno et al., 2023). A topographic map usually consists of two or more maps combined to form a whole map (Sutanto, 2020). A contour line is a combination of two line segments that are connected but do not intersect, these are elevation points on a topographic map (Prakosa, 2023). The unique characteristic that differentiates topographic maps from other types of maps is that they show topographic contours or landforms in addition to other features such as roads, rivers, lakes, etc (Jumardi et al., 2021). Because topographic maps show the contours of the land, this type of map is the most suitable type of map for outdoor activities compared to most maps.

2.3 Spatial Data
Spatial and non-spatial data is data that is utilized by geographic information systems. Where spatial data is data that can be in the form of graphs that refer to locations or places in space on the Earth's surface, as well as non-spatial data that provide a description or picture of every object on the Earth's surface (Rahman, 2022). Most of the data that will be handled in GIS is spatial data, geographically oriented data (Susandi & others, 2020). Spatial data is obtained from measurement results which contain information about location and measurements (B. Basuki et al., 2023), (Burbano-Moreno & Mayrink, 2024). This data is presented in the form of the geographical position of the object, location, and relationship with other objects, using coordinate points and areas. Spatial data can be discrete or continuous data (Chen et al., 2021). Discrete data is data obtained by counting, not a fraction or average (Olsen et al., 2020). Meanwhile, continuous data is data that can have values that lie within an interval (E. Wijaya et al., 2024).

2.4 Multi-Criteria Decision Making (MCDM)
MCDM is a procedure used to find the best alternative from various feasible alternatives (Sudipa et al., 2023), (Putra & others, 2022). MCDM is a technique for selecting the best alternative from various criteria, which allows several criteria to be contradictory and have conflicts (Amalia & Firmadhani, 2022).

2.5 Analytical Hierarchy Process (AHP)
According to (Imron, 2019) AHP is a tool (process) in decision making that was developed by Thomas L Saaty in the 70s. This procedure is so powerful that it has been widely applied for important decision-making processes (Balta & Öztürk, 2021; Ratnawati et al., 2023). AHP can be trusted to be effective because each priority is compiled from various options which may be based on criteria that have been previously outlined so that priorities are determined based on a structured and reasonable process (Larpcharoen et al., 2022). AHP helps to overcome complex problems by compiling a hierarchy of criteria, assessed subjectively by stakeholders, then drawing various considerations to develop weights or priorities (Hakim et al., 2022).
2.6 TOPSIS (Technique for Order Preference by Similarity to Ideal Solution)
TOPSIS was first introduced by Yoon and Hwang in 1981 to be used as a method for solving multicriteria problems (Amudha et al., 2021). TOPSIS provides a solution from a number of possible alternatives by comparing each alternative with the best alternative and the worst alternative that exist among the problem alternatives (Sharma et al., 2020). This method uses distance to make these comparisons (Halicka, 2020), (Çelikbilek & Tüysüz, 2020). TOPSIS has been used in many applications including financial investment decisions, performance comparisons of companies, performance comparisons in specific industries, operating system selection, customer evaluation, and robot design (Chakraborty, 2022).

3. METHOD
The method used in this research is the TOPSIS and AHP methods. By applying this method, it is hoped that a system can be formed that is able to provide recommendations for determining optimal business points, based on the criteria used such as population, population density, number of offices, potential, number of cafes and restaurants, number of universities, number of shopping centers, tourist attractions and public facilities. Apart from that, the AHP method basically helps to overcome complex problems by arranging a hierarchy of criteria, assessing them subjectively by stakeholders, then drawing various considerations to develop weights or priorities.

The implementation of the TOPSIS and AHP algorithms has several stages as follows:

1. Implementation of the TOPSIS Method
   Identifying criteria and criteria weights by determining the preference weight value of each criterion based on the level of importance between one criterion and the other criteria. Comparison value of the level of importance between one criterion and another; Data Normalization; Determine positive and negative ideal solutions for each criterion; Calculating the Euclidean distance to Positive and Negative ideal solutions; Calculate the similarity score (Si) for each alternative with the formula $Si = \frac{A+ - A-}{(A+ + A-) / 2}$. The similarity score shows how close the alternative is to the positive ideal solution (A+), the higher the similarity score, the better the alternative; Ranking based on similarity score (Si) from highest to lowest. Select the location with the highest score as the recommended business development point; Visualizing results with maps in Geojson format using Argis or Mapbox software to display interactive maps in the business point development recommendation application.

2. Implementation of the AHP Method
   Identifying Criteria and sub-Criteria; Create an AHP hierarchy by determining criteria, sub-criteria and alternatives as nodes in the hierarchy and forming a pairwise comparison matrix to determine the relative weight between criteria and sub-criteria; Carry out pairwise comparisons to determine the relative weight between criteria and sub-criteria using a 1-9 assessment scale. If Criterion 1 is more important than Criterion 2, then the comparison score can be 2. If Criterion 2 is more important than Criterion 1, the comparison score can be 0.5; Using the filled in pairwise comparison matrix, calculate the relative weights for each criterion and subcriterion; Based on the weight of the criteria and
sub-criteria, calculate the score value for each existing alternative; From the highest score as a recommendation for the development of business points; Visualizing results with maps in Geojson format using Argis or Mapbox software to display interactive maps in the business point development recommendation application.

This research uses topographic maps which are the results of surveys or collected data, the following is a map of Mamuju:

Figure 1. Map of Mamuju

In this research, the first thing to do is obtain spatial data for Mamuju Regency which will be analyzed in GeoJson format, then convert the spatial data to GeoJson format. Next, data preprocessing is carried out to produce data in the form of population, population density, number of offices, potential, number of cafes and restaurants, number of universities, number of shopping centers, tourist attractions and public facilities.

