Journal of Infrastructure, Policy and Development 2024, 8(10), 7627.
https://doi.org/10.24294/jipd.v8i10.7627

Article

Selection of potential location for technopark based on pineapple SMEs using AHP-GIS techniques in Kampar Regency

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CITATION

Diniaty D, Fauzi AM, Sunarti TC, Raharja S. (2024). Selection of potential location for technopark based on pineapple SMEs using AHP-GIS techniques in Kampar Regency. Journal of Infrastructure, Policy and Development. 8(10): 7627.
https://doi.org/10.24294/jipd.v8i10.7627

ARTICLE INFO

Received: 29 June 2024
Accepted: 29 July 2024
Available online: 24 September 2024

Abstract: Kampar Regency, as the largest pineapple producer in Riau Province, has yet to provide significant added value for the surrounding SMEs. The limitations in technology and innovation, infrastructure support, and market access have prevented this potential from being optimally utilized. A Technopark can provide the necessary facilities and infrastructure to enhance production efficiency, innovation, and product quality, thus driving local economic growth. The objective of this study is to identify and determine potential locations for the development of a pineapple-based Technopark in Kampar Regency. This study is crucial as a fundamental consideration in selecting the technopark location and assessing the effectiveness and success of the technopark area. The method used in this study is AHP-GIS to analyze relevant parameters in the site selection process for the technopark area. Parameters considered in this study include slope, land use, availability of raw materials, accessibility of roads, access to water resources, proximity to universities, market access, population density, and landfill. The analysis results indicate that the percentage of land highly suitable for the technopark location is 0.78%, covering an area of 8943 hectares. Based on the analysis, it is recommended that potential locations for the development of a pineapple SMEs-based technopark in Kampar Regency are dispersed in Tambang District, encompassing three villages: Rimbo Panjang, Kualu Nenas and Tarai Bangun. The findings of this study align with the spatial planning of Kampar Regency.

Keywords: site selection; SMEs; technopark; Analytical Hierarchy Process (AHP); Geographic Information System (GIS)

1. Introduction

Industrial growth can encourage the development of a region because the gap is primarily caused by industrial diversity (Chakraborty, 2024). Local policies often prioritize innovation-driven employment and industrial growth (Davis and Hashimoto, 2022). Strategies to promote regional economic growth based on innovation and enhanced industrial competitiveness include the development of technoparks (Henriques et al., 2018; Nosonov, 2019). A technopark is the ideal model for integrating science and production to accelerating the development, implementation, and utilization of innovations (Zianko, 2023; Zolotov, 2023). Technopark areas currently functions as instruments designed for development, fostering innovation, creating jobs, and making significant contributions to social welfare (Adamaitis, 2021; Cabral, 2024; Durak, 2022). Technopark can help the growth of new businesses and encourage economic development through innovation and technology transfer

(Mansour et al., 2018; Segarra-blasco and Teruel, 2018).

Kampar Regency is located in Riau Province covering an area of 11,289.28 km^2 (BPS Riau, 2020). Kampar Regency directly borders West Sumatra Province and serves as a main route connecting Riau Province with West Sumatra Province. Additionally, Kampar Regency is close to Pekanbaru city, the capital of Riau Province, which serves as the center of government and economy (Diniaty et al., 2024). Kampar Regency holds significant potential for the development of SMEs based on leading commodities, as evidenced by the presence 29.136 food sector SMEs (BPS Riau, 2022). One of the leading commodities in Kampar Regency is pineapple (Diniaty et al., 2024). Pineapples have the potential to drive the development of SMEs in Kampar Regency due to the sufficient supply that can meet the needs of these enterprises (Diniaty et al., 2024). However, this potential has not been fully optimized, as many SMEs face challenges such as limited access to technology and resources (Arranz et al., 2024; Basit et al., 2024). The development of pineapple-based SMEs requires adequate facilities and infrastructure. A technopark can provide the necessary facilities and infrastructure to support the growth of SMEs by enabling the adoption of the latest technologies to enhance production efficiency, product quality, innovation, thereby fostering economic growth (Cheng et al., 2014; Zolotov, 2023). A technopark can facilitate collaboration among various stakeholders, research institutions and universities, and the technology and industry sectors (Cadorin et al., 2019; Maria et al., 2019).

Determining the location of a technopark is the main challenge in realizing the effective and sustainable development of a pineapple-based SMEs. This is due to the many factors that must be considered to ensure the effectiveness and sustainability of developing a pineapple SMEs-based technopark. Accessibility, infrastructure, government support, funding, and resource availability are some of the requirements that must be met for technopark to operate in the long term. Adequate accessibility and infrastructure can facilitate the delivery of raw materials to the technopark and the distribution of processed products from the pineapple SMEs within the technopark environment. Transportation and logistics costs can increase if the technopark location is difficult to reach (Shahrabi-farahani et al., 2024). Location selection is one of the fundamental considerations that are very important in establishing and developing any type of business (Rikalovic et al., 2014). Choosing the wrong location will not only increase production costs but can also cause environmental problems, thus hindering industrial expansion (Shahrabi-farahani et al., 2024).

