

The Role of Geographic Information Systems in Marketing Strategy: Improving the Efficiency of Store Locations and Consumer Targeting Based on Alfamart Locations in Bandung City

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Abstract—This research explores the application of Geographic Information Systems (GIS) to optimize location selection and consumer targeting strategies for Alfamart mini markets in Bandung City. The purpose of this study is to assess how GIS can improve the decision-making process in determining the location of new outlets by integrating spatial data with multi-criteria decision analysis methods. This research uses Analytical Hierarchy Process (AHP) to evaluate the best location based on factors such as population density, accessibility, and the presence of competitors. Additionally, authors conducted consumer segmentation using the K-means clustering technique to understand consumer behavior based on shopping patterns and geographical distribution. Key findings showed that the Dago area in Bandung was the optimal location for the new store, with a 25% increase in foot traffic and a 30% increase in sales during the first three months of operation. This research emphasizes the importance of using GIS not only for spatial analysis but also for more targeted marketing, improved operational efficiency, and customer satisfaction. However, there are limitations in terms of dependence on data quality and the dynamics of consumer preferences. Future research could expand the coverage area and integrate additional variables to refine the application of GIS in retail location planning.

Index Terms—Geographic information system, analytic hierarchy process, k-means clustering, consumer segmentation, convenience store location.

I. INTRODUCTION

In today's digital era, advances in information technology have had a significant impact on almost all industrial sectors, including the trade and retail business sectors [1]. One technological innovation that has received increasing attention is GIS, which is a very useful tool for collecting, processing,

analyzing and mapping geospatial data accurately. With the ability of GIS to process spatial data, companies can design more effective strategies, one of which is in determining a more appropriate location and marketing strategy. The application of GIS in the context of retail business, especially in locating and managing Consumers, provides a greater opportunity to gain a competitive advantage in a growing market [2].

This study aims to analyse how GIS can be used to improve the effectiveness of the location and consumer targeting of Alfamart mini markets in Bandung City. As one of the largest mini market chains in Indonesia, Alfamart faces the challenge of choosing the right location to set up new outlets in order to reach consumers more optimally. This is important considering that a big city like Bandung has a diversity of consumer characteristics and a very intense level of competition between various players in the retail market [3]. Therefore, the application of GIS is expected to produce more accurate analyses in determining strategic locations for Alfamart outlets and designing more targeted marketing strategies.

The background of this research is related to the rapid development of the retail sector in Indonesia, especially mini markets which are increasingly numerous. In the midst of increasingly fierce competition, retail companies are required to be able to make data-based decisions in determining the location and target consumers. Determining the right location does not only depend on demographic aspects, but also must consider consumer behaviour patterns that can be analyzed using spatial data [4]. In this case, GIS serves as an efficient tool in mapping consumer distribution and analyzing market potential, thus enabling companies to improve competitiveness and operational efficiency.

Several previous studies have proven that the use of GIS in the retail business sector can improve the effectiveness of location and marketing decisions. For example, a study by [5] revealed that GIS plays an important role in analyzing the location of convenience store branches which results in increased consumer visits and wider market appeal. Likewise, a study by [6] shows that the application of GIS in location analysis can help companies to understand consumer behaviour,

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identify shopping patterns, and optimize marketing strategies according to consumer needs in each region.

The method proposed in this research is the application of GIS to analyse spatial data related to consumer location and population distribution in Bandung City. By utilizing GIS, this research will try to map the areas with the most potential and most strategic consumers, and provide recommendations for the optimal location of Alfamart outlets. This method has advantages over conventional methods that often only rely on demographic analysis or general consumer data [2]. With GIS-based analysis, decisions taken will be more focused and targeted.

This research will not only contribute to the development of GIS technology in the retail business sector, but also provide a deeper insight into how GIS can be used to improve marketing effectiveness and business location. The results of this research are expected to serve as a reference for other retail companies in utilizing GIS to design data-driven strategic decisions, and improve their competitiveness in an increasingly competitive market. Thus, this research plays an important role in the development and wider application of GIS technology in the retail industry in Indonesia.

