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Integrated AHP-TOPSIS Model for Multi-Level Prioritization of Drug Abuse Risk Indicators: Evidence from Bengkulu Province, Indonesia

Rewan Jayadi, Herry Suprajitno*, Miswanto

Department of Mathematics, Faculty of Science and Technology, Universitas Airlangga, Surabaya, Indonesia

Abstract This study applies an integrated Analytic Hierarchy Process (AHP) and Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) model to evaluate multilevel risk factors and regional vulnerability to drug abuse in Bengkulu Province, Indonesia. Expert assessment data were formally obtained from the National Narcotics Board (BNN) of Bengkulu Province under procedures approved by the institutional research ethics committee. Consistency testing confirmed that all pairwise comparison matrices had Consistency Ratio values below 0.1, ensuring logical reliability of the data. The AHP analysis generated weighted risk factors that served as input for the TOPSIS framework. The integrated results identified Rejang Lebong Regency as the most vulnerable area, followed by Bengkulu City, Mukomuko, Lebong, Kepahiang, North Bengkulu, Seluma, South Bengkulu, Kaur, and Central Bengkulu. This integrated model provides an evidence-based decision-making framework to prioritize preventive actions and resource allocation for effective drug control policy and public health risk management.

Keywords Drug Abuse, Analytic Hierarchy Process, Technique for Order Preference by Similarity to Ideal Solution, Evidence-Based Decision Making, Bengkulu Province

AMS 2010 subject classifications 93A13, 90B50, 74P05

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1. Introduction

Drug abuse in Indonesia has escalated into a multidimensional national crisis, affecting public health, social stability, and national security. Psychoactive substances-whether natural, synthetic, or semi-synthetic exert pharmacological effects that impair cognitive functions, distort perception, and stimulate neuropsychological activity, potentially leading to severe neurological damage and life-threatening conditions [1, 2]. This phenomenon is no longer confined to specific demographic groups; it has penetrated all layers of society, including children, adolescents, and adults, both as users and actors within illicit drug distribution networks [2]. Furthermore, recent studies reveal a concerning geographical diffusion of narcotics trafficking, extending beyond metropolitan centers into rural and peripheral regions [3]. These trends underscore the urgent need for evidence-based, interdisciplinary approaches that integrate analytical decision-support tools into public policy and regional intervention strategies.

From a behavioral perspective, drug abuse frequently originates from experimental use driven by peer influence, psychological stress, curiosity, and social acceptance, particularly during adolescence. While initial consumption often occurs in recreational contexts, prolonged exposure increases physiological tolerance and dependency, thereby intensifying psychological and physical addiction risks [4, 5, 6]. Structural and environmental factors such as weak family supervision, socio-economic stressors, and permissive community environments significantly accelerate the transition from casual use to chronic dependence. In Bengkulu Province, this pattern

*Correspondence to: Herry Suprajitno (Email: herry-s@fst.unair.ac.id). Department of Mathematics, Faculty of Science and Technology, Universitas Airlangga, Jln. Dr. Ir. H. Soekarno, Mulyorejo, Surabaya, Indonesia (60115).

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is increasingly evident. As of September 2024, 296 drug abuse cases were officially recorded across multiple districts, with Bengkulu City exhibiting the highest incidence rate [7]. This situation reflects systemic challenges in regional prevention and control mechanisms, emphasizing the necessity of coordinated, data-driven, and cross-sectoral policy responses that incorporate early detection, institutional strengthening, and community-based interventions [4, 8].

In recent years, Multi-Criteria Decision Making (MCDM) methods have gained increasing attention in public health, social policy, and criminology research as effective tools for addressing complex, multidimensional problems characterized by uncertainty and competing risk factors [9]. Studies employing MCDM frameworks-particularly AHP, TOPSIS, VIKOR, and PROMETHEE have demonstrated their capacity to prioritize risk determinants, optimize intervention strategies, and support transparent policy formulation in areas such as disease prevention, substance abuse risk assessment, and social vulnerability mapping [10]. However, within the context of drug abuse prevention in Indonesia, particularly at the provincial and sub-regional levels, the application of hybrid MCDM models remains limited. This gap highlights the need for localized, empirically grounded decision-support systems that are sensitive to regional socio-cultural dynamics.

This study addresses this gap by integrating the Analytic Hierarchy Process (AHP) and the Technique for Order Preference by Similarity to the Ideal Solution (TOPSIS) to evaluate and prioritize drug abuse risk factors in Bengkulu Province. AHP is employed to systematically derive criterion weights through pairwise comparisons, enabling the incorporation of expert judgment and subjective preferences within a structured decision hierarchy [11]. TOPSIS subsequently utilizes these weights to rank alternatives based on their relative closeness to ideal and anti-ideal solutions, thereby enhancing discriminatory power in multi-criteria evaluation [12]. The methodological synergy of AHP-TOPSIS has been widely recognized for improving decision accuracy and robustness in complex social and health-related assessments [13].

The selection of the eight risk criteria in this study is theoretically grounded in established behavioral and social science frameworks, particularly the Social Ecological Model and the Risk and Protective Factors Framework [14]. These frameworks emphasize that substance abuse behavior emerges from the interaction of individual characteristics (e.g., personality and psychological condition), interpersonal influences (family and peer environment), institutional contexts (school and community), and broader socio-environmental conditions. Each criterion employed in this research reflects empirically validated risk dimensions that have been previously examined in the Indonesian and Southeast Asian contexts [15, 16]. By explicitly linking these criteria to established theoretical models, this study strengthens the conceptual validity of the proposed decision-support framework.

Aligned with national policy objectives, this research supports Indonesia's strategic commitment to reducing the prevalence of drug abuse to 1.60 % by 2029, as outlined in the 2024–2029 National Medium-Term Development Plan [17]. Through the development of a localized hybrid AHP–TOPSIS model, this study contributes not only methodological advancement in MCDM applications but also practical, data-driven policy insights tailored to the socio-spatial characteristics of Bengkulu Province. Consequently, the findings are expected to inform targeted prevention strategies, enhance institutional decision-making capacity, and support sustainable efforts to mitigate drug abuse at the regional level.

2. Research Methods

This study employs a Multi-Criteria Decision Making (MCDM) approach by integrating the Analytic Hierarchy Process (AHP) and the Technique for Order Preference by Similarity to the Ideal Solution (TOPSIS) to evaluate risk factors and rank the vulnerability levels of districts/cities to drug abuse in Bengkulu Province, Indonesia. The research is systematically initiated through an extensive literature review and expert consultation to identify key risk factors encompassing social, demographic, psychological, economic, and environmental dimensions. Subsequently, the relative importance of each risk factor is determined using AHP based on pairwise comparison judgments provided by a multidisciplinary panel of experts with backgrounds in public health, social policy, and drug abuse prevention. The resulting weights are then incorporated into the TOPSIS framework to assess the relative closeness of each region to the ideal and anti-ideal solutions, thereby producing an objective and multidimensional regional vulnerability ranking.

The selection of the AHP–TOPSIS hybrid model is grounded in methodological considerations and the nature of the data employed in this study. Compared to alternative MCDM approaches such as AHP–VIKOR or ANP–TOPSIS, the AHP–TOPSIS framework offers greater structural simplicity and transparency while maintaining strong analytical capability in handling both qualitative expert judgments and quantitative regional data. AHP is particularly effective in deriving consistent and mathematically validated priority weights, whereas TOPSIS excels in discriminating alternatives based on their relative proximity to ideal and worst-case scenarios. This complementary integration makes AHP–TOPSIS especially suitable for policy-oriented research, where interpretability, reproducibility, and practical relevance are essential. Consequently, the proposed integrated approach provides a robust analytical foundation for evidence-based and context-sensitive drug abuse prevention policies at the regional level. Based on the conceptual framework and methodological considerations outlined above, the following section presents a detailed description of the implementation of the AHP and TOPSIS employed in this study.

2.1. AHP Method

The decision criteria in this study refer to various risk factors that have been previously identified as key determinants in the analysis of vulnerability to drug abuse. Each criterion will be weighted based on its relative importance to the research objectives, facilitating a systematic and data-driven prioritization process. The weighting process was carried out using the AHP approach. The Analytic Hierarchy Process, introduced by Saaty between 1971 and 1975, is one of the most widely used multi-criteria decision-making methods. This approach combines a mathematical framework with qualitative considerations, enabling it to solve complex problems through a systematic and rational hierarchical structure [18, 19]. The AHP method framework comprises several key components, including hierarchical objectives that encompass the primary objectives, followed by criteria and sub-criteria, and ultimately alternatives [20]. Here are the steps to calculate the weight of each criterion using the AHP method.

Step 1: The initial stage in applying the AHP method begins with the systematic formulation of a problem and the construction of a decision-making hierarchy structure. After identifying the criteria and alternatives related to drug abuse, the next step is to develop a hierarchical framework that represents the logical relationship between the main objectives, risk factors as assessment criteria, and administrative area alternatives as evaluation objects. In the context of this study, this structure is used to facilitate the weighting process for various risk factors that affect the vulnerability of districts/cities to drug abuse in Bengkulu Province.

Step 2: Create a pairwise comparison matrix from the identified criteria. The values in this pairwise comparison matrix are obtained from experts who are competent in the field of drug abuse prevention, ensuring they accurately represent real-world conditions. Furthermore, the Saaty scale used has 9 points, with numerical values ranging from 1 to 9, to compare the criteria in the matrix [21, 18]. With this systematic process, reliable criterion weight values can be obtained for subsequent decision making.

The pairwise comparison matrix A is constructed using Equation 1, where a_{ij} represents the pairwise comparison between criteria i and j, for $i, j \in 1, 2, 3, \ldots, n$, $a_{ij} = 1$, $a_{ji} = \frac{1}{a_{ij}}$, and n denotes the number of each criterion in the comparison matrix [21].

$$A = \begin{bmatrix} 1 & a_{12} & \ldots & a_{1n} \\ \frac{1}{a_{12}} & 1 & \ldots & a_{2n} \\ \ldots & \ldots & \ldots & \ldots \\ \frac{1}{a_{1n}} & \frac{1}{a_{2n}} & \ldots & 1 \end{bmatrix}. \quad (1)$$

Step 3: For each matrix A, each element located in column i is divided by the number of elements located in the entire column i, so that the sum of each column of the matrix is 1. All columns of the pairwise comparison matrix undergo this process. This will also develop a new matrix called the normalization matrix of A, denoted as A_{norm}.

$$A_{norm} = \begin{bmatrix} \frac{a_{11}}{\sum_{i=1}^{n} a_{i1}} & \frac{a_{12}}{\sum_{i=1}^{n} a_{i2}} & \cdots & \frac{a_{1n}}{\sum_{i=1}^{n} a_{in}} \\ \frac{a_{21}}{\sum_{i=1}^{n} a_{i1}} & \frac{a_{22}}{\sum_{i=1}^{n} a_{i2}} & \cdots & \frac{a_{2n}}{\sum_{i=1}^{n} a_{in}} \\ \cdots & \cdots & \cdots & \cdots \\ \frac{a_{n1}}{\sum_{i=1}^{n} a_{i1}} & \frac{a_{n2}}{\sum_{i=1}^{n} a_{i2}} & \cdots & \frac{a_{nn}}{\sum_{i=1}^{n} a_{in}} \end{bmatrix}. \tag{2}$$

Next, determine the eigenvalues and eigenvectors for the normalized matrix. The eigenvector (w) that corresponds to the maximum eigenvalue $(\lambda_{\max})$ Provides the relative weight [22].

Step 4: AHP method consistency test. Consistency test is a very important step to assess the level of consistency or inconsistency in the decision matrix using the Consistency Ratio (CR). This assessment involves a comparison of the Consistency Index (CI) calculated with the Random Index (RI) value [22]. The equation can be written as follows:

$$CI = \frac{\lambda_{\max} - n}{n-1}, \tag{3}$$

$$CR = \frac{CI}{CR}. \tag{4}$$

RI values vary depending on the size of the paired comparison matrix, as established by Saaty in the development of the AHP method [21]. To assess the level of consistency in respondents' assessments, the CR value is used, which is calculated by comparing the actual consistency index with the RI value. A comparison matrix is said to be consistent if the CR value is below the threshold of 0.1 or 10%. If the CR value exceeds this limit, the weighting results are considered to not meet the logical consistency criteria, thus requiring a re-evaluation of the paired comparison matrix to improve the validity of the results [18, 19].