The determination of potential locations for the development of a technopark area plays a crucial role and will impact various stakeholders in assessing the effectiveness and success of the area (Chumaidiyah et al., 2021). Selecting a potential location for the area requires a significant amount of spatial information (Sahnoun et al., 2012). Geographic Information Systems (GIS) can assist in conducting spatial analysis and simplify the presentation of results in maps form due to the diverse criteria considered in determining the location of an area (Engineering et al., 2016). There are several criteria that need to be considered to assess the suitability of a location for developing a pineapple SMEs-based technopark area. The Analytic Hierarchy Process (AHP) can be used for weighting and scoring the established parameters or criteria (Ramya and Devadas, 2019). The Multiple Criteria Decision Making (MCDM) model, specifically the AHP method, is used in this research because AHP can help make better decisions. AHP enables a comprehensive evaluation of various factors. It integrates criteria such as land slope, land use, and road access by assigning appropriate weights to each factor, thus reducing subjectivity and enhancing objectivity in decision-making (Aihie, 2023). AHP has a clear and systematic structure, enabling it to address complex problem effectively. AHP can help optimize resource use, ensure the selected location supports the growth of pineapple-based SMEs, and minimize the risk of errors.

Many studies have been conducted on location determination but research on the location selection for technopark development is still limited. This study focuses on the determination of technopark locations aimed at developing pineapple-based SMEs, thereby enhancing the competitiveness of the industry and local economic growth in Kampar Regency. This constitutes the strategic contribution of this study. This study will provide in-depth insights into the factors influencing the successful development of a pineapple SMEs-based technopark, including accessibility, infrastructure availability, funding, regulation and policies, proximity to raw materials, and other factors relevant to the area’s conditions. A potential technopark location allows for more efficient resources management, increased productivity for pineapple SMEs, and easy market access for product distribution. This result of this study will not only support the development and economic growth in Kampar Regency but can also serve as a reference for other regions with similar potential. A potential location is a key component in the development of a pineapple SMEs-based technopark. Based on these conditions, the objective of this study is to identify and determine the most potential area for the development of a pineapple SMEs-based technopark in Kampar Regency.

2. Literature review

Small and medium industries (SMEs) play a significant role in the growth and development of regional economic (Chaichana et al., 2024). Economic growth can be influenced by factors such as technology, capital, and resource management. SMEs contribute to technology creation and innovation, develop new products, and significantly impact job creation (Al-Karkhi, 2024; Wang, 2016; Zhou et al., 2023). SMEs also contribute to production, local exports, and the enhancement of Gross Domestic Product (GDP) (Su et al., 2020; Varshney et al., 2024). SMEs are adaptable to the ever-changing market dynamics can respond quickly to market demands. SMEs contribute to market transparency and economic competitiveness (Gao, 2024). SMEs are considered drivers force behind economic growth and technological advancement (Singh et al., 2022). However, SMEs face numerous challenges and obstacles, including inadequate infrastructure, lack of capital, and difficulty in obtaining raw materials (Varshney et al., 2024; Wang, 2016). SMEs must adopt digital technology in their operations and production processes to achieve succeed (Soluk et al., 2023). Research and development (R&D) can also drive SMEs to become more innovative and competitive; however, SMEs often have limited funds to conduct such R&D (Zhou et al., 2023).

A technopark can be a viable solution to address the challenges and issues faced by SMEs. The presence of a technopark can offer various positive impacts for the industries operating within it. A technopark can drive industries to create innovation, expand market distribution networks, and facilitate technology and knowledge transfer among industries and relevant institutions. Financial support is also provided for industrial development, as technoparks offer facilities to help industries overcome capital constraints and accelerate industrial growth (Diniaty et al., 2024). The success of a technopark in industrial development can be determined by selecting the appropriate location. An ideal location can enhance accessibility, minimize costs, and offer significant potential for collaboration among industry, academia, government, and the surrounding community. Location selection is a critical factor in determining the success or failure of a venture. It is a complex decision involving various considerations, including economic factors, infrastructure, logistics, environmental aspects, and even political factors (Rao et al., 2015). Location determination aims to find the most suitable site based on established selection criteria (Rikalovic et al., 2014). Location is a key factor in the success of a business. An ideal location can facilitate distribution, reduce operational costs, and shorten delivery distance. However, a location's ability to compete effectively can be hindered by cultural differences, a lack of skilled labor, limited facilities and space, and inadequate infrastructure (Muerza et al., 2024).

The theory of location selection has been extensively discussed in various literatures. The distance between business customer, geographical proximity to raw materials sources, accessibility, and convenience are influential factors in location selection (Han et al., 2024). Rezaeisabzevar et al. (2020) identify several factors commonly considered in the selection of landfill sites, including groundwater depth, elevation, soil permeability, soil stability, flood vulnerability, land use, settlements patterns, lithology, and stratigraphy, as well as culture and environmental protection aspects. Liu et al. (2023) examined the selection of locations for agricultural machinery warehouses. The study results found that the main factors affecting location determination include carbon emissions, fuel consumption, operational distance, total cost, and timeliness. By considering these factors, companies can enhance their delivery systems.

Research on determining potential locations has been extensively conducted using various approaches. Multi-Criteria Decision-Making (MCDM) approaches are among the most commonly used methods for location determination. Sahoo et al. (2024) investigated the optimal selection of university locations using the Fuzzy MCDM (FMCDM) approach. The criteria employed in selecting an optimal university location include accessibility and connectivity, demographics and population density, infrastructure and facilities, economic opportunities, cost of living, cultural and recreational opportunities, safety and security, local facilities and services, environmental factors, zoning and regulatory considerations, support and collaboration, future growth and development.

