# Analytical Hierarchy Process Approach in Determining the Weight of Crime Vulnerability Information in Food and Drug Control

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ABSTRACT / ABSTRAK

Referring to the previous 2020-2024 RPJMN period, it has been identified that the existing court decision indicators for convictions do not encompass all functions within the Deputy of Law Enforcement of The Indonesian Food and Drug Authority (Indonesian FDA), thereby failing to holistically represent the effectiveness of law enforcement against drug and food crimes. One strategic activity not reflected in these indicators is the crime vulnerability mapping function within the Law Enforcement Dashboard (ADP). However, the crime vulnerability mapping system remains limited due to its inability to assign weighted values based on the accuracy of information during data input. Addressing this issue, a study was conducted to develop a crime vulnerability score for drug and food crimes based on information source criteria, serving as a proposed consideration for designing performance indicators for the upcoming RPJMN period. Employing a mixed-methods approach, the study utilized quantitative methods through Analytical Hierarchy Process (AHP) and qualitative methods through surveys, involving 33 respondents from diverse backgrounds. The findings revealed that the highest-weighted information source criteria in assessing crime vulnerability were Investigation Results on Drugs and Food (0.225), Intelligence Operations Results on Drugs and Food (0.150), and Surveillance Results on Drugs and Food (0.141). These findings can be further elaborated through broader surveys involving experts in drug and food crime prevention, enabling the proposed "Drug and Food Crime Vulnerability Index" to be advanced as an output indicator for the Indonesian FDA Law Enforcement program objectives.

*Merujuk pada periode RPJMN 2020-2024, diketahui Indikator Kinerja putusan pengadilan yang dinyatakan bersalah belum mencakup seluruh fungsi di Deputi Bidang Penindakan Badan POM sehingga belum dapat menggambarkan secara holistik bagaimana efektivitas penegakan hukum terhadap kejahatan Obat dan Makanan. Salah satu kegiatan strategis yang belum tergambarkan dalam indikator tersebut adalah fungsi pemetaan kerawanan kejahatan yang terintegrasi pada Aplikasi Dashboard Penindakan (ADP). Namun, pemetaan kerawanan kejahatan masih memiliki keterbatasan karena belum mampu memberikan bobot nilai sesuai dengan akurasi informasi pada saat dilakukan input data. Berdasarkan permasalahan tersebut, maka dilakukan penelitian yang bertujuan untuk menyusun nilai kerawanan kejahatan Obat dan Makanan berdasarkan kriteria sumber informasi, sebagai salah satu pertimbangan usulan dalam pemantauan indikator kinerja. Penelitian dilakukan menggunakan metodologi mix method yaitu melalui pendekatan kuantitatif menggunakan Analytical Hierarchy Process (AHP) dan pendekatan kualitatif menggunakan survei, dengan melibatkan 33 responden yang berasal dari latar belakang yang beragam. Hasil penilaian menunjukkan bahwa kriteria sumber informasi dengan bobot tertinggi dalam penilaian kerawanan kejahatan Obat dan Makanan yaitu Hasil Penyidikan Obat dan Makanan (0,225), Hasil Kegiatan/Operasi Intelijen Obat dan Makanan (0,150), dan Hasil Pengawasan Obat dan Makanan (0,141). Temuan pada kajian ini dapat dielaborasi melalui survei lanjutan dengan cakupan lebih luas dan melibatkan ahli yang kompeten di bidang pencegahan kejahatan Obat dan Makanan, sehingga proyeksi usulan "Indeks kerawanan kejahatan Obat dan Makanan" dapat diusulkan menjadi salah satu indikator output pada sasaran program Deputi Bidang Penindakan.*

**Keywords:** *crime vulnerability, crime prevention, law enforcement*
**Kata Kunci:** cegah tangkal, indikator penindakan, kerawanan kejahatan