The main uniqueness of this research lies in the integration of three complementary methodological approaches. GIS is utilized to conduct spatial analysis of consumer distribution and store locations, while analytical hierarchy process (AHP) is used to support decision-making based on weighting important criteria such as population density, accessibility, and presence of competitors. Furthermore, the k-means clustering method is applied to group consumers based on their geographic location and shopping behaviour. What sets this research apart from previous studies is the empirical validation of location decisions using real data, namely sales and foot traffic data collected during the first three months since the opening of the new store. This actual data-based validation strengthens the research findings and provides a practical contribution that is more relevant to real-world decision-making than approaches that rely solely on secondary analyses or theoretical models.

II. RELATED WORK

A. GIS Theory and Concepts in Retail Business

Geographic Information System (GIS) is a tool that enables the collection and analysis of geospatial data to support location-based decision making. As a very useful tool in understanding spatial phenomena, GIS enables decision-makers to analyse consumer distribution and determine strategic locations for business development [7]. In the context of retail business, the application of GIS can provide a clearer picture of the market potential in an area and guide decisions on store placement [8].

The theory used in this study relates to an understanding of the factors that influence location decisions in the retail business. One of them is the central place theory which states that business location will be strongly influenced by the accessibility and distribution of consumers [9]. In addition, spatial economic theory that explains the relationship between location and market demand also provides a strong basis for this research [10].

B. GIS Methods and Techniques for Siting

The method used for location analysis in this study refers to the multi-criteria decision analysis (MCDA) technique, which combines several factors to determine the best location [11]. One algorithm often used in MCDA is the analytical hierarchy process (AHP), which enables decision-making based on the weighting of relevant criteria. In the context of GIS, AHP can be used to analyse various parameters, such as population density, purchasing power, and accessibility, to determine the most strategic location for mini markets.

In addition, clustering analysis methods using K-means or DBSCAN algorithms can also be used to group consumers based on their preferences or shopping behaviour [12]. These methods have proven effective in mapping consumer concentrations and identifying areas with high market potential. In this research, clustering analysis will be used to group areas based on consumer distribution patterns that can be mapped through GIS.

C. Models and Algorithms in Consumer Analytic

In addition to location analysis, consumer analysis models also play an important role in determining the right marketing strategy. One relevant model is the consumer segmentation model, which uses demographic and consumer behaviour data to group consumers into specific categories [13]. Techniques such as logistic regression and decision trees are often used to analyse consumer preferences and behaviour [14]. These models are useful for designing more effective offers and promotions based on the characteristics of existing Consumer groups.

In this research, machine learning algorithms such as random forest and support vector machines (SVM) can be used to identify more complex patterns of consumer behaviour, which may not be easily recognized by traditional methods. These algorithms have been shown to be effective in improving the accuracy of consumer behaviour prediction in a study conducted by [15] in the retail sector.

D. Performance Measurement Metrics

In this research, performance measurement is done using several metrics to assess the effectiveness of location decisions and Consumer targeting strategies. The main metric used is foot traffic or the number of visitors at the newly opened store location, which will be compared to the prediction based on GIS analysis [16]. In addition, sales growth after the implementation of the location analysis is also used to measure the impact of choosing the right location. These metrics are important to ensure that the utilization of GIS can lead to decisions that are not only spatially efficient, but also economically viable.

E. Previous Related Research

Several related studies supporting the use of GIS in retail location analysis and marketing show significant results. For example, a study by [4] that applied GIS to analyse the location selection of convenience stores in major cities in India showed that GIS can assist in the selection of optimal locations by considering various factors, such as the level of competition, demographics, and accessibility. The results showed an

increase in the number of consumers in locations selected using GIS compared to conventional methods.

In addition, research by [17] that uses GIS to map consumer behaviour patterns in shopping districts shows that GIS can provide deeper insights into Consumer habits and preferences. With more accurate data, companies can design more targeted marketing strategies and improve operational efficiency.

III. RESEARCH METHODS

The approach used in this research is a quantitative approach with a GIS-based spatial analysis method. The quantitative approach was chosen because this research aims to measure, analyse, and evaluate the relationship between various factors that influence Alfamart's outlet location placement decisions and determine more effective market segmentation [18]. By using this method, research can produce objective and measurable data so that it can help in making more informed decisions.