Nong (2021) examined the selection of distribution center locations using the Analytic Network Process (ANP) and Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) methods. The weight of the selection criteria was determined using the ANP method, while the TOPSIS method was used to rank the alternatives. The criteria considered for the selection of distribution center locations included distance to suppliers, distance to markets, distance to airports, distance to highways, distance to ports, distance to railways, land cost, installation cost, logistics cost, labor cost, storage convenience, forwarding service, evaluated area size, transportation service diversity, and availability of human resources. The study found that the potential location is in Long Khanh, as it ranked highest in the preference order.

The Analytic Hierarchy Process (AHP) is part of multi-criteria decision-making techniques designed to support complex decision-making. AHP is also a commonly used method in determining location. The AHP method can be employed for pairwise assessment of criteria affecting potential locations to determine weights (Sahoo et al., 2024). This study utilizes AHP combined with Geographic Information Systems (GIS) to perform spatial analysis for identifying suitable locations. GIS is a tool capable of rapidly and effectively storing, processing, analyzing, and visualizing spatial data (Elghazouly et al., 2024; Villacreses et al., 2022). GIS is designed to model physical features on the Earth's surface for management, analysis, and visualization of spatial data (Ashkezari et al., 2018). The accuracy of spatial modeling can be enhanced by integrating AHP with GIS, given the spatial nature of various criteria that can impact potential site selection strategies (Elghazouly et al., 2024). The AHP method combines qualitative and quantitative analysis to address complex problems with multiple objectives (Guo and Liu, 2023). The combination of AHP and GIS integrates spatial information and criteria weights to identify potential locations through overlay analysis (Aykut, 2021; Villacreses et al., 2022).

Harishnaika et al. (2023) examined the determining of potential sites for ecotourism development using AHP and GIS techniques in Uttara Kannada District, India. This study used nine criteria: visibility, land use/cover, reservation/protection, species diversity, elevation, slope, proximity to cultural sites, distance from highways, and settlement size to evaluate ecotourism locations. The results indicated that suitable land for ecotourism development was found in forest areas located in Joida and Karwar, covering an area of 362.7 km^2. Ramya and Devadas (2019) identified suitable location for agricultural industry development using GIS-MCDM integration. The parameters included topography, soil characteristics, connectivity, settlement, natural resources, availability of raw materials, labor, barren land, and climate. The results showed that, in general, 0.06% (2.54 km^2) of the study area was categorized as highly suitable for industrial development.

This study will examine the determination of the sites for technopark area, which focuses on the growth of pineapple SMEs. Research on the location determination of technopark areas remains limited. A technopark is a zone designed for knowledge and technology transfer and fostering innovation to enhance industrial competitiveness according to its potential (Diniaty et al., 2024). Key success factors for a technopark include proximity to universities (Faria et al., 2019), adequate accessibility and infrastructure, and the availability of energy and capital, making location a critical element for the success of a technopark (Chumaidiyah et al., 2021). This study focuses on determining the location for a technopark aimed at developing SMEs based on pineapples. Integration of spatial analysis (GIS) with Multi-Criteria Decision-Making (MCDM) analysis (AHP) is used to identify the most suitable location for the development of a pineapple SMEs -based technopark.

In this study, AHP is used for weighting each parameter in the process of determining the location of a technopark, which will then be followed by an overlay analysis. Nine parameters are used in this study to determine the suitability of land for a technopark based on leading commodities These parameters include slope, land use, availability of raw materials, affordability road accessibility, access to water resources, market access, university access, population density, and landfill. for determining the technopark location for small and medium-sized enterprise (SME) development in this study is based on the Ministry of Industry Regulation No. 30 of 2020 on Technical Criteria for Development Areas and several relevant literature sources, adjusted to the geographical conditions and specific needs of the technopark area.

3. Materials and methods

3.1. Study area

This study is conducted in Kampar Regency, Riau Province, which ranks the fifth among the largest pineapple-producing region in Indonesia. Riau Province is one of the more developed provinces in Indonesia, serving as an international trade hub (Mirza et al., 2017). The educational landscape in Riau Province has also advanced, with several universities and higher education institutions established, including both public and private universities. In 2018, the number of universities and higher education institutions in Riau Province reached 79 (BPS Riau, 2020). Kampar Regency is one of the largest regencies in Riau Province, Indonesia. Geographically, Kampar Regency was located at 1°00′40″ North Latitude to 0°27′00″ South Latitude and 100°28′30″ to 101°14′30″ East Longitude. The territory covers an area of 11,289.28 km^2 with a population of 860,379 people (BPS, 2024).

The geographical position of Kampar Regency is very strategic, as it borders West Sumatra Province and lies on the main route between Pekanbaru City and West Sumatra Province. The tropical climate in Kampar Regency is influenced by two seasons: the rainy and dry seasons. Such climatic conditions are very suitable for the developing of various agricultural commodities, livestock, fisheries, and several types of plantation crops. The soil conditions are relatively fertile, with the predominant soil types being andosol, gleihumus, alluvial, gray hydromorphic, podzolic red-yellow, lithosol, and regosol. The andosol type is widely distributed in swampy lowlands and is associated with humus. The administrative map of Kampar Regency can be seen in **Figure 1**.