2.2. TOPSIS Method

TOPSIS is one of the methods in the MCDM framework used to determine the optimal alternative based on its proximity to the best solution. This approach relies on a series of evaluative criteria to identify the most efficient and effective choice. The basic principle of TOPSIS is that the best alternative should have the smallest distance from the positive ideal solution (theoretically the best solution) and the largest distance from the negative ideal solution (the worst solution) [23, 24]. In the context of this study, after the weight of each criterion was determined using the AHP method, the next step was to apply the TOPSIS method to evaluate the level of vulnerability to drug abuse at the district/city level. This process involved determining the relative proximity value of each alternative to the ideal solution as a basis for ranking, which will be described in detail in the following step:

Step 1: Decision matrix normalization is a crucial step in the TOPSIS method to align values between criteria into a uniform scale, given the differences in units and ranges between variables. This process enables objective and scale-free comparison of alternatives [24]. Thus, normalization not only improves the validity of the analysis but also ensures that the contribution of each criterion to the final result remains proportional and can be interpreted comprehensively in the context of decision making [25], with r_{ij}, it can be calculated using the following equation:

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} x_{ij}^2}}, \tag{5}$$

where $i =$ alternative $(1, 2, 3, ..., m)$ and $j =$criteria (1,2,3,...,n)

Step 2: This stage involves compiling a weighted normalized decision matrix by multiplying each element in the normalized decision matrix by the AHP result criteria weight. This step aims to integrate relative preferences into the assessment of alternatives proportionally, thereby producing a more representative evaluation in line with the relative importance of each criterion [12]. This process is formulated as:

$$v_{ij} = w_j r_{ij} \tag{6}$$

where w_j, is the criterion weight obtained from the AHP process stage.

Step 3: Positive Ideal Solution (A^+) and Negative Ideal Solution (A^-) are determined by identifying the best and worst values of each criterion among all available alternatives. (A^+) represents the most desirable optimal values for each criterion, while (A^-) reflects the worst, least desirable values [24, 25, 23]. These values are calculated using Equations 7 and 8, which formulate positive and negative ideal solutions based on the type of criteria, respectively.

$$A^+ = \{(\max v_{ij} \mid j \in J), (\min v_{ij} \mid j \in J'), i = 1, 2, 3, ..., m\} = \{v_{1^+}, v_{2^+}, ..., v_{m^+}\}, \tag{7}$$
$$A^- = \{(\min v_{ij} \mid j \in J), (\max v_{ij} \mid j \in J'), i = 1, 2, 3, ..., m\} = \{v_{1^-}, v_{2^-}, ..., v_{m^-}\}, \tag{8}$$

where J represents the set of benefit attributes, which are better when larger. Meanwhile, J' represents the set of cost attributes, which are better when smaller.

Step 4: Separation Measure is a method for calculating the distance between an alternative and the positive ideal solution and the negative ideal solution. Each can be calculated using Equations 9 and 10 [24]. Here is the formula for measuring the similarity between alternative solutions and ideal solutions:

$$S_i^+ = \sqrt{\sum_{j=1}^{n} (v_{ij} - v_{j^+})^2}, i = 1, 2, 3, ..., n, \tag{9}$$
$$S_i^- = \sqrt{\sum_{j=1}^{n} (v_{ij} - v_{j^-})^2}, i = 1, 2, 3, ..., n. \tag{10}$$

Step 5: Next, calculate the relative proximity of the positive ideal solution alternative A^+ to the negative ideal solution A^- as follows:

$$C_i = \frac{S_i^-}{S_i^+ + S_i^-}, \text{ with } 0 < C_i < 1 \text{ and } i = 1, 2, 3, ..., m. \tag{11}$$

The final stage in the TOPSIS method is the ranking of alternatives based on the relative closeness value (Closeness Coefficient). Alternatives with relatively high proximity values are considered optimal choices, while other alternatives are ranked sequentially according to these values. These values reflect the extent to which each alternative approaches the decision-making positive ideal solution and moves away from the negative ideal solution. Thus, the ranking results can be used as an objective basis for rational and priority-based decision-making.

Step 6: Next, the final stage in this study is to determine global priorities. Global priorities can be determined using the following equation:

$$C_i^{global} = \sum_{i=1}^{n} w_i C_i^{(j)}, \tag{12}$$

where w_i is the weight of criterion i of AHP, while $C_i^{(j)}$ is the preference score of alternative j on criterion j.

3. Instrument Validity and Reliability Test

3.1. Validity Test

Before data analysis is conducted, research instruments must undergo a validity test to ensure that the questions in the questionnaire are empirically capable of accurately measuring the intended construct. He validity test is conducted by comparing the calculated correlation coefficient value. r_{count} against the critical value in the r_{table} at a certain significance level. An instrument is considered valid if $r_{count} > r_{table}$. Conversely, if $r_{count} < r_{table}$ then the item is considered invalid and needs to be reanalyzed or revised. One statistical approach commonly used to test validity is Pearson's product-moment correlation [26], with the calculation formula presented as follows:

$$r_{xy} = \frac{N(\sum XY) - (\sum X)(\sum Y)}{\sqrt{(N(\sum X^2) - (\sum X)^2)(N(\sum Y^2) - (\sum Y)^2)}}, \tag{13}$$

where r_{xy} is criteria compiled from correlation coefficients on the test, X is respondents variable with respective scores (test compiled), Y is respondents variable with respective scores (criteria test), and N is the number of respondents.

3.2. Reliability Test

Reliability testing is conducted to assess the extent to which research instruments produce consistent and stable data when tested on the same subjects at different times. This test aims to ensure that the instruments are not only valid but also capable of maintaining measurement reliability under various conditions. One of the techniques used is the calculation of **Cronbach's Alpha** coefficient, which measures internal homogeneity between items in a single construct. An instrument is considered reliable if the Cronbach's Alpha value exceeds the significance threshold, which is 0.60. Conversely, if the reliability value is below the specified threshold, the research instrument is considered inconsistent and needs to be improved, either through item revision, deletion of weak items, or addition of more appropriate questions, until an adequate level of reliability is achieved. The formula for calculating Cronbach's Alpha is presented as follows:

$$r = \frac{n}{n+1}\left(1 - \frac{\sum \sigma_t^2}{\sigma_t^2}\right), \tag{14}$$

where r is the instrument reliability coefficient (number of tests), n is the number of questions, σ_t^2 is the total score variance, and $\sum \sigma_t^2$ is the total variance of each question score [27].

4. Research Methodology

This study applies a mathematical approach in a decision support system to evaluate risk factors and rank the vulnerability of districts/cities to drug abuse in the Bengkulu Region. The methodology used, as presented in Figure 1, involves several structured stages, namely: literature study and expert consultation, identification of criteria and alternatives, preparation of a decision hierarchy, data collection, mathematical modeling for weight determination using AHP, consistency testing, analysis of alternatives of the TOPSIS method to obtain optimal solutions, ranking, and interpretation. The results of the analysis were used as the basis for drawing conclusions and strategic recommendations for drug control at the regional level.

1. Literature review and expert consultation
   The initial stage of this research began with a comprehensive literature review on drug abuse in Bengkulu Province, the basic concepts of Decision Support Systems, and the application of the AHP and TOPSIS methods in various fields, including various industrial sectors. In addition, consultations were held with experts to gain a consensus as the basis for drawing conclusions and formulating ntextual understanding of current issues and to validate the relevance of the research.

2. Identify criteria and alternatives
   At this stage, the process of identifying risk factors (criteria) and alternative administrative areas (districts/cities) relevant to drug abuse is carried out. This process refers to previous literature findings and is reinforced by input from experts to ensure the feasibility and measurability of each criterion used in the analysis.
3. Establishing a hierarchy of decisions
   The next strategic step is to develop a decision hierarchy structure as a basis for multi-criteria decision making. This hierarchy structure consists of the main research objectives at the top level, followed by criteria and sub-criteria at the middle level, and decision alternatives at the bottom level. This structure serves as a conceptual framework for the systematic application of the AHP and TOPSIS methods.
4. Research data collection
   Data collection was conducted through surveys, observations, agency reports, and secondary data searches from relevant agencies. The data collected included information on drug abuse cases in districts/cities throughout Bengkulu Province, which was then constructed into a questionnaire format for expert assessment in the next stage.
5. Conducting analyses for validity and reliability testing
   This stage is carried out as a questionnaire instrument verification process to ensure the feasibility and accuracy of the measuring instrument before it is used in the main analysis. This test serves as a crucial step in maintaining the methodological strength of the research by ensuring that the data collected comes from a valid and reliable instrument, so that the analysis results produced have high accuracy and credibility.
6. Criteria weight analysis using AHP
   This stage aims to determine the relative importance of each criterion and subcriterion based on expert assessment results using the AHP method. The weighting process is carried out using a pairwise comparison matrix that represents the subjective preferences of experts for each risk factor.
7. Consistency testing
   Consistency testing of paired comparison results is conducted to ensure the logical validity of the preferences given. If the CR value is less than 0.1, the weighting is considered consistent. This stage is crucial because it ensures the accuracy and reliability of the weights obtained before they are used in further evaluation processes.
8. Analysis of optimal solutions with TOPSIS
   After the criteria weights are obtained, the TOPSIS method is applied to evaluate district/city alternatives based on their proximity to positive and negative ideal solutions. This process includes data normalization, matrix weighting, and relative proximity calculations to determine the ranking of each alternative objectively.
9. Ranking and interpretation
   The final stage involves synthesizing the results of calculations from the AHP and TOPSIS methods to determine the global priority of each region. Based on this ranking, research conclusions and strategic policy recommendations are formulated that can be implemented by stakeholders in efforts to prevent and control drug abuse in Bengkulu Province more effectively and based on evidence.

5. Results and Discussion

5.1. Decision Hierarchy

Figure 2 illustrates the hierarchical decision-making structure used to evaluate risk factors for drug abuse at the district and municipal levels in Bengkulu Province. The hierarchy is designed to represent the conceptual link between the primary objective ranking regions based on their vulnerability to drug abuse and the eight main assessment criteria, along with ten regional alternatives. Each criterion is directly associated with the evaluated districts or cities, forming a structured, rational, and comprehensive multicriteria decision-making framework.

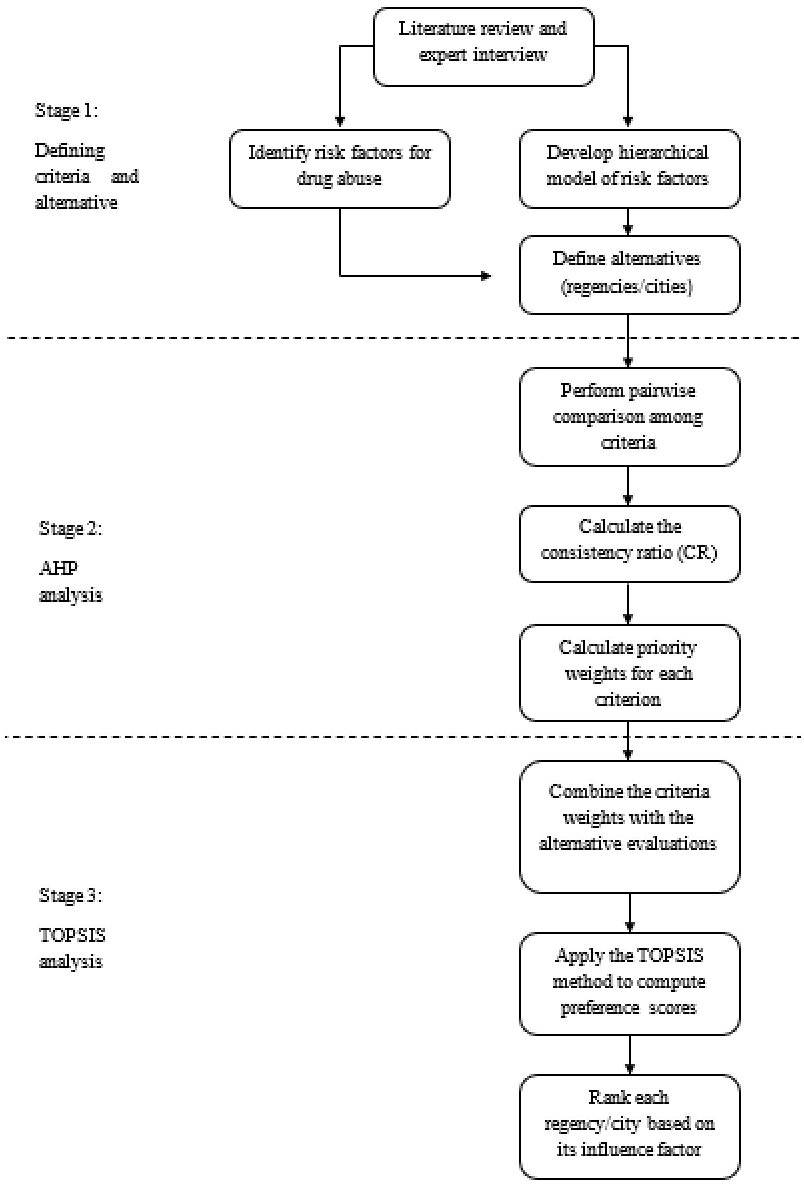

Figure 1. Research Procedure

Table 1. Hierarchy symbol description

Symbol	Description	Symbol	Description	Symbol	Description
KP	Personality	LM	Community Environment	L	Lebong Regency
KD	Anxiety and Depression	EP	Economic and Psychosocial	M	Mukomuko Regency
KG	Family	A	Seluma Regency	S	South Bengkulu Regency
KT	Peer Group	U	North Bengkulu Regency	T	Central Bengkulu Regency
KN	Drug Availability	K	Kaur Regency	R	Rejang Lebong Regency
LS	School Environment	P	Kepahiang Regency	B	Bengkulu City