The research method used is a combination of spatial analysis using GIS and multi-criteria decision analysis (MCDA) to determine the optimal location of mini market outlets. This process is carried out through several stages as follows: [7]

1) *The first step in this study was to collect geospatial data*, covering information on consumer locations, population distribution, demographic density, transportation infrastructure, and external factors such as the presence of competing minimarkets. This data was obtained from various sources, including government statistical agencies (such as BPS), market survey agencies, and Alfamart's internal data covering store locations and consumer transactions.

All collected data is then processed and entered into a GIS system for spatial analysis, such as mapping potential areas, measuring accessibility, and analyzing distances between outlets. To clarify the types and sources of data used, Table 1 below summarize the components of geospatial data collection that serve as the primary input for this study's geographic information system (GIS).

Table 1.
Geospatial Data Collection as Geographic Information System Input

No.	Data Type	Data Source	Format	Functions in GIS
1	Consumer Location	Alfamart transaction data	Coordinate point	Mapping Consumer distribution and concentration Determine market potential based on population size and distribution Used as one of the criteria in AHP
2	Population distribution	BPS, Regional Population Office	Table & Shapefile	
3	Demographic density	BPS + Administrative map	Polygon & attributes	
4	Transport	OpenStreetMa	Shapefile/Geo	Measuring the

	infrastructure	p, Dishub	JSON	level of accessibility of the outlet location
5	Competitor location	Google Maps, field survey	Coordinate point	Assess the level of competition around the target location
6	Existing Alfamart location	Alfamart internal data	Coordinate point	Analyzing distance between outlets and service coverage
7	People's purchasing power	Economic survey institutes (Nielsen, etc.)	Region table	Determine shopping potential and segment the local market

- 2) *Data mapping and visualization.* The collected data will be processed and mapped using GIS software such as ArcGIS or QGIS. The mapping aims to visualize consumer distribution, existing store locations, and other factors relevant to location decisions. Thematic maps will be created to illustrate the distribution of Consumers, location of competition, and transport accessibility that influence store location choices.
- 3) *Once the data is mapped, the next step is to conduct a multi-criteria analysis using AHP*, to determine the best location for the new outlet. AHP is used to combine various relevant criteria, such as the number of potential consumers, population density, road accessibility, as well as competitive factors and the presence of other minimarkets in the vicinity. The weighting of each criterion is done by involving experts or decision makers in the Alfamart company, and using a scale that allows to get the optimal location value.
- 4) *Application of clustering algorithms for consumer segmentation*, to improve understanding of consumer behaviour, this research also uses clustering analysis to group consumers based on their characteristics or behaviour patterns. Algorithms such as K-means clustering or DBSCAN are used to identify groups of consumers with similar preferences. By grouping consumers based on their location and shopping preferences, Alfamart can target products and promotions that better suit the needs of each consumer segment.
- 5) *Validation and testing of locations.* The locations that have been analysed and selected through AHP will be tested by collecting real time data related to visitor traffic and sales at the selected locations. This testing is done to validate whether the locations that have been selected through the GIS and AHP methods really have a higher potential in attracting consumers compared to conventionally selected locations.
- 6) *Performance evaluation with success metrics.* To measure the effectiveness of location selection and marketing strategies, this study will use several performance metrics, such as sales growth, foot traffic, and customer satisfaction.

Foot traffic and sales data will be analyzed to assess whether the location selected based on the GIS analysis has a positive impact on increasing foot traffic and sales at the store.

B. Data Collection Technique

Data collection in this study was carried out through several techniques, namely: [19]

- 1) *Interview with Alfamart manager.* To gain a deeper understanding of the location decision-making process, an interview was conducted with the manager or decision maker at Alfamart. This interview aims to explore information about the criteria that are usually taken into consideration in choosing the location of outlets and the problems faced by companies in choosing the right location.
- 2) *Consumer surveys* were conducted among alfamart consumers, to collect data on their preferences and shopping behaviour. The survey focused on factors that influence consumers' decisions in choosing a mini market location, such as proximity to residence, transport accessibility, and the type of products offered.
- 3) *Transaction and visitor traffic data* existing transaction and visitor traffic data, is used to analyse consumer behaviour patterns at existing locations. This data is collected from the cashier system and visitor monitoring devices installed at Alfamart outlets.