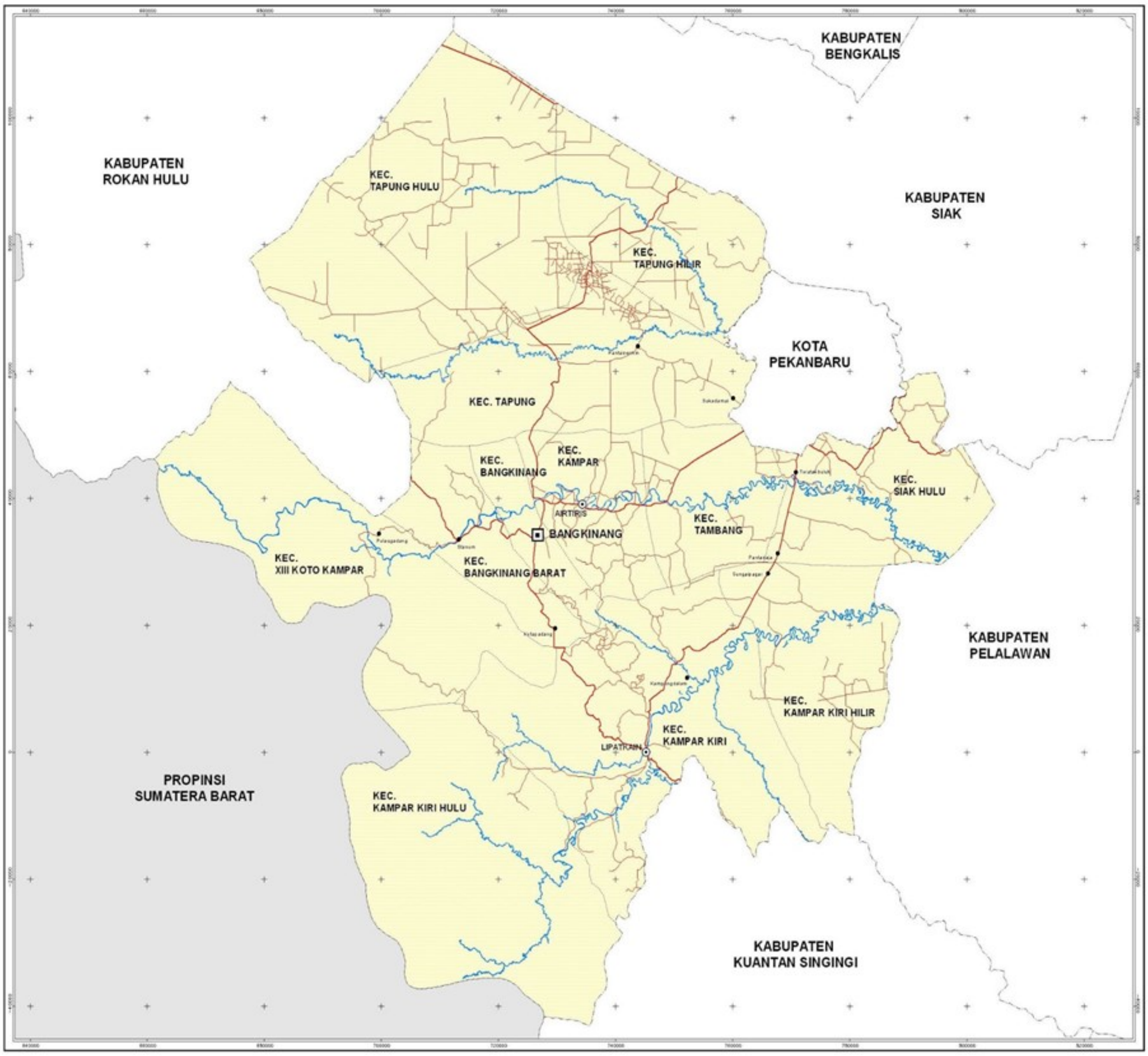

Figure 1. Administrative map of Kampar Regency, Riau Province.

Source: Regional development planning agency, Kampar Regency.

3.2. Data collection

This study employs a quantitative research methodology. Data collection was carried out from June 2022 to April 2023 to obtain both primary and secondary data. Primary data was collected through field observations, a series of in-depth interviews, and consultations with experts. Field observations were conducted to identify potential locations for the development of the technopark by performing preliminary surveys directly at the research site. These preliminary surveys were necessary to gain an overview of the study area and its current existing conditions. In-depth interviews were conducted with key actors to gather initial information related to the development of the technopark area. Experts were consulted to complete the AHP questionnaires, given their extensive knowledge and expertise in location selection for technoparks. Snowball sampling was employed to identify sources and experts. Details of the number of sources and experts are provided in **Table 1**.

Table 1. Respondents of in-depth interviews.