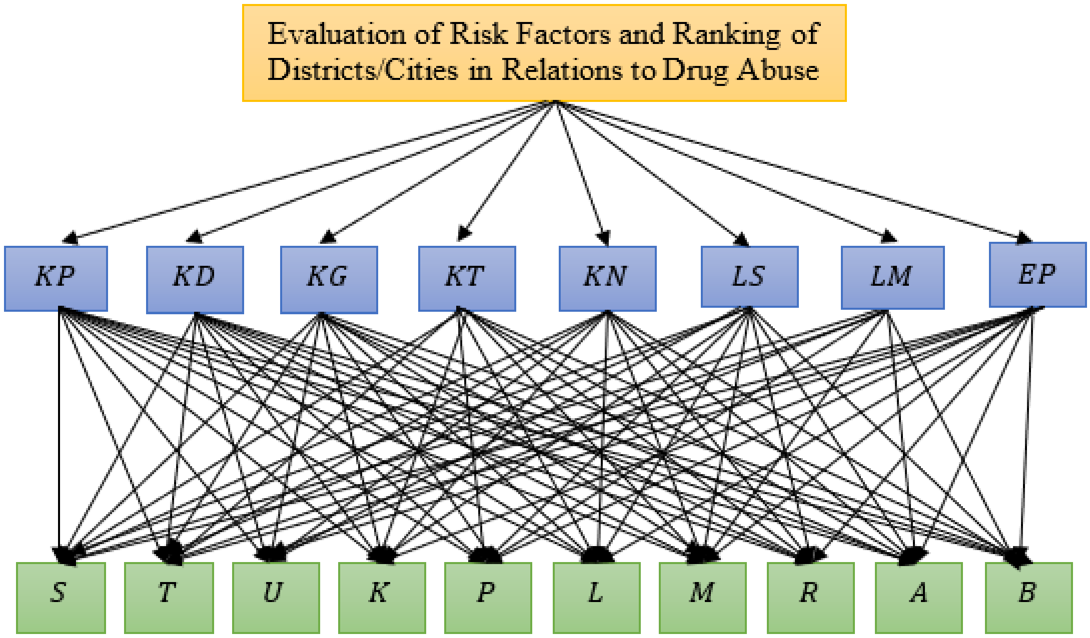

Figure 2. Hierarchy of Drug Abuse Decisions in Bengkulu Province

5.2. Research Sources and Data

The research data were obtained from the National Narcotics Agency (BNN) of Bengkulu Province through a structured data collection process, including direct observation, in-depth interviews, and the administration of pairwise comparison–based questionnaires. The expert assessment involved ten specialists who were purposively selected based on their professional competence and extensive experience in addressing drug abuse issues in Bengkulu Province, encompassing the domains of prevention and outreach, rehabilitation, and law enforcement. All experts possessed relevant institutional involvement in policy formulation, program implementation, and the management of drug abuse cases at the regional level. All stages of data collection were conducted under official authorization and received ethical approval from the relevant institutions, thereby ensuring compliance with the principles of transparency, scientific integrity, and research ethics. Although the expert panel in this study was predominantly composed of institutional stakeholders, this composition was considered appropriate given the study's objective of supporting evidence-based policy decision-making. Nevertheless, future research is encouraged to broaden panel representation by incorporating cross-sectoral actors, such as educators, community leaders, and affected communities, to enrich perspectives and mitigate potential assessment bias.

Based on the results of validity and reliability tests on all factors causing drug abuse used in the study, evidence was obtained that all constructs, including personality, anxiety and depression, family, peer groups, drug availability, school environment, community environment, and economic and psychosocial factors, had a significant correlation with the total score, with very high reliability values (Cronbach's Alpha ≥ 0.90) [27]. This indicates that the instrument used has strong psychometric qualities, both in terms of construct validity and internal consistency, making it suitable for use in further analysis using the AHP-TOPSIS method in determining the spatial prioritization of risk factors and alternatives for drug abuse.

The expert judgment data were subsequently presented in detail, as shown in Appendix A. The pairwise comparison matrices used in the analysis were synthesized from all expert responses using a mode-based consensus approach by identifying the most dominant judgment value for each criterion and alternative pair. This approach was adopted to capture the prevailing tendency of the majority of experts regarding the relative importance of each element within the decision hierarchy, while minimizing potential distortions arising from extreme judgments provided by a limited number of respondents. The aggregated matrices were then analyzed using the mathematical formulation in Equation 1 within the Analytic Hierarchy Process (AHP) framework and subjected to consistency testing to ensure logical validity and the appropriateness of the derived weights for subsequent integration with the TOPSIS method.

5.3. Analysis using the AHP Method

The subsequent stage in implementing the Analytic Hierarchy Process (AHP) involves constructing the pairwise comparison matrix using Equation 1. This matrix is developed based on Saaty's fundamental scale (ranging from 1 to 9), which reflects the relative preference intensity between criteria. Once the comparison matrix is established, normalization is performed by dividing each element in the i column by the total sum of elements in that column, thereby ensuring that the normalized column sums equal one. This procedure systematically follows the mathematical formulation presented in Equation 2. The next step is the consistency assessment to verify the logical validity of expert judgments, particularly concerning the criteria (risk factors) data. Consistency testing is applied to all matrices derived from expert questionnaires to ensure that the computed weights are stable, rational, and representative. Achieving satisfactory consistency is a prerequisite before proceeding to the hybrid integration of the AHP–TOPSIS method, ensuring that the resulting decision model rests on a rigorous mathematical foundation. The computed criteria weights and Weighted Sum Vector (WSV) values from the pairwise comparison matrix are presented in Table 2.

Table 2. Weight and WSV Results for Criteria

Criteria	Weight	WSV
Personality	0.1132	0.9929
Anxiety and Depression	0.0458	0.3850
Family	0.4031	3.6985
Peer Group	0.1464	1.3188
Drug Availability	0.0702	0.5826
School Environment	0.0312	0.2700
Community Environment	0.0978	0.8277
Economic and Psychosocial	0.0924	0.8444

The AHP weighting results indicate that the family factor is the most dominant determinant influencing vulnerability to drug abuse, with the highest priority weight of 0.4031, reflecting expert judgment on the central role of family functioning as a primary protective unit. Within the socio-cultural context of Bengkulu Province, this finding suggests that family dysfunction—such as inadequate parental supervision, permissive parenting styles, economic pressures, and the absence of positive role models—substantially increases susceptibility to addictive behaviors. Peer group influence ranks second 0.1464, highlighting the significant role of social interactions, particularly when familial control weakens. Furthermore, personality traits 0.1132, community environment 0.0978, and economic and psychosocial conditions 0.0924 demonstrate that drug abuse risk emerges from complex interactions between individual characteristics and broader social-ecological factors. Drug availability 0.0702 is perceived as an enabling rather than a primary driver, while anxiety and depression 0.0458 underscore the contribution of mental health dimensions. Although the school environment shows the lowest weight 0.0312, it remains relevant as an institutional prevention setting. Overall, this weighting pattern emphasizes the need for a multifactorial and cross-sectoral prevention strategy, prioritizing family- and community-based interventions.

The WSV value obtained is used for the next step, which is to determine the λ_{max} value using the formula as follows:

$$\lambda_{max} = \frac{1}{8}\left[\frac{0.9929}{0.1132} + \frac{0.3850}{0.0458} + \frac{3.6985}{0.4031} + \frac{1.3188}{0.1464} + \frac{0.5826}{0.0702} + \frac{0.2700}{0.0312} + \frac{0.8277}{0.0978} + \frac{0.8444}{0.0924}\right]$$

$$\lambda_{max} = 8.7412$$

Subsequently, the maximum eigenvalue obtained λ_{max} is substituted into Equation 3 to calculate the Consistency Index (CI), as presented in the following formulation:

$$CI = \frac{\lambda_{max} - n}{n - 1}$$
$$CI = \frac{8.7412 - 8}{8 - 1}$$
$$CI = 0.1059$$

After obtaining the Consistency Index (CI), the next step is to compute the Consistency Ratio (CR) using Equation 4, where the Random Index (RI) is determined according to the corresponding matrix order. The resulting consistency value is presented as follows:

$$CR = \frac{CI}{RI}$$
$$CR = \frac{0.1059}{1.41}$$
$$CR = 0.0751$$

The results for the criteria (risk factors) obtained a CR result with a value of < 0.1, so that the research data for the criteria obtained consistent results. The AHP-derived weights from this stage were subsequently utilized as standardized weighting coefficients within the hybrid AHP–TOPSIS framework developed in this study. These weights were not interpreted as independent analytical findings but rather served as the normalization basis for subsequent pairwise comparison matrices among the alternatives under each criterion. This approach ensures methodological coherence across the integrated model while avoiding redundancy with previous AHP-based studies, as the current application focuses on the hybridization process and its decision-support implications rather than on the derivation of the factor weights themselves.

Next, the same method as in the previous stage of finding the weight values of the criteria can be used to calculate the weight of each criterion for each alternative, so that the weight results of each criterion for each alternative are obtained as shown in Table 3.

Table 3. Alternative Weights for Each Criterion to the Alternative

Paired Matrix	Alternative Weight									
	S	T	U	K	P	L	M	R	A	B
KP to Alternatives	0.0471	0.0360	0.0736	0.0309	0.0977	0.0396	0.0984	0.2845	0.0289	0.2632
KD to Alternatives	0.0446	0.0248	0.0456	0.0378	0.0596	0.0728	0.1251	0.2745	0.0543	0.2609
KG to Alternatives	0.0389	0.0244	0.0434	0.0459	0.0434	0.0679	0.1283	0.2910	0.0718	0.2450
KT to Alternatives	0.0308	0.0329	0.0817	0.0373	0.0872	0.0566	0.1300	0.2408	0.0387	0.2639
KN to Alternatives	0.0399	0.0353	0.0725	0.0279	0.0635	0.0579	0.1523	0.2674	0.0278	0.2554
LS to Alternatives	0.0415	0.0239	0.0634	0.0346	0.0716	0.0692	0.1241	0.2036	0.0383	0.3298
LM to Alternatives	0.0341	0.0236	0.0376	0.0398	0.0576	0.0928	0.1046	0.3280	0.0508	0.2311
EP to Alternatives	0.0430	0.0234	0.0432	0.0459	0.0442	0.0738	0.1028	0.3107	0.0572	0.2558

After obtaining the weight results for each criterion for the alternative, to find the consistency test results, the WSV value is first sought. This value can be found in the same way as finding the WSV value in the previous criteria. The following are the WSV values obtained for each criterion for the alternative as presented in Table 4.

Next, the same steps were taken as in the consistency testing of the previous criteria (research risk factors). The results of the consistency testing of each criterion against the alternatives are presented in Table 5.