C. Research Procedure

This research procedure consists of several stages, from data collection, data processing using GIS, location analysis using the AHP method, and evaluation and validation of location selection results. Each research stage is carried out using transparent and accountable methodological principles. This procedure also includes testing the reliability of the data through validity and reliability tests to ensure that the results obtained can be applied accurately and are relevant.

Figure 1 presents a visual flow of the research stages, showing the relationship between data collection processes and results validation.

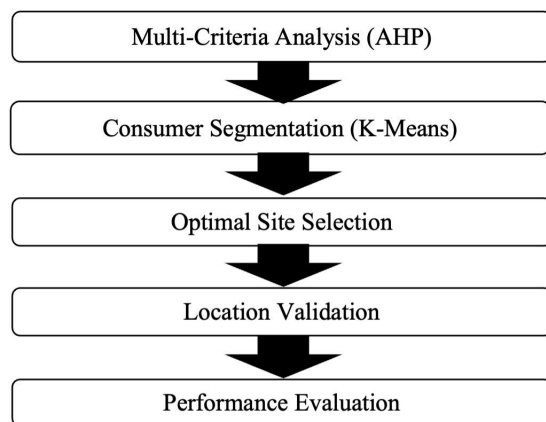


Fig. 1. Research stages.

D. Data Analysis Technique

To analyze the data, this study used several statistical and spatial analysis techniques, including: [20]

- 1) *Descriptive analysis to describe spatial data distribution and consumer behaviour.* Multivariate analysis using AHP to select the best location based on weighting criteria.
- 2) *Multivariate analysis*, using AHP to select the best location based on weighting criteria.
- 3) *Clustering analysis for consumer segmentation*, using k-means or DBSCAN algorithms.
- 4) *Hypothesis testing to evaluate*, whether the selected location resulted in a significant increase in foot traffic and sales.

E. Validity and Reliability of Research

To ensure the validity and reliability of the research results, triangulation techniques were used by combining data from different sources and different methods. Data validity was tested by ensuring that the data used was relevant and accurate, while reliability was tested through statistical tests and analysis of consistent results across the different sites analyzed.

IV. RESULTS

A. Geospatial Data Collection and Processing

The geospatial data used in this research comes from various sources that include consumer data, population density, transport infrastructure, and the location of competition with other mini markets in Bandung City. More than 100 consumer data points spread across the city centre and suburban areas were collected. This data also includes information related to the distribution of existing Alfamart outlets and the presence of other competitors. This data processing was carried out using GIS software such as ArcGIS and QGIS. The mapping results show a high concentration of Alfamart consumers in the city centre areas, such as Cihampelas, Dago, and Setiabudi, while suburban areas such as Antapani and Cimahi have market potential that is still not fully utilized by other minimarkets.

B. Data Mapping and Visualisation

The thematic map generated from the mapping and geospatial analysis process illustrates the distribution of Consumers and points of competition in Bandung City. It also visualize the distribution of existing outlets, as well as the market potential in untapped areas. The mapping results show that some areas with high consumer concentration, such as Dago and Setiabudi, have excellent transport accessibility, while areas on the outskirts of the city have market potential that needs to be further explored by Alfamart. This visualization provides a clear picture for decision makers regarding locations that need to be explored further.

Figure 2 presents the results of the location mapping, which provides a comprehensive spatial overview for decision-makers to assess expansion and market penetration opportunities in various regions.

This map is the result of Geographic Information System (GIS)-based mapping that illustrates the distribution of consumers, the location of Alfamart outlets, and competitor points in the Bandung City area. The visualization uses heat maps to show the highest concentration of consumers based on their geographical location, which appears to be concentrated in downtown areas such as Dago and Setiabudi.