Actors	Number of interviewees
Department of Agriculture, Food Crops and Horticulture, Kampar Regency	1 respondent
Regional Development Planning Agency, Kampar Regency	2 respondents
Department of Public Works and Spatial Planning, Kampar Regency	1 respondent
Regional Development Planning Agency, Pelalawan Regency	1 respondent
Department of Industry, Trade, Cooperatives and SMEs, Riau Province	1 respondent
Regional Development Planning, Research, Development and Agency, Riau Province	2 respondents
Academics	3 respondents
SMEs	2 respondents
Pineapple Farmers	2 respondents

A series of in-depth interviews were conducted using an open-ended questionnaires with questions related to the development of a technopark based on pineapple SMEs, including (1) the availability of land for the development of technoparks, (2) the potential within Kampar Regency for technopark development, (3) the availability of infrastructure and facilities relevant to the development of technoparks, (4) the potential social impacts of the technoparks development, and (5) policies and regulations concerning technoparks development in Kampar Regency. Expert interviews for filling out the AHP questionnaires were conducted with seven expert in the fields of planning, geography (spatial analysis), and technology management.

Secondary data were obtained through a literature review to gather information related to the determination of a technopark location based on pineapple SMEs, including both spatial and non-spatial data. The Spatial data consists of the administrative map of Kampar Regency, slope maps, raw material availability maps, road network maps, river network maps, university and market access, settlement maps, and landfill maps. These data were obtained from the Geospatial Information Agency and the Regional Development Planning Agency, Kampar Regency. Non-spatial data were obtained by determining the location assessment criteria through a literature review.

3.3. Parameter

The parameters used in this study refer to the Regulation of the Minister of Industry Number 30 of 2020 concerning Technical Criteria for Designated Areas and relevant literature, adjusted to the geographical conditions and specific needs of the technopark area. The details of the criteria parameters are shown in **Table 2**.

Table 2. Parameters and descriptions.

Parameters	Descriptions	Ref.
Slope	The relatively flat slope can maximize land use, facilitate construction, and save costs	Ramya and Devadas (2019); Harishnaika et al. (2023); Xue et al. (2023); Chumaidiyah et al. (2021)
Land use	Land use is essential in determining land's strategic and functional location to ensure proper placement without damaging existing land use patterns.	Rezaeisabzevar et al. (2020); Xue et al. (2023); Chumaidiyah et al. (2021)
Availability of raw materials	Proximity to raw material sources is essential to guarantee availability and shorten delivery times.	Harishnaika et al. (2023); Nong (2021)
Road accessibility	Affordability of road access to facilitate and accelerate the distribution of raw materials and products to various places	Nong (2021); Harishnaika et al. (2023); Chumaidiyah et al. (2021)
Access to water resources	Ease of access to water resources has an essential role in the procurement of water that will be used for the production process	Ramya and Devadas (2019); Chumaidiyah et al. (2021)
Access to universities	University access has an essential role in technology transfer, and it is a hub for research and innovation collaboration between academia and industry.	Chumaidiyah et al. (2021)
Market access	Ease of market access an essential role in distributing finished products to save time and transportation costs	Nong (2021)
Population density	The distance between population density and the location of the technopark an essential role in ensuring the community's quality of life and ease of access for the surrounding community involved in the development of the technopark	Rezaeisabzevar et al. (2020); Sahoo et al. (2024); Harishnaika et al. (2023); Ramya and Devadas (2019)
Landfill	The distance from the landfill to the technopark location ensures a healthy and clean environment	William et al. (2019)

3.4. Parameter weighting with the AHP method

The initial stage in the parameter weighting process involves developing a pairwise comparison questionnaire. This questionnaire is based on the nine parameters previously established. The pairwise comparison questionnaire is then distributed to seven experts to obtain parameter weights using the AHP method. These seven experts in this study have expertise in planning, spatial analysis, innovation, and technology management. The results of the expert questionnaire will be processed using Super Decisions software version 3.2 to determine the weight of each parameter.

3.5. Parameter scoring

Scoring is an advanced stage to analyze and determine potential locations for the development of a technopark focus on pineapple SMEs. The scoring is calculated based on the values obtained from the parameter weighting results. Parameter map classification is necessary to ensure data clarity and consistency. Before processing data using the ArcGIS application, it is necessary to classify the parameter map through the standardization process and the distribution of parameter weights.

3.6. Overlay

The overlay process is carried out by combining multiple layers of spatial data used as inputs. The combination of these layers forms a new layer that includes the combined attributes from each input layer. The next step involves adding all the scores of each attribute in the new layer to determine the potential land areas.

3.7. Verification

Verification is conducted by validating the data through field observations. The overlay results are compared with the actual conditions on the ground. Reference data, such as the Kampar Regency Spatial Plan (RTRW) Map, is also used to compare the suitability and accuracy of the overlay results.

4. Results and discussion

4.1. AHP weighting results

The weighting of parameters in this study was carried out using the AHP method. Weighting was performed on nine parameters by evaluating the pairwise comparison matrix for each parameter. The consistency of the pairwise comparison matrix results is measured using the consistency ratio (CR). CR < 0.1 indicates a satisfactory level of consistency in the weights derived from the pairwise comparison matrix (Vidya et al., 2024). Based on the pairwise comparison matrix results processed using Super Decisions software version 3.2, a CR value of 0.08972 was obtained, indicating consistent weight values. The weighting results for each parameter are shown in **Table 3** and **Figure 2**.

Table 3. Parameters weighting results.