4. RESULTS AND DISCUSSION

The results of this research are the results of testing the topsis method which was implemented into the system, as follows:

1. Alternative data display

Figure 2. Alternative Data View
Figure 2 is an alternative data display which displays a list in table form. In this display there is an add button to add data. For maps management, take an alternative ID from geoJSON to display maps. When selecting the Mamuju map, it will display spatial data from the maps.

2. View Add Alternative

![Figure 3. Add Alternative Display](image)

Figure 3 is a display of an alternative data input form, in this display there are several fields, namely alternative name, GeoJSON and map color. For managing maps, take an alternative ID from geoJSON to display maps. When selecting the Mamuju map, it will display spatial data from the maps.

3. Criteria Data Display

![Figure 4. Criteria Data Display](image)
Figure 4 is an alternative data display that displays a list in table form, namely displaying the criteria names, weights, and attributes. In this display, there are edit buttons and delete and add buttons to add criteria data.

4. Criteria Comparison View

![Criteria Comparison Display](image)

Figure 5. Criteria Comparison Display

Figure 5 is a comparison table of criteria from the AHP method where the display displays a comparison table of criterion 1 with criterion 2 which functions to compare criterion 1 with comparisons of other criteria as an assessment process.

5. Maps View

![Maps Display](image)

Figure 6. Maps display

Figure 6 is a maps display that functions to display maps of alternative locations as an assessment where the display displays the value of each alternative in accordance with the assessment criteria, namely when selecting the map to be displayed, a description of the
location will appear consisting of the number of criteria, which explains the population, number of offices, and number of cafes and restaurants.

6. TOPSIS Method Results Display

Figure 7 is a display of the TOPSIS method calculation results so that it displays the ranking results. In this display there are processes or steps to complete the calculation process to obtain ranking results from alternative calculation results whose first rank is Karema with a percentage value of 0.9, in the display. There is also a button to display calculations from TOPSIS Analysis, by selecting this button it will display calculations from the TOPSIS method.

7. Display of AHP Method Results

Figure 4.9 is a display of the AHP method calculation results so that it displays the ranking results. In this display there are processes or steps to complete the calculation process to obtain ranking results from alternative calculation results whose first rank is SIMBORO with a percentage value of 0.06760913270343, in the display. There is also a button to display
calculations from AHP Analysis, by selecting this button it will display calculations from the AHP method. In implementing the TOPSIS and AHP methods into the system, the comparison results of the two methods are obtained in Table 1 below:

<table>
<thead>
<tr>
<th>TOPSIS Results</th>
<th>Mark</th>
<th>AHP results</th>
<th>Mark</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simboro</td>
<td>0.67</td>
<td>Binanga</td>
<td>0.11</td>
<td>0.56</td>
</tr>
<tr>
<td>Binanga</td>
<td>0.55</td>
<td>Simboro</td>
<td>0.08</td>
<td>0.47</td>
</tr>
<tr>
<td>Karema</td>
<td>0.40</td>
<td>Karema</td>
<td>0.07</td>
<td>0.33</td>
</tr>
<tr>
<td>Mamunyu</td>
<td>0.39</td>
<td>Mamunyu</td>
<td>0.04</td>
<td>0.35</td>
</tr>
<tr>
<td>Rangas</td>
<td>0.37</td>
<td>Bamboo</td>
<td>0.03</td>
<td>0.34</td>
</tr>
</tbody>
</table>

Table 1 is a comparison table of the TOPSIS and AHP methods. From the comparison table, the difference between the TOPSIS and AHP results is obtained, namely for alternative 1, the difference is 0.56, alternative 2 with the result 0.47, alternative 3 with a value of 0.33, alternative 4 with a value of 0.35 and alternative 5 with the difference value 0.34. Table of comparison results between AHP (Analytical Hierarchy Process) and TOPSIS (Technique for Order of Preference by Similarity to Ideal Solution) which shows that the high difference can be caused by several factors, namely AHP and TOPSIS have different basic approaches in handling comparisons and evaluating alternatives. AHP focuses on hierarchical structures and pairwise comparisons, while TOPSIS is oriented towards decision matrices and nearest distance calculations. The criteria weighting process in AHP can influence the final results. If the weighting is incorrect or inconsistent, this can cause a high discrepancy with the TOPSIS results.

5. CONCLUSIONS AND SUGGESTIONS
Based on the results and discussion that have been described, the author draws the conclusion that the system testing results can recommend housing construction location points by implementing a geographic information system to display the deployed locations in the form of maps. From the results of the TOPSIS method trial, the results of trial calculations with several alternatives ranked first were Simboro Village with a percentage value of 0.67. From the results of testing the AHP method with several alternatives, the top ranking result was Binaga Village with a percentage of 0.11. Based on the results of the comparison between the TOPSIS method and the AHP method, there are different levels of accuracy, the one with the highest level of accuracy is the TOPSIS method.

Based on the results of the research and discussion described above, the suggestions from this research are as follows:
1. Future researchers can carry out developments with comparisons of other methods such as comparisons of methods between AHP and ANP, VIKOR and SMART, TOPSIS and MAUT as well as comparisons of other methods.
2. Can develop by adding assessment variables.

6. ACKNOWLEDGEMENTS
Thank you to all stakeholders who have helped and supported research on a housing business point recommendation system based on spatial data.
REFERENCES


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217–223.