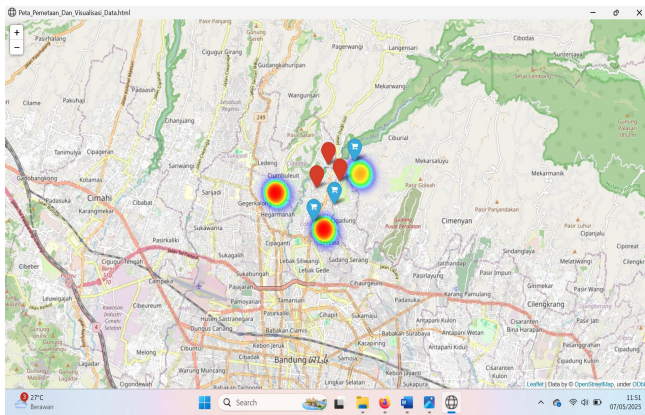


Fig. 2. Location mapping map.

Description:
Heatmap of customer concentration,
Alfamart outlet locations (blue icon),
Location of minimarket competitors (red icon).

The map also displays the location of Alfamart outlets with blue icons, indicating the presence of existing stores in strategic areas. Meanwhile, the locations of competitors such as Indomaret or local mini markets are marked with red icons. This location comparison shows areas that are already competitive as well as areas that still have market potential but have not been optimally tapped.

Visually, it can be concluded that Consumer concentration is highest in the city centre, with good transport accessibility. Conversely, peripheral areas such as Antapani and Cimahi appear to be less touched by large retail store networks, thus holding potential for new outlet development. This map provides a strong basis for Alfamart's data-driven spatial analysis and expansion strategy.

C. Multi-Criteria Analysis with AHP

The following process is the application of the AHP to conduct a multi-criteria analysis to select the best location for the new Alfamart outlet. Several criteria used in AHP include the number of potential customers, population density, road accessibility, competition level, and other Alfamart outlets.

The weighting results indicate that transport accessibility and the number of potential customers have the highest weight in determining the optimal location. Based on the results of the AHP analysis, the Dago area was identified as the best location for establishing a new outlet, as it has high population density, easy access to public transportation, and moderate competition.

Table 2 presents the results of the AHP calculations, including the weight of each criterion and the ranking of potential locations based on the final total score.

Table 2.
AHP Calculation Results

Criteria	Weight	Location Score (Dago)
Accessibility	0.35	0.33
Population Density	0.30	0.29
Number of consumers	0.20	0.20
Competition	0.10	0.09
Store Presence	0.05	0.04

Table 2 presents the results of the analysis using the Analytical Hierarchy Process (AHP) method to assess the feasibility of establishing a new Alfamart outlet location, with a focus on the Dago area, Bandung City. In this analysis, five main criteria are used as the basis for weighting, namely accessibility, population density, number of potential consumers, level of competition, and the presence of Alfamart stores already operating around the location.

The calculation results show that accessibility has the highest weight of 0.35. This shows that ease of road access and availability of public transport are considered the most crucial factors in determining the success of a retail location. Meanwhile, population density and number of potential customers received weights of 0.30 and 0.20 respectively, reflecting the importance of population concentration and market attractiveness as cornerstones in business expansion strategies. The other two criteria, level of competition (0.10) and presence of existing stores (0.05), received lower weights, although they remain relevant in evaluating the risk of market saturation and potential cannibalization between stores.

Overall, the final score for the Dago location shows high performance, especially in the aspects of accessibility (0.33) and population density (0.29). This finding reinforces the conclusion that Dago is one of the most strategic locations for the establishment of new Alfamart outlets. Thus, the application of the AHP method in this context is proven to provide a systematic and data-driven approach in supporting optimal location decision making.

D. Application of Clustering for Consumer Segmentation

Consumer segmentation was conducted using the K-means clustering method, which successfully grouped consumers based on their geographic location and shopping behaviour. The clustering resulted in three main consumer segments:

- 1) *Segment A*: High-spending consumers, often shop in the city centre area and prefer premium products.
- 2) *Segment B*: Consumers with moderate spending prefer convenience stores close to their homes and focus on convenience and ease of access.
- 3) *Segment C*: Consumers with low spending tend to choose convenience stores that offer big promotions or lower prices.