Parameter	Weight
Slope	0.32352
Land use	0.27519
Availability of raw materials	0.19201
Road accessibility	0.07965
Access to water resources	0.03248
Access to universities	0.03036
Market access	0.02587
Population density	0.02332
Landfill	0.01760
∑	**1**

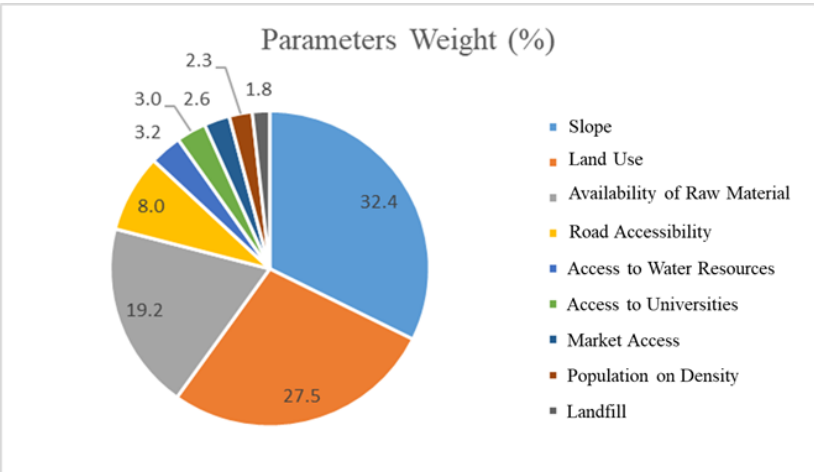

Figure 2. Parameter weighting diagram.

Figure 2 shows the percentage of weighting results for each parameter. Slope is the top priority in determining the location of the technopark area based on pineapple SMEs, with the highest weight of 32.4%. A relatively flat slope can maximize land use, facilitate construction, and reduce construction costs. The second-highest weighted parameter is land use, with a value of 27.5%. Land use ensures that the location placement does not disrupt existing land use patterns. The third influential parameter for determining the technopark location is the availability of raw materials, with a weight of 19.2%. Proximity to raw material sources ensures the availability of raw materials and shortens delivery times. The fourth parameter is road access, with a weight of 8%. Road accessibility facilitates and speeds up the distribution of raw materials and products to various places. Water resources access and university access have almost equal weights, at 3.2% and 3.0%, respectively. Market access and population density each have weights of 2.6% and 2.3%, respectively, while the landfill is the lowest-weighted parameter, with a value of 1.8%.

4.2. Parameter analysis

The parameters used in this study consist of nine parameters influencing the determination of the technopark area location based on pineapple SMEs. Each parameter is classified based on sub-criteria or class according to the Minister of Industry Regulation Number 30 of 2020 on Technical Criteria for Area Designation and relevant literature studies. The parameter weight values serve as the basis for scoring calculations for each parameter class classification. The recapitulation of scoring calculation results for each parameter class is shown in **Table 4**.

Table 4. Recapitulation of scoring calculation results in each parameter class.

Parameter	Weight	Sub-criteria	Suitability	Scoring	Area (Ha)	%
Slope	12.9	0%–3%	Most suitable	51.8	435,698	38
	9.7	3%–8%	Suitable	29.1	241,950	21
	6.5	8%–15%	Moderately suitable	12.9	149,680	13
	3.2	15%–30%	Marginally suitable	3.2	219,023	19
	0.0	>30%	Not suitable	0.0	99,803	9
Land use	11	Vacantland/unusedland	Most suitable	44.0	17,306	1.51
	8.3	Plantation/industry/trade	Suitable	24.8	2743	0.24
	5.5	Tegalan	Moderately suitable	11.0	951	0.08
	2.8	Farmland	Marginally suitable	2.8	857,161	74.79
	0.0	Settlementsetc.	Not suitable	0.0	267,993	23.38
Availability of raw materials	7.7	>20,000(tons)	Most suitable	30.7	38,768	3.4
	5.8	15,001–20,000	Suitable	17.3	0.0	0.0
	3.8	10,001–15,000	Moderately suitable	7.7	0.0	0.0
	1.9	5001–10,000	Marginally suitable	1.9	0.0	0.0
	0.0	0–5000	Not suitable	0.0	1,107,386	96.6
Road accessibility	3.2	0–500	Most suitable	12.7	58,638	5.1
	2.4	501–1000	Suitable	7.2	54,647	4.8
	1.6	1001–1500	Moderately suitable	3.2	51,692	4.5
	0.8	1501–2000	Marginally suitable	0.8	49,631	4.3
	0.0	>2000	Not suitable	0.0	931,547	81.3
Access to water resources	1.3	0–50	Most suitable	5.2	16,261.6	1.4
	1.0	51–250	Suitable	2.9	30,976	2.7
	0.6	251–500	Moderately suitable	1.3	31,825.9	2.8
	0.3	501–750	Marginally suitable	0.3	28,908.3	2.5
	0.0	>750	Not suitable	0.0	1,038,182.6	90.6

Table 4. (*Continued*).