Based on the consistency test results conducted on the paired comparison matrix, both at the main criteria level (risk factors) and at each criterion for the alternatives, it was found that the overall Consistency Ratio (CR)

Table 4. WSV Values for Each Criterion to Alternative

Paired Matrix	Alternative WSV Value									
	S	T	U	K	P	L	M	R	A	B
KP to Alternatives	0.5251	0.3692	0.8262	0.3261	1.0934	0.4468	1.1441	3.2088	0.3108	3.0715
KD to Alternatives	0.4962	0.2756	0.5049	0.4159	0.6565	0.8432	1.4132	3.0938	0.6022	3.0027
KG to Alternatives	0.4269	0.2653	0.4640	0.4950	0.4637	0.8835	1.4525	3.2699	0.7938	2.7812
KT to Alternatives	0.3359	0.2514	0.8993	0.3926	0.9999	0.6112	1.5550	2.8429	0.4239	3.0152
KN to Alternatives	0.4246	0.3623	0.8162	0.3074	0.7302	0.6554	1.7526	3.0582	0.2990	2.8806
LS to Alternatives	0.4413	0.2677	0.7037	0.3667	0.8029	0.7680	1.4515	2.3198	0.4181	3.7591
LM to Alternatives	0.3712	0.2553	0.3964	0.4316	0.6150	1.0410	1.1496	3.7468	0.5631	2.7111
EP to Alternatives	0.4511	0.2557	0.4621	0.5088	0.4664	0.8581	1.1961	3.5219	0.6257	2.9883

Table 5. Consistency Test Results

Paired Matrix	λ_{max}	CI	CR	Result
KP to Alternatives	10.9730	0.1081	0.0726	Consistent
KD to Alternatives	11.1189	0.1243	0.0834	Consistent
KG to Alternatives	10.9144	0.1016	0.0682	Consistent
KT to Alternatives	11,3278	0.1168	0.0990	Consistent
KN to Alternatives	11.0511	0.1168	0.0784	Consistent
LS to Alternatives	11.0508	0.1168	0.0784	Consistent
LM to Alternatives	10.9030	0.1003	0.0673	Consistent
EP to Alternatives	11.0332	0.1148	0.0770	Consistent

value was below the tolerance threshold set by the AHP method, which is 0.1. The CR value in the main criteria matrix was recorded at **0.0751**, indicating that the assessment process for risk factors was carried out logically and consistently by the experts involved.

The consistency testing results for each criterion with respect to the alternatives, as presented in Table 5, indicate a high level of logical coherence. The obtained Consistency Ratio (CR) values are as follows: **0.0726** for the criterion of KP, **0.0834** for KD, **0.0682** for KG, and **0.0990** for KT. Furthermore, the CR values for KN and LS are **0.0784** each, while the CR for LM and EP are **0.0673** and **0.0770**, respectively. All these values fall below the recommended tolerance threshold of **0.10** proposed by Saaty (1990), indicating that the expert assessments were logically and rationally consistent. These results reinforce the validity of the AHP evaluation process and confirm that the derived priority weights are reliable for subsequent integration within the TOPSIS method. Consequently, there is no indication of bias or conceptual contradiction that could undermine the accuracy of the multicriteria decision-making outcomes in this study.

Thus, all consistency test results, both at the criterion level and in each relationship between criteria and alternatives, have met the structural validity requirements within the framework of the Analytic Hierarchy Process (AHP) method. This condition ensures that the priority weights generated from each comparison are methodologically accountable and can be used as a basis for further analysis stages. Furthermore, these results are suitable for integration into the TOPSIS method to obtain a final assessment in the form of a global ranking of alternatives, as a basis for objective, systematic, and scientific priority decision making.

5.4. AHP-TOPSIS Method Analysis

This section presents the results of an analysis based on the integration of the AHP and TOPSIS methods, which were used to evaluate the level of influence of each risk factor and determine the priority of districts/cities most vulnerable to drug abuse in Bengkulu Province. The initial stage was carried out by calculating the relative weight of each criterion using AHP, accompanied by a consistency test to ensure the validity of the decision-making process. Next, these weights were processed within the TOPSIS framework to identify alternatives that were closest to the positive ideal solution and furthest from the negative ideal solution. This hybrid approach enabled objective, structured, and data-driven analysis to produce comprehensive and accountable regional rankings. The results of the weighted normalized matrix values following the formulas in Equation 5 and Equation 6 using the AHP-TOPSIS method from the research data can be seen in Appendix B.

The next step is to determine the positive ideal solution value using the AHP-TOPSIS method. Using Equation 7, the positive ideal solution results obtained can be presented in Table 6.

Table 6. Positive Ideal Solution Results

Paired Matrix	A^+									
	S	T	U	K	P	L	M	R	A	B
KP to Alternatives	0.07332	0.06633	0.08073	0.07443	0.08321	0.07309	0.07556	0.09099	0.07115	0.09858
KD to Alternatives	0.03307	0.02906	0.02666	0.03007	0.02878	0.03267	0.03935	0.03503	0.02461	0.03996
KG to Alternatives	0.26212	0.23039	0.24767	0.22777	0.23335	0.29499	0.31218	0.32732	0.25698	0.34951
KT to Alternatives	0.09291	0.07681	0.09113	0.08884	0.11088	0.09174	0.11436	0.12561	0.08448	0.11511
KN to Alternatives	0.04255	0.03754	0.04921	0.04346	0.04636	0.04828	0.04536	0.03814	0.04372	0.04508
LS to Alternatives	0.01982	0.01866	0.02146	0.02113	0.02744	0.02046	0.02808	0.02865	0.02045	0.02694
LM to Alternatives	0.07087	0.05666	0.06777	0.06257	0.06132	0.06808	0.07078	0.08509	0.06085	0.09137
EP to Alternatives	0.06142	0.05264	0.06213	0.06544	0.06213	0.06337	0.06148	0.07548	0.05701	0.08042

The negative ideal solution using the AHP-TOPSIS method can be calculated using Equation 8, so that the negative ideal solution results can be presented in Table 7.

Table 7. Negative Ideal Solution Results

Paired Matrix	A^-									
	S	T	U	K	P	L	M	R	A	B
KP to Alternatives	0.00183	0.00276	0.00269	0.0093	0.00347	0.00522	0.0084	0.01299	0.01016	0.00616
KD to Alternatives	0.00207	0.00363	0.00222	0.00188	0.00192	0.00117	0.00246	0.00438	0.00123	0.0025
KG to Alternatives	0.01092	0.03291	0.01376	0.01898	0.01111	0.01639	0.01561	0.04676	0.01028	0.02184
KT to Alternatives	0.00344	0.01097	0.00365	0.00317	0.00462	0.00382	0.00762	0.00698	0.00469	0.01439
KN to Alternatives	0.00177	0.00179	0.00141	0.00543	0.00221	0.00201	0.00378	0.00477	0.00547	0.00563
LS to Alternatives	0.00094	0.00233	0.00119	0.00132	0.00114	0.00085	0.00094	0.00119	0.00097	0.00337
LM to Alternatives	0.00394	0.00809	0.00279	0.00261	0.00341	0.00284	0.00354	0.00945	0.00507	0.00381
EP to Alternatives	0.00171	0.00752	0.00296	0.00409	0.00296	0.00226	0.00411	0.00839	0.00271	0.00447

After obtaining the positive ideal solution and negative ideal solution values based on the criteria weighting of the AHP-TOPSIS method, the next stage in the TOPSIS analysis is to calculate the distance of each alternative from both solutions using Equations 9 and 10. This measurement aims to determine how close each alternative (district/city) is to the best ideal condition and how far it is from the worst ideal condition. The smaller the distance to the positive ideal solution and the greater the distance to the negative ideal solution, the higher the preference for that alternative. This stage is the core of the TOPSIS method in identifying the alternative that is closest to the optimal condition objectively, so that the ranking results can reflect the comprehensive and measurable level of regional vulnerability presented in Table 8.

The final stage in TOPSIS analysis is the calculation of the relative closeness value (relative closeness to the ideal solution) for each alternative. This value is obtained by comparing the distance of an alternative to the negative ideal solution and the total distance to both solutions (positive and negative). The greater the relative closeness value (approaching 1), the closer the alternative is considered to be to the ideal solution and the higher its preference level. This relative closeness value, as presented in Table 9, is used as the basis for determining the global priority order between districts/cities, which reflects the level of vulnerability of each region to drug abuse. Through this approach, the final ranking is objective, data-driven, and relevant to support the formulation of evidence-based intervention policies.

Figure 3 presents a visualization in the form of a bar chart of the relative proximity values of each risk factor criterion to the alternatives, which were calculated using the AHP-TOPSIS method. This visualization aims to

Table 8. Separation Measure Results

Alternatives	KP		KD		KG		KT		KN		LS		LM		EP	
	S^+	S^-	S^+	S^-	S^+	S^-	S^+	S^-	S^+	S^-	S^+	S^-	S^+	S^-	S^+	S^-
S	0.2152	0.0417	0.0877	0.0120	0.7713	0.0981	0.2846	0.0258	0.1197	0.0156	0.0659	0.0068	0.1991	0.0123	0.1780	0.0283
T	0.2219	0.0230	0.0938	0.0017	0.8033	0.0146	0.2916	0.0104	0.1221	0.0129	0.0693	0.0012	0.2055	0.0037	0.1884	0.0045
U	0.1948	0.0554	0.0873	0.0123	0.7534	0.0953	0.2397	0.0912	0.1045	0.0370	0.0617	0.0123	0.1966	0.0212	0.1768	0.0221
K	0.2255	0.0084	0.0902	0.0087	0.7475	0.1050	0.2793	0.0368	0.1252	0.0065	0.0673	0.0056	0.1952	0.0249	0.1751	0.0226
P	0.1774	0.0740	0.0840	0.0190	0.7625	0.1210	0.2328	0.0913	0.1072	0.0264	0.0601	0.0144	0.1842	0.0375	0.1760	0.0224
L	0.2187	0.0226	0.0809	0.0239	0.6713	0.2065	0.2596	0.0578	0.1126	0.0296	0.0603	0.0148	0.1648	0.0599	0.1595	0.0440
M	0.1710	0.0647	0.0634	0.0365	0.5453	0.3491	0.1864	0.1312	0.0669	0.0699	0.0512	0.0272	0.1565	0.0693	0.1409	0.0629
R	0.0268	0.2114	0.0213	0.0845	0.0676	0.7810	0.0939	0.2471	0.0097	0.1247	0.0384	0.0441	0	0.2078	0.0081	0.1891
A	0.2264	0.0071	0.0856	0.0178	0.6897	0.2094	0.2756	0.0334	0.1254	0.0064	0.0666	0.0061	0.1881	0.0281	0.1686	0.0372
B	0.0700	0.1988	0.0280	0.0805	0.2591	0.6608	0.0506	0.2713	0.0168	0.1194	0.0077	0.0676	0.0902	0.1506	0.0590	0.1564

Table 9. Relative Proximity Preference Scores

Alternatives	Relative proximity value							
	KP	KD	KG	KT	KN	LS	LM	EP
S	0.1624	0.1208	0.1129	0.0832	0.1157	0.0945	0.0584	0.1371
T	0.0941	0.0181	0.0179	0.0346	0.0955	0.0180	0.0180	0.0237
U	0.2215	0.1241	0.1123	0.2756	0.2617	0.1669	0.0973	0.1115
K	0.0359	0.0882	0.1231	0.1166	0.0499	0.0777	0.1132	0.1144
P	0.2945	0.1846	0.1370	0.2816	0.1976	0.1933	0.1693	0.1129
L	0.0937	0.2286	0.2353	0.1820	0.2082	0.1969	0.2666	0.2163
M	0.2745	0.3658	0.3902	0.4131	0.5108	0.3471	0.3069	0.3086
R	0.8872	0.7983	0.9203	0.7245	0.9276	0.5347	1	0.9587
A	0.0307	0.1725	0.2329	0.1082	0.0492	0.0839	0.1301	0.1807
B	0.7394	0.7415	0.7182	0.8426	0.8765	0.8977	0.6254	0.7258

facilitate the interpretation of comparisons between criteria and alternatives in analyzing and observing the level of influence of each risk factor on the alternatives used in this study, namely, nine districts and one city in Bengkulu Province, in making strategic decisions regarding drug abuse in the region.

Based on the analysis of relative proximity values for the Personality (KP) criterion as listed in Figure 4, Rejang Lebong Regency shows significant dominance with a priority score of **0.8872**, indicating that individual personality aspects in this region play a crucial role in shaping tendencies toward drug abuse. This superior value clearly highlights the urgency of an individual psychology-based intervention approach in Rejang Lebong. Bengkulu City follows in second place with a score of **0.7394**, which is consistent with literature findings that social pressure and the complexity of the urban environment also reinforce the contribution of personality to the risk of addictive behavior [28]. Next, Kepahiang Regency ranked third with a score of **0.2945**, followed by Mukomuko with a score of **0.2745**, North Bengkulu with **0.2215**, South Bengkulu with **0.1624**, and Lebong with **0.09375**, indicating that personality still has a relevant influence but is relatively lower. On the other hand, Seluma and Kaur Districts obtained the lowest scores of **0.0307** and **0.0359**, respectively, indicating that personality factors in these regions tend to be less dominant and are likely to be more influenced by external determinants such as socio-communal dynamics or economic limitations. This distribution pattern as a whole reflects structural heterogeneity between regions in terms of psychosocial characteristics, while also emphasizing the need for a differential and contextual policy approach based on region, with a focus on strengthening protective personality factors, especially in regions that show a high level of priority.