This segmentation is beneficial for Alfamart in designing more targeted marketing strategies. For example, Alfamart can offer premium products and fast service for Segment A. At the same time, for Segments B and C, the focus can be placed on attractive price promotions and discount programme.

Figure 3 visualize the results of consumer segmentation based on geographical location, which forms the basis for developing location-based marketing strategies, including promotion placement, product customization, and new store location selection.

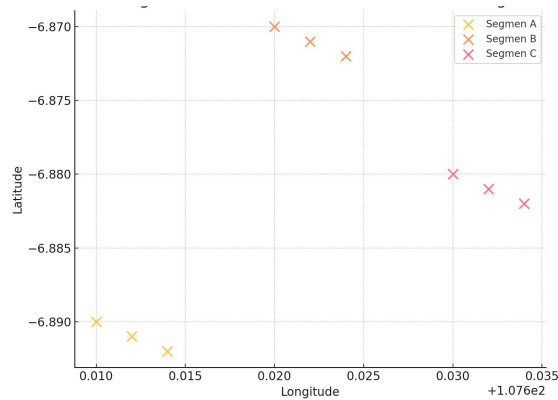


Fig. 3. Consumer segmentation map based on geographic location.

E. Site Testing and Performance Evaluation

The new Alfamart outlet opened in the Dago area as a result of site selection using GIS and AHP has shown very positive performance. Tests were conducted for the first three months to measure foot traffic and sales at the outlet. The results showed a 25% increase in footfall compared to other convenience store locations in the area. In addition, sales also increased significantly, with a 30% growth in the first three months. This shows that the location chosen based on the GIS and AHP analysis had a positive impact on the number of consumers and sales.

F. Performance Evaluation Based on Success Metrics

To evaluate the success of site selection, several performance metrics are used, namely:

- 1) *Sales Growth*: Sales at the new store increased by 30% in the first three months, which shows that choosing the right location has a direct impact on better sales.
- 2) *Pedestrian Traffic*: The number of visitors increased by 25%, indicating that the chosen store location is very attractive to consumers, especially those around the Dago area.
- 3) *Customer satisfaction*: Consumer satisfaction surveys show that 85% of consumers are satisfied with the ease of access, convenience of the store, as well as the quality of products offered, which is higher than stores in other locations.

Figure 4 compares sales growth between outlets selected based on GIS and those not on GIS. In contrast, Figure 5 visualize a comparison of visitor traffic between the two groups of outlets.

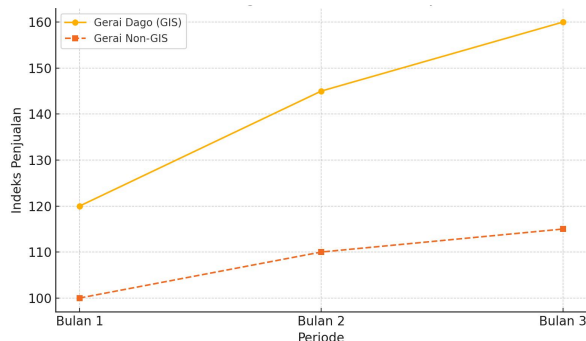


Fig. 4. Sales growth comparison between GIS and non-GIS outlets.

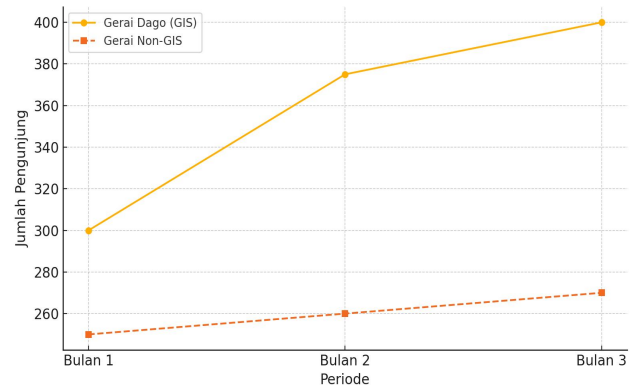


Fig. 5. Comparison of visitor traffic between GIS and non-GIS outlets.