## 1. Introduction

Currently, the handling and prevention of food and drug-related crimes remain largely based on a classical criminalistic approach, focusing primarily on the perpetrator, victim, and crime scene. This is reflected in the strategic objectives of the enforcement function outlined in the Regulation of The Indonesian Food and Drug Authority (BPOM, 2020a), concerning the Indonesian FDA's Strategic Plan for 2020–2024. According to the organizational vision document, the strategic objective of the enforcement function is to enhance the effectiveness of law enforcement against food and drug crimes, as measured by the output indicator of the percentage of court decisions resulting in guilty verdicts. However, referring to The Indonesian FDA Regulation Number 21 of 2020 concerning the Organization and Work Procedures of The Indonesian FDA (BPOM, 2020b), the Deputy of Law Enforcement is responsible for preventive, intelligence, and investigative functions. Therefore, the output indicator of guilty court decisions does not encompass all tasks within the Deputy of Law Enforcement and thus does not fully reflect the effectiveness of law enforcement against food and drug crimes.

A review of law enforcement performance indicators across several ministries and agencies reveals that some already have indicators that adequately reflect their assigned tasks and functions. The Directorate General of Customs and Excise, as per the Director General's Decision Number KEP-198/BC/2020, has a strategic objective of providing optimal protection and support for the economy and society, operationalized through performance indicators such as the percentage of effectiveness in supervising narcotics, psychotropics, precursors, and restricted goods. Activities include law enforcement in customs and excise, measured by indicators such as the percentage of completed investigations confirmed by the prosecutor (P21), rate of successful supervision of illegal excise goods (BKC), and percentage of operations resulting in actions against narcotics, psychotropics, and precursors (NPP). Similarly, the National Narcotics Agency, as per Head Regulation Number 6 of 2020 (BNN, 2020), emphasizes the strategic objective of increasing the prevention and eradication of illicit drug abuse and trafficking (P4GN), operationalized through the P4GN Index as a performance indicator.

At a global level, current discourse within the Criminal Justice System has reached a consensus that the key drivers of future law enforcement involve complex interactions. According to Silberglitt et al. (2015) in a study on the vision of law enforcement referenced by the U.S. Department of Justice for 2024–2034, two main clusters influence public order in norm compliance: societal trend changes and technological developments. In this context, law enforcement requires a multi-perspective approach, utilizing the PESTEL framework (Politics, Economy, Society, Technology, Environment, and Law).

Based on those data, it can be understood that there is a gap between the current representation of food and drug crime through The Indonesian FDA’s output indicators and expected condition in the future within the global strategic environment. The output indicator for the strategic objective of increasing law enforcement effectiveness cannot rely solely on a single criminal law perspective. However, it must also include preventive and intelligent functions, incorporating political, economic, social, technological, and environmental perspectives. In the preventive function, the Deputy of Law Enforcement currently implements tasks through crime vulnerability mapping, analysis of food and drug crime, and stakeholder engagement. Among these business processes, crime vulnerability mapping can serve as an indicator of enforcement effectiveness.

Research specifically addressing crime vulnerability assessment in the food and drug sector is still very limited. Most studies focus on general crime vulnerability assessment, primarily using incident reports or crime statistics. Babenko et al. (2019) mapped narcotics crimes in Ukraine using cartography based on official crime data from government agencies and UNODC analysis. Furthermore, Snaphaan et al. (2024) measured territorial management quality for crime prevention by combining police crime data with community reviews from Google Places, while Deng et al. (2023) applied machine learning to predict crime risk based on crime data, environmental variables (presence of retail businesses, banks, hotels, hospitals), and demographic variables (poverty, unemployment, migration, population density, etc.). However, these approaches have not been widely adapted specifically for the food and drug sector, highlighting the need for further research.