Based on the results of preference calculations for the Anxiety and Depression (KD) criteria, it was found that Rejang Lebong Regency ranked highest with a score of **0.7983**, followed by Bengkulu City with a score of **0.7415**, indicating the highest levels of anxiety and depression among all regions. Mukomuko Regency ranked third with a score of **0.3658**, followed by Lebong Regency with **0.2286**, and Kepahiang Regency with **0.1846**. Seluma Regency ranked sixth with a score of **0.1725**, followed by North Bengkulu Regency in seventh place with a score of **0.1241**, and South Bengkulu Regency and Kaur with scores of **0.1208** and **0.0882**, respectively. The lowest position is

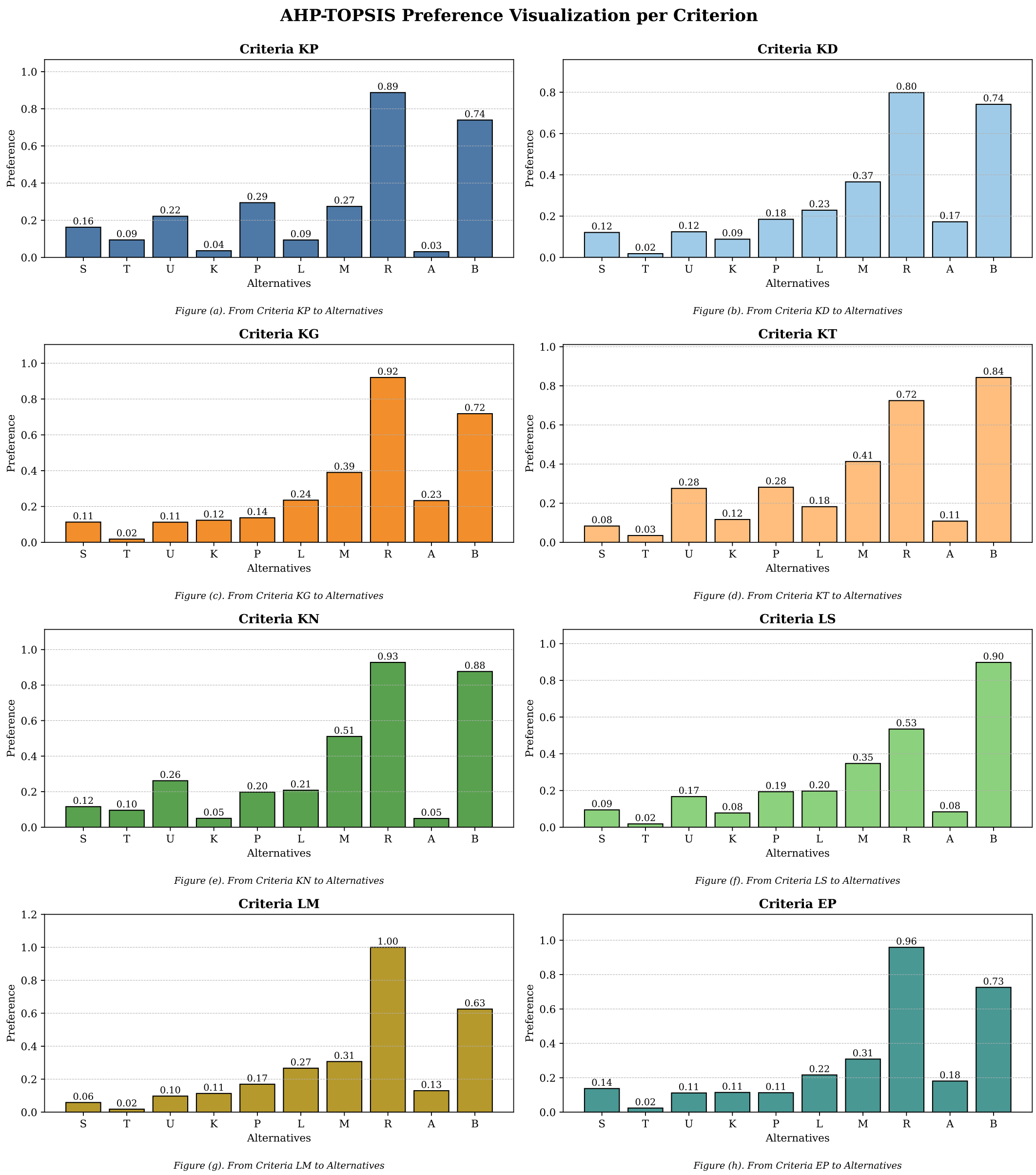

Figure 3. Results of Preference Values for Each Criterion to Alternatives

occupied by Central Bengkulu Regency with a score of only **0.0181**, indicating a relatively lower level of anxiety and depression compared to other regions. The distribution pattern of these preference scores reflects psychosocial disparities between regions, which can be interpreted as the influence of complex structural, social, and economic factors. Therefore, these results provide a strong analytical basis for formulating more adaptive and contextual policy interventions for mental health conditions in the Bengkulu Province.

Based on the results of calculations of relative proximity to the Family (KG) criteria, Rejang Lebong Regency ranks highest in priority with a score of **0.9203**, which explicitly confirms that family dynamics have a dominant influence on drug abuse trends in this region. This value not only shows the central role of family structure and function, but also indicates a potential relational crisis that needs to be addressed immediately through a community-based approach. Bengkulu City follows in second place with a score of **0.7182**, illustrating that in an urban context, family dysfunction remains a major risk factor requiring cross-sectoral intervention, in line with previous empirical findings regarding domestic pressures in urban areas [8]. Mukomuko and Lebong Districts ranked third and fourth with scores of **0.3902** and **0.2353**, respectively, which still reflect the significant influence of family factors, albeit with lower intensity. Furthermore, Seluma, Kepahiang, Kaur, and North Bengkulu Districts showed relatively moderate to low preference values with scores of **0.2329**, **0.1370**, **0.1231**, and **0.1123**, respectively. Meanwhile, South Bengkulu and Central Bengkulu Districts occupy the bottom two positions with scores of **0.1129** and **0.0179**, respectively, indicating that in these regions, family factors may be less of a primary determinant, and further exploration of other variables, such as social environment or economic resilience, is needed. In general, this distribution of values reflects the importance of the local context in understanding family-based vulnerability, while also emphasizing the urgency of preventive strategies that focus on strengthening family bonds as the front line in mitigating the risk of drug abuse.

The analysis of preferences for the Peer Group (KT) criterion shows that Bengkulu City received the highest score of **0.8426** reveals that Bengkulu City received the highest score of **0.8426**, indicating that peer pressure is the most significant determinant of, indicating that peer pressure is the most significant determining factor for the potential for drug abuse in this area. This finding indicates the strong social interaction and group dynamics among adolescents in shaping risky behavior patterns, which aligns with the theory of differential association in modern criminology. Rejang Lebong Regency is ranked second with a score of **0.7245**, reflecting a similar influence that might occur in a community-based local social context, where group norms can replace family norms in shaping individual behavior. Mukomuko Regency ranked third with a score of **0.4131**, followed by Kepahiang and North Bengkulu, which recorded scores of **0.2817** and **0.2756**, respectively. This indicates that although peer influence is still significant, its intensity is relatively more moderate. Lebong, Kaur, and Seluma districts ranked in the middle to lower positions with scores of **0.1821**, **0.1166**, and **0.1082**, indicating that peer-based interventions need to be designed more selectively according to demographic characteristics. South Bengkulu and Central Bengkulu districts recorded the lowest scores, **0.0832** and **0.0346**, respectively, indicating that the role of peer groups in these areas is relatively less dominant or may be overshadowed by other factors such as family ties or environmental conditions. Overall, the distribution of these preference values confirms that peer pressure has varying contributions across regions, and therefore, community-based policy approaches must consider local socio-cultural aspects to enhance the effectiveness of participatory and adaptive drug prevention strategies.

The results of the priority analysis based on the Drug Availability (KN) criteria revealed that Rejang Lebong Regency received the highest score of **0.9276**, which significantly indicates that the availability or ease of access to drugs in this area is the most dominant factor influencing the level of abuse vulnerability. This is potentially due to its strategic geographical position and distribution routes that are not fully monitored. Bengkulu City ranks second with a score of **0.8765**, indicating an almost equal level of exposure, which suggests that, as a center of social and economic activity, the city is highly vulnerable to the open circulation of drugs. Mukomuko Regency followed in third place with a score of **0.5108**, while North Bengkulu Regency and Lebong Regency were in the middle with scores of **0.2617** and **0.2082**, indicating a need for improved distribution monitoring at the local level. Kepahiang and South Bengkulu districts each scored **0.1976** and **0.1157**, indicating that although not dominant, the availability of drugs remains a factor that needs attention. Meanwhile, Central Bengkulu Regency, Kaur Regency, and Seluma recorded the lowest scores, at **0.0955**, **0.0499**, and **0.0492**, respectively, which can be interpreted as an indication of relative success in controlling distribution or geographical factors that limit access. This variation in scores highlights the importance of region-based management strategies that consider differences in accessibility and drug supply routes, allowing for more effective and evidence-based design of both preventive and repressive policy interventions.

Regarding the School Environment (LS) criteria, the analysis results show that Bengkulu City ranks highest with a preference score of **0.8977**, explicitly confirming that the characteristics of the school environment in this region significantly contribute to the vulnerability to drug abuse. This can be assumed due to the high social dynamics in schools, insufficient internal supervision, or poor implementation of prevention programs. Rejang Lebong Regency is ranked second with a score of **0.5347**, followed by Mukomuko Regency in third place with a score of **0.3471**. High scores in both regions also indicate that the educational environment there needs special attention in efforts to strengthen the protection system against the influence of narcotics. Lebong, Kepahiang, and North Bengkulu districts are in the middle position with scores of **0.1969**, **0.1933**, and **0.1669**, respectively, indicating moderate vulnerability potential that can still be controlled through school-based preventive approaches. Meanwhile, South Bengkulu and Seluma districts recorded relatively low scores, **0.0945** and **0.0839**, respectively, which may reflect a stricter school system or a more homogeneous educational community. Kaur and Central Bengkulu districts ranked the lowest with scores of **0.0777** and **0.0180**, indicating that school environmental factors in these areas are not considered to contribute significantly to the drug problem. This score distribution provides an important indication that strengthening the role of educational institutions as the main bulwark against drug abuse prevention must be contextually adjusted based on the risk level of each region.

In the Community Environment (LM) dimension, the analysis results show that Rejang Lebong Regency received the highest score of **1.0000**, indicating that the influence of the community's social environment in this area is very strong on the potential for drug abuse. Factors such as weak social control, exposure to user or dealer networks, and permissive social norms are believed to contribute to the high score. Bengkulu City followed in second place with a score of **0.6254**, reflecting that the urban community environment also significantly contributes to the vulnerability of drug abuse. Mukomuko Regency is in third place with a score of **0.3069**, followed by Lebong Regency with **0.2666** and Kepahiang Regency with **0.1693**. These five regions deserve priority in community-based intervention strategies. Meanwhile, Seluma Regency scored **0.1301**, Kaur Regency **0.1132**, and North Bengkulu Regency **0.0973**, placing them in the middle and still indicating potential risks that need to be mitigated. Meanwhile, South Bengkulu and Central Bengkulu districts occupy the bottom two positions with scores of **0.0584** and **0.0180**, respectively, indicating that the influence of the community environment on drug abuse in these two regions is relatively low, although regular monitoring is still necessary. Overall, these results reinforce the importance of a community-based approach in building social resilience against the threat of narcotics in Bengkulu Province.

In the Economic and Psychosocial (EP) dimension, Rejang Lebong Regency once again ranked at the top with a score of **0.9587**, indicating that factors such as economic pressure, psychosocial disorders, and social inequality have a very strong influence on the risk of drug abuse in the region. Bengkulu City followed with a score of **0.7258**, indicating that cities with high socioeconomic dynamics also face significant challenges in psychosocial aspects. Mukomuko Regency is in third place with a score of **0.3086**, indicating a moderate level of vulnerability. Meanwhile, Lebong Regency and Kepahiang Regency scored **0.2163** and **0.1129**, respectively, indicating a declining but still concerning influence. Kaur and North Bengkulu districts each scored **0.1144** and **0.1115**, respectively, indicating non-dominant but still relevant economic and psychosocial pressure. South Bengkulu and Seluma districts, with scores of **0.1371** and **0.1807**, respectively, are in the middle of the rankings, while Central Bengkulu district is at the bottom with a score of **0.0237**. This indicates that economic and psychosocial aspects in this region do not seem to be the main drivers in the context of drug abuse. This result underscores that drug prevention strategies must not only consider structural aspects but also more comprehensively address the psychosocial conditions of society, particularly in areas with high social and economic pressure.