Parameter	Weight	Sub-criteria	Suitability	Scoring	Area (Ha)	%
Access to universities	1.5	0–10,000	Most suitable	4.6	7679.0	0.7
	1.0	10,001–20,000	Suitable	2.0	56,575.5	4.9
	0.5	20,001–30,000	Marginally suitable	0.5	116,851.7	10.2
	0.0	>30,000	Not suitable	0.0	965,048.1	84.2
Market access	1.3	0–1000	Most suitable	3.9	342,522.8	29.9
	0.9	1001–3000	Suitable	1.7	338,172.0	29.5
	0.4	3001–5000	Marginally suitable	0.4	289,875.0	25.3
	0.0	>5000	Not suitable	0.0	175,584.0	15.3
Population density	0.9	0–50	Most suitable	3.7	652,526	56.9
	0.7	51–100	Suitable	2.1	261,210	22.8
	0.5	101–150	Moderately suitable	0.9	199,204	17.4
	0.2	151–200	Marginally suitable	0.2	15,267	1.3
	0.0	>200	Not suitable	0.0	17,946	1.6
Landfill	1.2	>1000	Most suitable	2.3	236	0.02
	0.6	501–1000	Suitable	0.6	707	0.06
	0.0	0–500	Not suitable	0.0	1,145,211	99.92

4.3. Land potential analysis

The land potential map for the technopark area based on pineapple SMEs in Kampar Regency is obtained through the overlay process. This process involves assessing nine parameters that have been scored based on their respective weights. The overlay highlights the areas most suitable for the development of the technopark area based on pineapple SMEs in Kampar Regency. The potential location map for the technopark area can be seen in **Figure 3**.

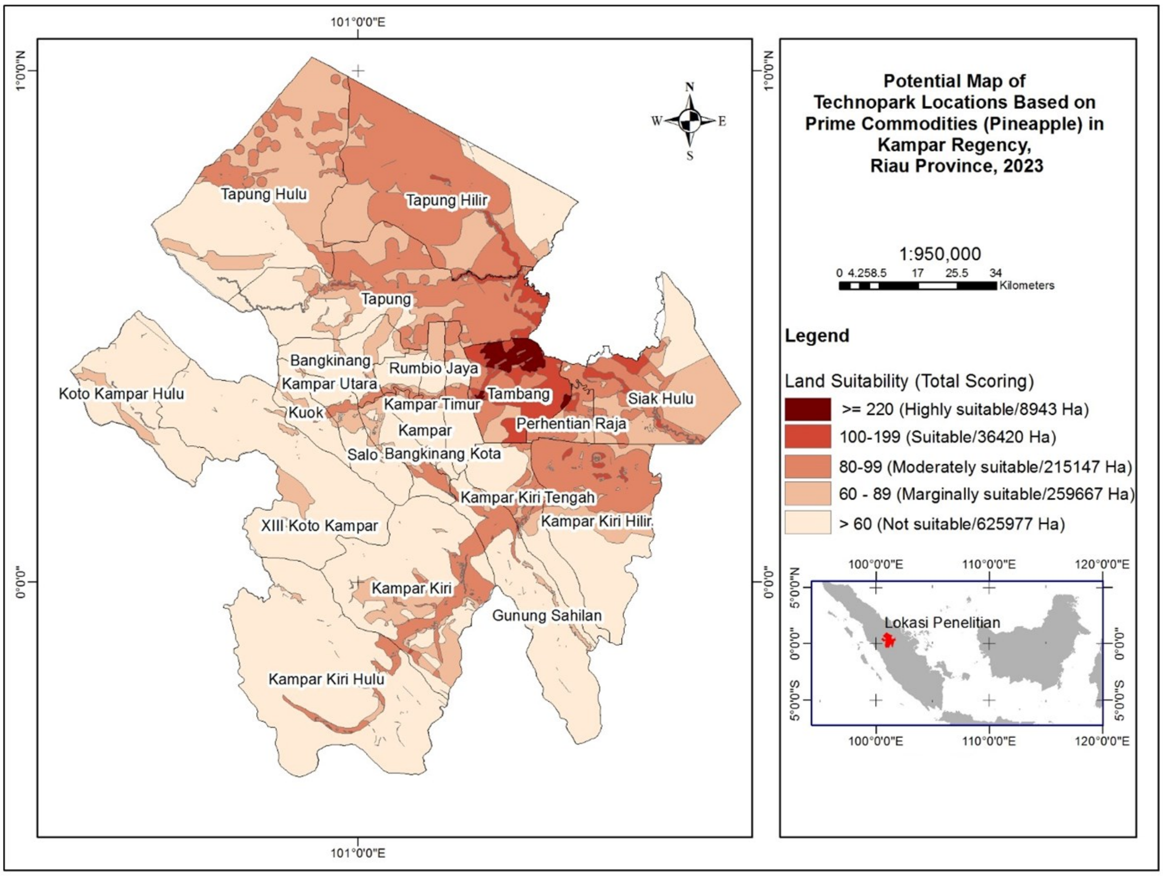

Figure 3. Map of the potential location of the technopark based on pineapple SMEs in Kampar regency.

Figure 3 illustrates the land suitability levels for the technopark area focused on the development of SMEs based on pineapples. The classification of land suitability for the technopark area development is divided into five classes (Mete et al., 2022; Mgelwa et al., 2024; Sahoo et al., 2024): S1 (Most suitable), S2 (Suitable), S3 (Moderately Suitable), N1 (Marginally Suitable) and N2 (Not Suitable). The classification of land suitability potential for the technopark location is shown in **Table 5**.

Table 5. Classification of land potential suitability for technopark based on pineapple SMEs.