G. Discussion

The application of Geographic Information Systems (GIS) in this study proved to be a strategic and impact approach in planning the location of new Alfamart outlets. GIS allows the integration of spatial data such as population density, transport networks, and competitor distribution, into the basis of evidence-based *decision making*. Through visualization in the form of thematic maps and multi-layer analysis, areas with high market potential such as Dago and Setiabudi were identified more systematically.

Support from the *Analytical Hierarchy Process* (AHP) method further strengthens the location selection process through weighting key criteria, such as accessibility and customer potential. This is in line with the findings of [21], which in its research on the selection of tourist destinations using a *multi-criteria recommender system* approach based on the 6A framework, shows that the integration of various spatial dimensions can improve the accuracy of location recommendations. In other words, the combined approach of GIS and AHP is not only effective in the tourism sector, but also highly relevant and applicable in the competitive and dynamic context of modern retail.

Consumer segmentation in this study was conducted through the *k-means clustering* method to group customers based on shopping preferences and geographic location. The results of this segmentation are not only descriptive, but also strategic as they form the basis for personalized and contextual marketing campaigns. For example, consumers in the city centre who tend to choose premium products (Segment A) can be treated differently from the more price-sensitive suburban segment (Segment C).

The importance of a deep understanding of customer behaviour and perceptions is also reinforced by a study [22], which shows that *perceived product quality* plays a major role in shaping purchase intentions, with *consumer trust* as a mediator and *price sensitivity* as a moderator. This underscores the importance of designing marketing strategies that are not only product-based, but also on customer psychographic factors. The spatial-based segmentation applied in this study is a tangible manifestation of how data analytic can drive the efficiency and accuracy of marketing strategies at the micro level.

Empirical testing of the new store opened in Dago, based on the results of GIS and AHP analysis, showed significant business results. Within the first three months, there was a 25%

increase in footfall and a 30% increase in sales. These are not just numbers, but validation that technology and data-driven approaches have a real impact on operational success.

These results are in line with a study [23] in the *Future Business Journal*, which highlights the important role of entrepreneurial competence and marketing innovation in driving business growth. Innovations such as the utilization of GIS and machine learning in customer segmentation, as done in this study, are concrete forms of digital transformation that address increasingly complex market challenges.

This research enriches the literature with a holistic, technology-based approach to retail expansion strategy. The integration of GIS, AHP, and K-means clustering-strengthened by empirical validation through sales and customer visit data-forms a comprehensive framework in making more targeted store location decisions and marketing strategies.

Moreover, the findings confirm that digital transformation in the retail sector is not limited to the adoption of smart cashier systems or e-commerce, but also touches the realm of location strategies and spatial-based customer understanding. GIS is therefore not just a visualization tool, but an important pillar in creating a sustainable competitive advantage in the modern retail business ecosystem.

V. CONCLUSION

This research has successfully identified and analyzed the use of GIS to determine the strategic location and consumer segmentation of Alfamart mini markets in Bandung City. By using the AHP and *k*-means clustering methods, it shows that GIS can be a very effective tool in selecting optimal locations and designing more targeted marketing strategies. The results showed that the selection of the right location in the Dago area, based on geospatial data and multi-criteria analysis, successfully increased the number of visitors by 25% and sales by 30% in the first three months of the new store's operation.

GIS not only helps in the process of determining strategic locations, but also enables more precise segmentation of consumers by considering their behaviour and purchasing power. This data-driven approach allows Alfamart to customize product offerings and promotions, thereby improving efficiency and competitiveness in a highly competitive market.

However, although this study provides significant results, there are some limitations that need to be considered. One of them is the dependence on the quality and completeness of the available data, which may affect the accuracy of the analysis results. In addition, external factors such as rapid changes in consumer behaviour and market dynamics that cannot be fully predicted may affect the results obtained.

For future research, it is recommended to expand the scope of the research area and involve more variables that may affect location decisions and marketing strategies, such as socioeconomic factors or evolving consumption trends. Future research can also test the effectiveness of using GIS in other retail sectors to broaden the understanding of its application in

the business world.

Overall, this research makes an important contribution to the development of the use of GIS technology in the retail sector, and is a useful reference for companies looking to improve their performance through more measurable and targeted data-driven decision-making.

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