After obtaining the contribution scores of each risk factor across the evaluated regions, as illustrated in Figure 3, the discussion proceeds to the formulation of targeted policy recommendations. This stage aims to translate the quantitative results into region-specific policy interventions that are aligned with the dominant risk characteristics of each district or city in Bengkulu Province. By explicitly considering the most influential risk factors in each region, the proposed recommendations provide a more contextual and actionable framework to support effective drug abuse prevention and intervention strategies at the local level.

5.5. *Targeted Policy Recommendations Based on Regional Risk Profiles*

Based on the preference mapping results obtained using the AHP–TOPSIS method for each risk criterion, each regency/city in Bengkulu Province exhibits distinct vulnerability characteristics, generally dominated by specific combinations of risk factors. Rejang Lebong Regency demonstrates a relatively high level of multidimensional vulnerability, while Bengkulu City and several other regions tend to exhibit more specific vulnerabilities, particularly related to social and environmental factors. Conversely, regions with relatively lower vulnerability levels, such as Central Bengkulu Regency, still show the dominance of certain risk factors that require preventive attention. These regional vulnerability patterns are visually illustrated in Figure 4. Therefore, the formulation of drug abuse prevention policies should be aligned with the dominant risk profiles of each region to ensure that

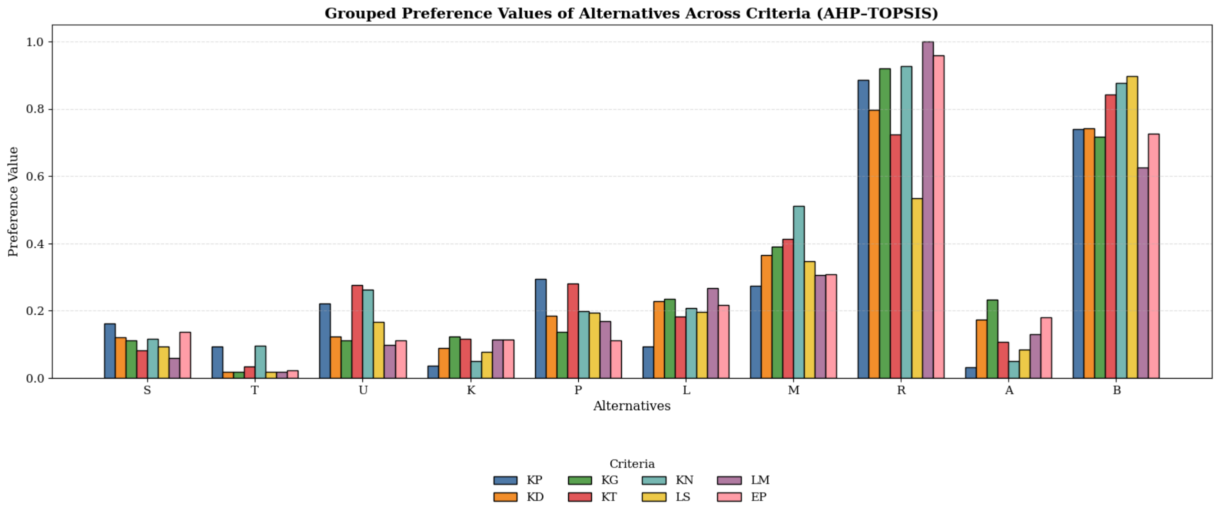

Figure 4. Grouped Preference Values of Alternatives Across Criteria

the implemented interventions are more targeted, effective, and context-sensitive. Furthermore, Table 10 presents targeted policy intervention recommendations for each regency/city in Bengkulu Province, taking into account the primary risk factors that most significantly contribute to drug abuse vulnerability levels in each respective region.

These targeted interventions demonstrate that the integrated AHP–TOPSIS model extends beyond regional ranking by providing an operational framework for evidence-based, region-specific drug abuse prevention policies.

Following the development of region-specific recommendations based on dominant risk factors, the next critical stage of the analysis is the determination of global priorities. This step is designed to identify the relative vulnerability levels across regions, ranging from the most vulnerable areas to those with lower risk levels. The global priority assessment offers a comprehensive overview of regional vulnerability patterns within Bengkulu Province and serves as a strategic foundation for resource allocation, intervention prioritization, and the formulation of preventive and mitigative policies in a more systematic and evidence-based manner.

5.6. Results of Global Priorities using the AHP-TOPSIS Method

Determining global priorities is the final stage in applying the hybrid AHP-TOPSIS method. In this study, this stage aims to identify the priority order in evaluating risk factors and rank districts/cities in Bengkulu Province that are vulnerable to drug abuse. This process is carried out by integrating the results of previous calculations into Equation 12, thus obtaining the final preference values used to compile a comprehensive global ranking, as presented below:

The final integration of the AHP-TOPSIS hybrid model produced a global prioritization of regional vulnerability to drug abuse in Figure 5, in which **Rejang Lebong Regency** ranked highest with a global score of **0.8822**. This result reflects a strong convergence of individual personality traits, drug availability, and psychosocial pressure, indicating a high level of underlying structural vulnerability compared to other regions. Importantly, this finding does not directly contradict prevalence-based statistics but instead highlights a conceptual distinction between current prevalence and latent vulnerability. While reported drug abuse cases in Bengkulu Province show the highest concentration in Bengkulu City, the model identifies Rejang Lebong as a region with a higher predictive risk profile, suggesting a potential future escalation if preventive interventions are not implemented proactively [7]. This interpretation is supported by previous findings indicating that Rejang Lebong has the highest number of designated dangerous villages or urban areas in the province, reflecting accumulated social and environmental risk factors [29].

Bengkulu City ranked second with a score of **0.7483**, indicating that despite its urban infrastructure and higher recorded prevalence, structural and social vulnerabilities—particularly those related to peer influence and

Table 10. Targeted Policy Interventions Based on Regional Risk Profiles

Region	Dominant Risk Factors	Regional Risk Profile	Targeted Policy Interventions
Rejang Lebong	Personality, Community Environment, Economic & Psychosocial, Anxiety & Depression, Family, Drug Availability	High multidimensional vulnerability driven by individual, familial, and structural factors	Integrated family strengthening programs; community-based mental health services; psychosocial intervention and economic empowerment; intensified drug supply control; cross-sectoral coordination
Bengkulu City	School Environment, Drug Availability	School-centered vulnerability reinforced by structural exposure to drug availability	School-based prevention programs; strengthened school counseling units; collaboration with law enforcement to control drug access around educational environments
Mukomuko	Peer Group, Drug Availability	Social exposure combined with external drug accessibility	Peer group intervention programs; community awareness campaigns; enhanced monitoring of drug distribution
Lebong	Community Environment, Family	Social-environmental and household-based vulnerability	Community resilience development; family counseling and parenting education; community surveillance
Kepahiang	Personality, Peer Group	Individual behavioral risk reinforced by peer influence	Psychosocial support services; youth mentoring programs; peer-based prevention strategies
North Bengkulu	Peer Group, Drug Availability	Peer-driven risk with structural exposure	Peer intervention programs; preventive outreach; strengthened coordination with law enforcement
Seluma	Family, Economic & Psychosocial	Socio-economic and family-related vulnerability	Family assistance programs; psychosocial support; integration with social protection policies
South Bengkulu	Personality, Economic & Psychosocial	Individual and socio-economic vulnerability	Mental health promotion; economic empowerment initiatives; early prevention programs
Kaur	Family, Peer Group	Household and peer-related vulnerability	Family-based intervention; peer group monitoring; community education
Central Bengkulu	Drug Availability, Personality	Low overall vulnerability with specific external exposure	Preventive monitoring; early warning systems; maintenance of protective social structures

school environments—continue to play a critical role in shaping addictive behavior patterns. **Mukomuko Regency** ranked third **0.3708**, which aligns with hypotheses suggesting that peripheral and transit regions are exposed to elevated risks due to drug distribution routes and limited community surveillance [30]. Regions with moderate scores, including **Lebong Regency 0.2094**, **Kepahiang 0.1851**, **North Bengkulu 0.1598**, and **Seluma 0.1566**, exhibit intermediate levels of vulnerability that require sustained preventive management through community-based and psychosocial interventions. Meanwhile, **South Bengkulu 0.1110**, **Kaur 0.1024**, and **Central Bengkulu 0.0350** recorded the lowest global scores, indicating relatively lower vulnerability; however, continuous monitoring remains essential to prevent future risk escalation.

From an analytical perspective, these findings confirm that the proposed model measures multidimensional vulnerability rather than historical case counts. This distinction is consistent with the bioecological framework,

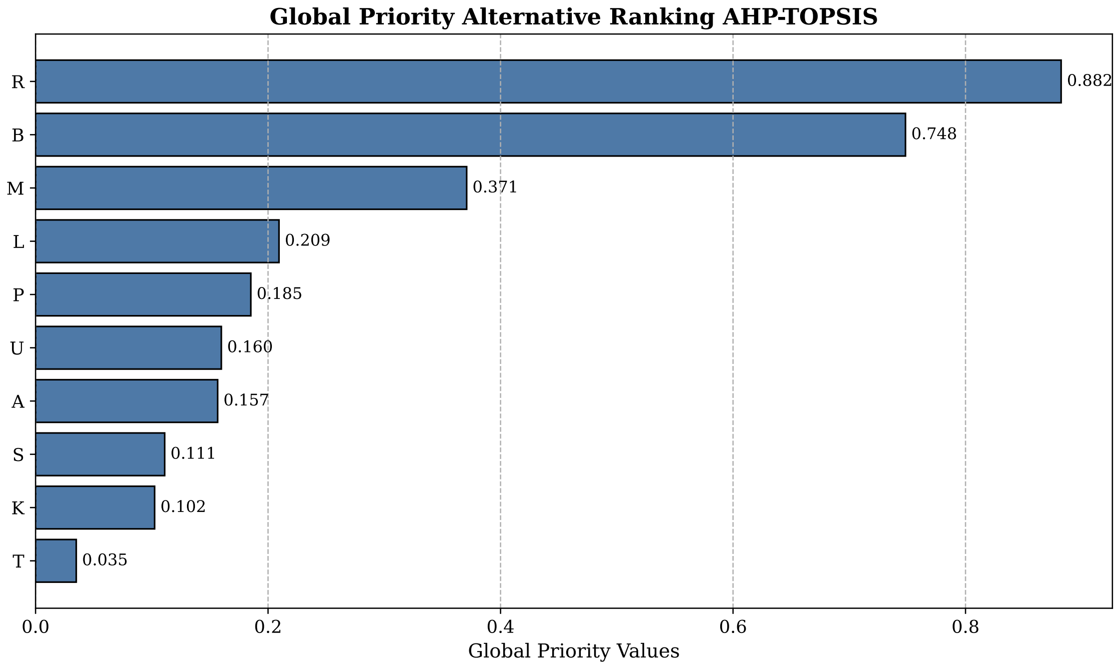

Figure 5. Global Priority Score Results Using the Hybrid AHP-TOPSIS Method

which emphasizes that cumulative exposure to family, peer, school, and environmental factors significantly increases the likelihood of substance abuse over time [31, 32]. Furthermore, the interaction between social pressure and weakened community support systems in high-ranking regions reinforces the Social Development Model [33], which highlights the importance of strengthening protective social structures as a primary prevention strategy [34, 35].

In terms of policy implications, the global ranking provides a practical basis for operational decision-making by the National Narcotics Board (BNN) and local governments. Regions with high vulnerability scores, such as Rejang Lebong and Bengkulu City, should be prioritized for resource reallocation, including targeted family-based interventions, mental health services, and intensified drug supply control. Moderate-risk regions require preventive outreach and early detection programs, while low-risk regions should focus on maintaining protective social structures through routine monitoring and community engagement. To ensure sustainability, these interventions should be supported by a structured policy implementation framework encompassing cross-sectoral coordination, stakeholder engagement, and continuous monitoring and evaluation mechanisms. Thus, the AHP–TOPSIS-based vulnerability assessment not only enhances predictive insight but also serves as an evidence-based foundation for proactive, region-specific drug abuse prevention policies.