Score	Suitability	Area (Ha)	Percentage (%)
≥120	Most suitable	8943	0.78
100–199	Suitable	36,420	3.18
80–99	Moderately Suitable	215,147	18.77
60–79	Marginally suitable	259,667	22.65
<60	Not suitable	625,977	54.62
		1,146,154	**100**

Based on **Table 5**, it can be seen that the land highly suitable for the development of a pineapple SMEs-based technopark covers 8943 hectares, or about 0.78% of the total area examined. The findings indicate that Tambang District is a highly suitable location for the development a pineapple SMEs-based technopark, encompassing three villages: Rimbo Panjang, Kualu Nenas, and Tarai Bangun. This finding is supported by several key factors that make Tambang District a potential site for the development of a pineapple SMEs-based technopark. Tambang District is the largest pineapple producer in Kampar Regency, with a production volume reaching 235,600 tons in 2023 (BPS, 2024). The high production volume indicates that the area has significant and stable resources to support the operation of the technopark. The abundant supply of pineapples can provide raw materials for the technopark, facilitating the development of processed pineapple products and increasing economic value. The technopark can optimize the use of raw materials to produce various processed products, ensuring operational sustainability and efficiency.

The quality of pineapples is also a supporting factor in the location selection, as it can influence the competitiveness of processed products in the market. Pineapples from Tambang District have high quality and productivity (Budianingsih et al., 2017; Oktari et al., 2020). High-quality products are more likely to be accepted and favored by consumers, both locally and globally, opening opportunities to expand markets and increase profits for the technopark. Additionally, accessibility in Tambang District is a crucial factor in selecting the technopark location. The location of Tambang District is very strategic, as it is close to Pekanbaru City, the capital of Riau Province. This proximity provides excellent accessibility and facilitates the distribution and logistics of processed pineapple products to a broader market. The closeness to the city center also simplifies the procurement of raw materials and other supporting services due to the adequate infrastructure. Tambang District is also situated on a major route connecting Riau Province with West Sumatra Province. This route not only supports smooth distribution of goods and mobility of residents but also plays a role in economic and social exchange between the two provinces.

Market access and the proximity of higher education institutions add extra value to Tambang District. Market access supports the development and distribution of products that can reach both domestic and international markets. An efficient distribution network can facilitate the delivery of products and ensure they arrive in good condition. The technopark can function as a distribution hub, connecting pineapple products with global markets, leveraging existing infrastructure to ensure efficient and timely product delivery. This will help SMEs enter new markets and increase sales, while addressing logistical challenges often faced by small businesses. Higher education institutions provide opportunities for collaboration in research and development as well as workforce training. The technopark can collaborate with these institutions to provide production facilities, technology, and innovation for pineapple SMEs. Access to modern equipment and efficient production processes allows SMEs to improve product quality and reduce production costs. With better technology, SMEs can produce a wider range of innovative processed pineapple products, such as pineapple juice, pineapple chips, jams, and other processed food products. The land suitability in Tambang District is also very good, with fertile soil, a supportive climate, and adequate water resources, supporting the development of technopark facilities. The technopark can be built according to plan and function optimally in supporting pineapple SME activities.

Considering all the factors identified in these findings, the development of a technopark in Tambang District has the potential to make a significant economic impact. This location choice will maximize the benefits from local resources and contribute to the economic growth and development of the pineapple industry in Kampar Regency. It will also create new economic opportunities, improve community welfare, and drive overall industrial advancement. Increased economic activity around the technopark will generate additional business opportunities, supporting related sectors such as transportation, packaging, and professional services. These findings can serve as a consideration for local government and stakeholders in the planning and development of the technopark in Kampar Regency.

5. Conclusion

AHP-GIS is used to determine the potential location for a technopark focused on developing pineapple-based SMEs in Kampar Regency. Based on the data processing result, land suitability levels for the technopark development were classified into five categories: Most suitable (0.78%) with an area of 8943 hectares, Suitable (3.18%) with an area of 36,420 hectares, Moderately Suitable (18.77%) with an area of 215,147 hectares, Marginally Suitable (22.65%) with an area of 259,667 hectares, and Not Suitable (54.62%) with an area of 625,977 hectares. Land that is very suitable for the development of a technopark based on pineapple SMEs is located in Tambang District. Tambang District is the largest pineapple producer in Kampar Regency. The location of Tambang District is directly adjacent to the capital of Riau Province, providing easy access to the city center, including transportation, communication networks, and other public facilities. Tambang District has the potential to enhance economic growth and the development of pineapple-based SMEs. The proposed model for determining the location of the technopark area based on pineapple SMEs remains conceptual, thus requiring further research focused on implementation strategies.

Author contributions: Conceptualization, DD, AMF, TCS and SR; methodology, AMF; software, DD; validation, AMF, TCS and SR; formal analysis, DD; investigation, AMF; resources, SR; data curation, TCS; writing—original draft preparation, DD; writing—review and editing, AMF, TCS and SR; visualization, AMF; supervision, SR; project administration, TCS; funding acquisition, DD. All authors have read and agreed to the published version of the manuscript.

Acknowledgments: This research was funded by the Indonesia Endowment Fund for Education of the Ministry of Finance of the Republic of Indonesia. The authors would like to extend their sincere gratitude for the Indonesia Endowment Fund for Education (LPDP) for sponsoring the doctoral study and supporting this article's publication.

Conflict of interest: The authors declare no conflict of interest.

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