5.7. Sensitivity Analysis

Sensitivity analysis was conducted to evaluate the robustness of the decision outcomes generated by the proposed hybrid AHP–TOPSIS model under potential uncertainty in criteria weighting. Although the criteria weights derived from the AHP procedure satisfied the consistency requirement (Consistency Ratio < 0.1), sensitivity analysis was incorporated as an additional validation step to ensure that the resulting regional prioritization is not overly influenced by moderate variations in expert judgment. Given that the criteria KG and KT were identified as the most influential factors, the analysis specifically examined the impact of perturbations in these dominant criteria on the resulting TOPSIS preference scores.

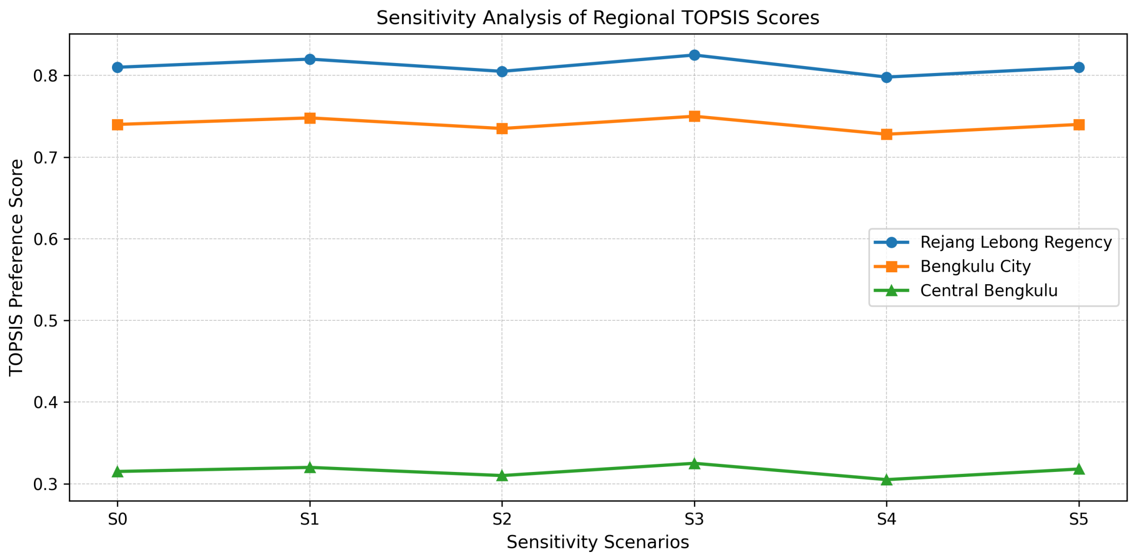

Figure 6. Sensitivity analysis of regional TOPSIS preference scores under variations in the dominant criteria weights

A one-way sensitivity analysis was performed by varying the weights of the dominant criteria (KG and KT) by $\pm 5\%$ and $\pm 10\%$ from their original values, followed by proportional normalization of the remaining criteria weights to maintain a total weight of one. For each scenario, the TOPSIS method was re-applied to recalculate preference scores. The results indicate a high level of stability in the decision outcomes: Rejang Lebong Regency consistently exhibits the highest preference scores across all scenarios, followed by Bengkulu City, while Central Bengkulu remains in the lowest position. Although minor numerical fluctuations in TOPSIS scores are observed, no rank reversal occurs, demonstrating that the model's recommendations are structurally robust and reliable under reasonable variations in criteria weights.

Figure 6 illustrates the variation of TOPSIS preference scores across the sensitivity scenarios. The relatively parallel trends and consistent separation between regions indicate that changes in criteria weights primarily affect the magnitude of preference scores rather than the relative ranking order. This graphical evidence further confirms the robustness of the proposed AHP–TOPSIS model and supports its applicability as a reliable decision-support tool for regional drug abuse prevention policy formulation.

6. Conclusion

Based on the findings of this study, the hybrid AHP–TOPSIS model has proven effective in analyzing the relationship between multidimensional risk factors and regional vulnerability to drug abuse in Bengkulu Province. The AHP method facilitates the derivation of consistent priority weights for each criterion and alternatives, which are subsequently integrated into the TOPSIS framework to objectively rank ten regencies and cities according to their proximity to the ideal solution. The results indicate that social, psychological, and structural factors jointly shape regional vulnerability patterns, with Rejang Lebong Regency identified as the most vulnerable area, followed by Bengkulu City, Mukomuko Regency, Lebong, Kepahiang, North Bengkulu, Seluma, South Bengkulu, and Kaur, while Central Bengkulu Regency consistently exhibits the lowest risk level. The resulting rankings demonstrate conceptual alignment with institutional observations reported by the National Narcotics Agency (BNN) and rehabilitation service providers, particularly in high-risk regions, thereby reinforcing the model's relevance as an evidence-based policy support tool. Although the empirical findings are context-specific to Bengkulu Province, the proposed hybrid AHP–TOPSIS framework is methodologically transferable and can be replicated in other Indonesian provinces or extended to cross-regional comparative studies by adapting the criteria and expert inputs to local socio-demographic conditions. Nevertheless, the proposed model remains static, as it is based on expert judgments and institutional conditions reflecting the year 2024; therefore, future studies are encouraged to strengthen empirical validation by correlating TOPSIS scores with real-world indicators such as BNN case reports or rehabilitation center data, as well as to extend the framework through dynamic approaches such as Fuzzy AHP–TOPSIS or time-series integration to capture temporal risk evolution. Overall, the integrated AHP–TOPSIS framework is recommended as a strategic analytical tool to support targeted prevention policies and resource allocation in drug abuse mitigation at both regional and national levels.

Acknowledgment

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A. Appendix A. Paired Comparison of Research Data

1. Paired Comparison Data Based on Criteria (Risk Factors)

	KP	KD	KG	KT	KN	LS	LM	EP
KP	1	2	1/4	1/2	2	3	2	2
KD	1/2	1	1/7	1/3	1/2	2	1/3	1/2
KG	4	7	1	6	5	8	5	6
KT	2	3	1/6	1	3	3	4	1/2
KN	1/2	2	1/5	1/3	1	3	1/2	1
LS	1/3	1/2	1/8	1/3	1/3	1	1/3	1/4
LM	1/2	3	1/5	1/4	2	3	1	2
EP	1/2	2	1/6	2	1	4	1/2	1

2. Paired Comparison Data Based on KP Criteria to Alternatives

	S	T	U	K	P	L	M	R	A	B
S	1	5	1/3	2	1/4	1/2	1/3	1/7	2	1/8
T	1/5	1	1/5	2	1/3	1/2	1/3	1/7	3	1/8
U	3	5	1	2	1/2	2	1/2	1/5	3	1/6
K	1/2	1/2	1/2	1	1/4	1	1/2	1/7	1	1/8
P	4	3	2	4	1	4	1/2	1/5	4	1/6
L	2	2	1/2	1	1/4	1	1/3	1/6	1	1/7
M	3	3	2	2	2	3	1	1/3	3	1/3
R	7	7	5	7	5	6	3	1	7	2
A	1/2	1/3	1/3	1	1/4	1	1/3	1/7	1	1/5
B	8	8	6	8	6	7	3	1/2	5	1

3. Paired Comparison Data Based on KD Criteria to Alternatives

	S	T	U	K	P	L	M	R	A	B
S	1	2	1/2	2	2	1/2	1/3	1/8	1/2	1/6
T	1/2	1	1/2	1/2	1/3	1/2	1/4	1/8	1/2	1/7
U	2	2	1	1/2	2	1/2	1/3	1/6	1/4	1/6
K	1/2	2	2	1	1/3	1/2	1/4	1/7	1	1/8
P	1/2	3	1/2	3	1	1/2	1/3	1/4	3	1/5
L	2	2	2	2	2	1	1/3	1/6	4	1/7
M	3	4	3	4	3	3	1	1/2	3	1/4
R	8	8	6	7	4	6	2	1	5	2
A	2	2	4	1	1/3	1/4	1/3	1/5	1	1/5
B	6	7	6	8	5	7	4	1/2	5	1

4. Paired Comparison Data Based on KG Criteria to Alternatives

	S	T	U	K	P	L	M	R	A	B
S	1	2	1/2	1/2	3	1/2	1/4	1/7	1/3	1/8
T	1/2	1	1/3	1/2	1/3	1/2	1/5	1/6	1/3	1/7
U	2	3	1	1/2	1	1/2	1/3	1/6	1/2	1/6
K	2	2	2	1	1/3	1/2	1/5	1/6	1	1/6
P	1/3	3	1	3	1	1/3	1/4	1/7	1/5	1/6
L	2	2	2	2	3	1	1/2	1/5	3	1/6
M	4	5	3	5	4	2	1	1/4	3	1/3
R	7	6	6	6	7	5	4	1	5	2
A	3	3	2	1	5	1/3	1/3	1/5	1	1/4
B	8	7	6	6	6	6	3	1/2	4	1

5. Paired Comparison Data Based on KT Criteria to Alternatives

	S	T	U	K	P	L	M	R	A	B
S	1	3	1/4	1	1/2	1/4	1/3	1/9	1/3	1/8
T	1/3	1	1/5	1/4	1/4	1/3	1/4	1/6	1	1/7
U	4	5	1	3	1/2	2	1/3	1/5	4	1/5
K	1	4	1/3	1	1/4	1/2	1/4	1/7	1	1/6
P	2	4	2	4	1	3	1/3	1/6	3	1/4
L	4	3	1/2	2	1/3	1	1/5	1/6	2	1/4
M	3	4	3	4	3	5	1	1/2	2	1/3
R	9	6	5	7	6	6	2	1	6	1/2
A	3	1	1/4	1	1/3	1/2	1/2	1/6	1	1/6
B	8	7	5	6	4	4	3	2	6	1

6. Paired Comparison Data Based on KN Criteria to Alternatives

	S	T	U	K	P	L	M	R	A	B
S	1	2	1/3	3	1/2	1/4	1/4	1/8	2	1/8
T	1/2	1	1/5	3	1/2	1/4	1/6	1/7	2	1/6
U	3	5	1	2	1/2	2	1/3	1/7	4	1/6
K	1/3	1/3	1/2	1	1/2	1	1/5	1/8	1	1/7
P	2	2	2	2	1	2	1/6	1/7	3	1/5
L	4	4	1/2	1	1/2	1	1/2	1/5	1	1/6
M	4	6	3	5	6	2	1	1/2	4	1/2
R	8	7	7	8	7	5	2	1	7	1
A	1/2	1/2	1/4	1	1/3	1	1/4	1/7	1	1/8
B	8	6	6	7	5	6	2	1	8	1

7. Paired Comparison Data Based on LS Criteria to Alternatives

	S	T	U	K	P	L	M	R	A	B
S	1	3	1/2	2	1/2	1/2	1/3	1/7	1	1/7
T	1/3	1	1/2	1/2	1/2	1/2	1/4	1/8	1/3	1/8
U	2	2	1	2	1/3	2	1/2	1/6	3	1/5
K	1/2	2	1/2	1	1/3	1/4	1/4	1/5	2	1/8
P	2	2	3	3	1	1/3	1/2	1/2	2	1/8
L	2	2	1/2	4	3	1	1/6	1/5	1	1/4
M	3	4	2	4	2	6	1	1/2	3	1/5
R	7	8	6	5	2	5	2	1	6	1/3
A	1	3	1/3	1/2	1/2	1	1/3	1/6	1	1/7
B	7	8	5	8	8	4	5	3	7	1

8. Paired Comparison Data Based on LM Criteria to Alternatives

	S	T	U	K	P	L	M	R	A	B
S	1	2	1/2	1	1/2	1/2	1/3	1/9	1	1/7
T	1/2	1	1/3	1/2	1/3	1/4	1/5	1/7	1/2	1/5
U	2	3	1	1/3	1/3	1/2	1/3	1/8	1/2	1/6
K	1	2	3	1	1/3	1/2	1/3	1/8	1/2	1/8
P	2	3	3	3	1	1/3	1/4	1/6	1/2	1/5
L	2	4	2	2	3	1	2	1/6	3	1/6
M	3	5	3	3	4	1/2	1	1/4	3	1/3
R	9	7	8	8	6	6	4	1	6	3
A	1	2	2	2	2	1/3	1/3	1/6	1	1/6
B	7	5	6	8	5	6	3	1/3	6	1

9. Paired Comparison Data Based on EP Criteria to Alternatives

	S	T	U	K	P	L	M	R	A	B
S	1	4	1/2	1/2	2	1/2	1/2	1/9	1/2	1/9
T	1/4	1	1/3	1/2	1/3	1/3	1/5	1/7	1/2	1/5
U	2	3	1	1/2	1	1/2	1/2	1/7	1/3	1/6
K	2	2	2	1	1/2	1/2	1/2	1/8	1	1/7
P	1/2	3	1	2	1	1/2	1/2	1/7	1/3	1/6
L	2	3	2	2	2	1	1/2	1/7	4	1/7
M	2	5	2	2	2	2	1	1/3	5	1/3
R	9	7	7	8	7	7	3	1	6	2
A	2	2	3	1	3	1/4	1/5	1/6	1	1/7
B	9	5	6	7	6	7	3	1/2	7	1

B. Results of Weighted Normalized Matrix Values for Each Criterion to Alternative

1. Based on the previous data, the weighted normalized matrix values for the AHP-TOPSIS criteria from KP to alternatives are obtained as follows:

	S	T	U	K	P	L	M	R	A	B
S	0.00916	0.04146	0.00449	0.01861	0.00347	0.00522	0.00844	0.01299	0.02033	0.00616
T	0.00183	0.00829	0.00269	0.01861	0.00462	0.00522	0.00844	0.01299	0.03049	0.00616
U	0.02749	0.04146	0.01346	0.01861	0.00693	0.02088	0.01259	0.01818	0.03049	0.00821
K	0.00458	0.00415	0.00673	0.00933	0.00347	0.01044	0.01259	0.01299	0.01016	0.00616
P	0.03666	0.02487	0.02691	0.03722	0.01387	0.04177	0.01259	0.01818	0.04066	0.00821
L	0.01833	0.01658	0.00673	0.00933	0.00347	0.01044	0.00844	0.01515	0.01016	0.00704
M	0.02749	0.02487	0.02691	0.01861	0.02774	0.03133	0.02519	0.03033	0.03049	0.01643
R	0.06415	0.05804	0.06728	0.06513	0.06934	0.06265	0.07556	0.09099	0.07115	0.09858
A	0.00458	0.00276	0.00449	0.00933	0.00347	0.01044	0.00844	0.01299	0.01016	0.00986
B	0.07332	0.06633	0.08073	0.07443	0.08321	0.07309	0.07556	0.04545	0.05082	0.04929

2. Based on the previous data, the weighted normalized matrix values for the AHP-TOPSIS criteria from KD to alternatives are obtained as follows:

	S	T	U	K	P	L	M	R	A	B
S	0.00413	0.00726	0.00222	0.00752	0.01151	0.00233	0.00328	0.00438	0.00246	0.00333
T	0.00207	0.00363	0.00222	0.00188	0.00192	0.00233	0.00246	0.00438	0.00246	0.00285
U	0.00827	0.00726	0.00443	0.00188	0.01151	0.00233	0.00328	0.00584	0.00123	0.00333
K	0.00207	0.00726	0.00887	0.00376	0.00192	0.00233	0.00246	0.00555	0.00492	0.00255
P	0.00207	0.01099	0.00222	0.01128	0.00576	0.00233	0.00328	0.00876	0.01477	0.00444
L	0.00827	0.00726	0.00887	0.00752	0.01151	0.00467	0.00328	0.00584	0.01969	0.00285
M	0.01244	0.01453	0.01333	0.01503	0.01727	0.01444	0.00984	0.01751	0.01477	0.00555
R	0.03307	0.02906	0.02666	0.02631	0.02302	0.02888	0.01967	0.03503	0.02461	0.03996
A	0.00827	0.00726	0.01773	0.00376	0.00192	0.00117	0.00328	0.00701	0.00492	0.00444
B	0.02488	0.02543	0.02666	0.03007	0.02878	0.03267	0.03935	0.01751	0.02461	0.01998

3. Based on the previous data, the weighted normalized matrix values for the AHP-TOPSIS criteria from KG to alternatives are obtained as follows:

	S	T	U	K	P	L	M	R	A	B
S	0.03276	0.06583	0.02064	0.01898	0.10001	0.02458	0.01951	0.04676	0.01713	0,02184
T	0.01638	0.03291	0.01376	0.01898	0.01111	0.02458	0.01561	0.05455	0.01713	0.02496
U	0.06553	0.09874	0.04128	0.01898	0.03334	0.02458	0.02601	0.05455	0.02577	0.02913
K	0.06553	0.06583	0.08256	0.03796	0.01111	0.02458	0.01561	0.05455	0.05144	0.02913
P	0.01092	0.09874	0.04128	0.11389	0.03334	0.01639	0.01951	0.04676	0.01028	0.02913
L	0.06553	0.06583	0.08256	0.07592	0.10001	0.04917	0.03902	0.06546	0.15419	0.02913
M	0.13106	0.16456	0.12384	0.18981	0.13334	0.09833	0.07804	0.08183	0.15419	0.05825
R	0.22935	0.19748	0.24767	0.22777	0.23335	0.24583	0.31218	0.32732	0.25698	0.34951
A	0.09829	0.09874	0.08256	0.03796	0.16668	0.01639	0.02601	0.06546	0.05144	0.04369
B	0.26212	0.23039	0.24767	0.22777	0.20001	0.29499	0.23413	0.16366	0.20559	0.17475

4. Based on the previous data, the weighted normalized matrix values for the AHP-TOPSIS criteria from KT to alternatives are obtained as follows:

	S	T	U	K	P	L	M	R	A	B
S	0.01032	0.03292	0.00456	0.01269	0.00923	0.00382	0.01271	0.00698	0.00469	0.01439
T	0.00344	0.01097	0.00365	0.00317	0.00462	0.00511	0.00953	0.01047	0.01408	0.01644
U	0.04129	0.05487	0.01823	0.03807	0.00923	0.03058	0.01271	0.01256	0.05632	0.02302
K	0.01032	0.04389	0.00608	0.01269	0.00462	0.00765	0.00953	0.00897	0.01408	0.01918
P	0.02065	0.04389	0.03645	0.05077	0.01847	0.04587	0.01271	0.01047	0.04224	0.02878
L	0.04129	0.03292	0.00911	0.02538	0.00616	0.01529	0.00762	0.01047	0.02816	0.02878
M	0.03097	0.04389	0.05468	0.05077	0.05544	0.07645	0.03812	0.03144	0.02816	0.03837
R	0.09291	0.06584	0.09113	0.08884	0.11088	0.09174	0.07624	0.06288	0.08448	0.05755
A	0.03097	0.01097	0.00456	0.01269	0.00616	0.00765	0.01906	0.01047	0.01408	0.01918
B	0.08259	0.07681	0.09113	0.07615	0.07387	0.06116	0.11436	0.12561	0.08448	0.11511

5. Based on the previous data, the weighted normalized matrix values for the AHP-TOPSIS criteria from KN to alternatives are obtained as follows:

	S	T	U	K	P	L	M	R	A	B
S	0.00531	0.01073	0.00234	0.01633	0.00331	0.00201	0.00567	0.00477	0.01093	0.00563
T	0.00266	0.00536	0.00141	0.01633	0.00331	0.00201	0.00378	0.00545	0.01093	0.00751
U	0.01594	0.02681	0.00703	0.01086	0.00331	0.01609	0.00756	0.00545	0.02186	0.00751
K	0.00177	0.00179	0.00352	0.00543	0.00331	0.00805	0.00454	0.00477	0.00547	0.00644
P	0.01063	0.01073	0.01406	0.01086	0.00662	0.01609	0.00378	0.00545	0.01644	0.00902
L	0.02125	0.02145	0.00352	0.00543	0.00331	0.00805	0.01134	0.00763	0.00547	0.00751
M	0.02125	0.03218	0.02109	0.02716	0.03974	0.01609	0.02268	0.01907	0.02186	0.02254
R	0.04255	0.03754	0.04921	0.04346	0.04636	0.04023	0.04536	0.03814	0.03826	0.04508
A	0.00266	0.00268	0.00176	0.00543	0.00221	0.00805	0.00567	0.00545	0.00547	0.00563
B	0.04255	0.03218	0.04218	0.03803	0.03311	0.04828	0.04536	0.03814	0.04372	0.04508

6. Based on the previous data, the weighted normalized matrix values for the AHP-TOPSIS criteria from LS to alternatives are obtained as follows:

	S	T	U	K	P	L	M	R	A	B
S	0.00283	0.00777	0.00179	0.00528	0.00171	0.00171	0.00187	0.00136	0.00292	0.00385
T	0.00094	0.00233	0.00179	0.00132	0.00171	0.00171	0.00144	0.00119	0.00097	0.00337
U	0.00566	0.00466	0.00358	0.00528	0.00114	0.00682	0.00281	0.00159	0.00876	0.00539
K	0.00142	0.00466	0.00179	0.00264	0.00114	0.00085	0.00144	0.00191	0.00584	0.00337
P	0.00566	0.00466	0.01073	0.00792	0.00343	0.00114	0.00281	0.00478	0.00584	0.00337
L	0.00566	0.00466	0.00179	0.01057	0.01028	0.00341	0.00094	0.00191	0.00292	0.00673
M	0.00855	0.00933	0.00715	0.01057	0.00685	0.02046	0.00562	0.00478	0.00876	0.00539
R	0.01982	0.01866	0.02146	0.01321	0.00685	0.01705	0.01123	0.00955	0.01752	0.00898
A	0.00283	0.00777	0.00119	0.00132	0.00171	0.00341	0.00187	0.00159	0.00292	0.00385
B	0.01982	0.01866	0.01788	0.02113	0.02744	0.01364	0.02808	0.02865	0.02045	0.02694

7. Based on the previous data, the weighted normalized matrix values for the AHP-TOPSIS criteria from LM to alternatives are obtained as follows:

	S	T	U	K	P	L	M	R	A	B
S	0.00787	0.01619	0.00419	0.00782	0.00511	0.00567	0.00599	0.00945	0.01014	0.00435
T	0.00394	0.00809	0.00279	0.00391	0.00341	0.00284	0.00354	0.01216	0.00507	0.00609
U	0.01575	0.02428	0.00838	0.00261	0.00341	0.00567	0.00599	0.01064	0.00507	0.00508
K	0.00787	0.01619	0.02513	0.00782	0.00341	0.00567	0.00599	0.01064	0.00507	0.00381
P	0.01575	0.02428	0.02513	0.02346	0.01022	0.00378	0.00442	0.01418	0.00507	0.00609
L	0.01575	0.03238	0.01675	0.01564	0.03066	0.01135	0.03539	0.01418	0.03042	0.00508
M	0.02362	0.04047	0.02513	0.02346	0.04088	0.00567	0.01777	0.02127	0.03042	0.01015
R	0.07087	0.05666	0.06777	0.06257	0.06132	0.06808	0.07078	0.08509	0.06085	0.09137
A	0.00787	0.01619	0.01675	0.01564	0.02044	0.00378	0.00599	0.01418	0.01014	0.00508
B	0.05512	0.04047	0.05025	0.06257	0.05111	0.06808	0.05309	0.02836	0.06085	0.03046

8. Based on the previous data, the weighted normalized matrix values for the AHP-TOPSIS criteria from EP to alternatives are obtained as follows:

	S	T	U	K	P	L	M	R	A	B
S	0.00682	0.03008	0.00444	0.00409	0.01775	0.00453	0.01025	0.00839	0.00407	0.00447
T	0.00171	0.00752	0.00296	0.00409	0.00296	0.00302	0.00411	0.01078	0.00407	0.00804
U	0.01365	0.02256	0.00888	0.00409	0.00888	0.00453	0.01025	0.01078	0.00271	0.00677
K	0.01365	0.01504	0.01775	0.00818	0.00444	0.00453	0.01025	0.00944	0.00814	0.00574
P	0.00341	0.02256	0.00888	0.01635	0.00888	0.00453	0.01025	0.01078	0.00271	0.00677
L	0.01365	0.02256	0.01775	0.01635	0.01775	0.00905	0.01025	0.01078	0.03258	0.00574
M	0.01365	0.03766	0.01775	0.01635	0.01775	0.01811	0.02049	0.02516	0.04072	0.01344
R	0.06142	0.05264	0.06213	0.06544	0.06213	0.06337	0.06148	0.07548	0.04886	0.08042
A	0.01365	0.01504	0.02663	0.00818	0.02663	0.00226	0.00411	0.01258	0.00814	0.00574
B	0.06142	0.03766	0.05326	0.05723	0.05326	0.06337	0.06148	0.03774	0.05701	0.04021

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