Garcia (2020) emphasizes that vulnerability assessments usually utilize incident reports, intelligence, law enforcement data, and public information from media and government sources. This approach has begun to be adapted in The Indonesian FDA's food and drug crime vulnerability mapping. Crime Vulnerability Mapping for Food and Drugs involves mapping potential occurrences of food and drug crimes based on information analysis, media reports, and studies, including results from monitoring, intelligence, cyber, and investigative activities. This mapping covers products, distribution, sources, modus operandi, and inter-regional linkages related to food and drug crimes. Current sources of food and drug crime vulnerability information refer to The Indonesian FDA's Head Decision Number HK.02.02.1.2.01.22.12 of 2022 on Guidelines for the Implementation of Preventing Food and Drug Crimes, which consist of:

1. Results of Food and Drug Investigations
2. Results of Food and Drug Intelligence Operations
3. Results of Food and Drug Control
4. Results of Food and Drug Cyber Patrols
5. Sample Testing Requests from Law Enforcement Authorities
6. Expert Statements Requested by Law Enforcement Authorities in Enforcement Process for Food and Drug Crimes
7. Information from Cross-Sectoral Agencies
8. Public Complaint Reports
9. Monitoring Results of Food and Drug Issues in Online/Traditional Media
10. Monitoring Results of Food and Drug Regional Issues

Crime vulnerability mapping was conducted using the Aplikasi Dashboard Penindakan (ADP), specifically through the crime vulnerability module. Between 2020 and 2022, 9,351 verified vulnerability data points were recorded on the Enforcement Dashboard, with the highest vulnerability observed in the cosmetics (41%), followed by medicines (25%), traditional medicines (20%), processed foods (13%), and health supplements (1%). The crime vulnerability map is visualized in the form of zoning based on the dominant crime vulnerability commodities in each province, as shown in Figure 1.

Figure 1. Food and Drug Crime Vulnerability Map, 2020–2022 (Source: Enforcement Dashboard Application, 2022).

The primary sources of crime vulnerability data for the 2020–2022 period were Results of Food and Drug Intelligence Operations (30%), Monitoring Results of Food and Drug Issues in Online/Traditional Media (26%), and Results of Food and Drug Control (20%). Other information sources accounted for 2–7% of the total data distribution. This indicates that crime vulnerability data are derived from a variety of sources, although some sources dominate. However, the management tools integrated into the Enforcement Dashboard for crime vulnerability mapping are still insufficient to provide a holistic perspective on food and drug crime risks, as all input data currently carry equal weight, despite differences in information sources.

Based on the issues described above, it is necessary to develop a crime vulnerability value for the information sources being inputted, so that it can serve as an indicator capable of representing policy direction, particularly in the enforcement function. Therefore, this study aims to conduct a self-assessment of the weighting of food and drug crime vulnerability scores based on information sources, as a consideration for the proposed outputs/indicators of the Deputy of Law Enforcement related to the implementation of relevant and measurable prevention and protection functions.

## 2. Methodology

The study was conducted from June 9 to 30, 2023, in Central Jakarta, East Jakarta, Tangerang Regency, and Bogor Regency, involving 33 respondents from the Deputy of Law Enforcement and law enforcement officers at The Indonesian FDA's regional offices (UPT). The research method used was a mixed-method approach, combining both quantitative and qualitative methods. The quantitative approach was based on comparative judgment, assessing crime vulnerability information sources using the Analytical Hierarchy Process (AHP) method with the SuperDecision software. The qualitative approach was conducted through questionnaire responses from the respondents.

The use of the AHP method encompasses three primary principles: decomposition, comparative judgment, and priority determination (Saaty, 1987). The quantitative assessment was based on ten crime vulnerability information sources outlined in The

Indonesian FDA's Head Decision Number HK.02.02.1.2.01.22.12 of 2022 on Guidelines for the Implementation of Preventing Food and Drug Crimes. Respondents asked to provide preferences regarding the priority of information sources organized into 45 pairwise comparison questions with a scale of 1-9. If the consistency ratio of the assessment/weighting process exceeded 0.1 (10%), the judgment data had to be corrected. If the consistency ratio was less than or equal to 0.1, the calculation result was considered valid. In addition, the quantitative assessment also included evaluating the relevance of current food and drug crime vulnerability information sources, where respondents were asked to determine whether the current sources were sufficiently appropriate or required revision. The interface for assessing information sources using the AHP method in the SuperDecisions software is shown in Figure 2.

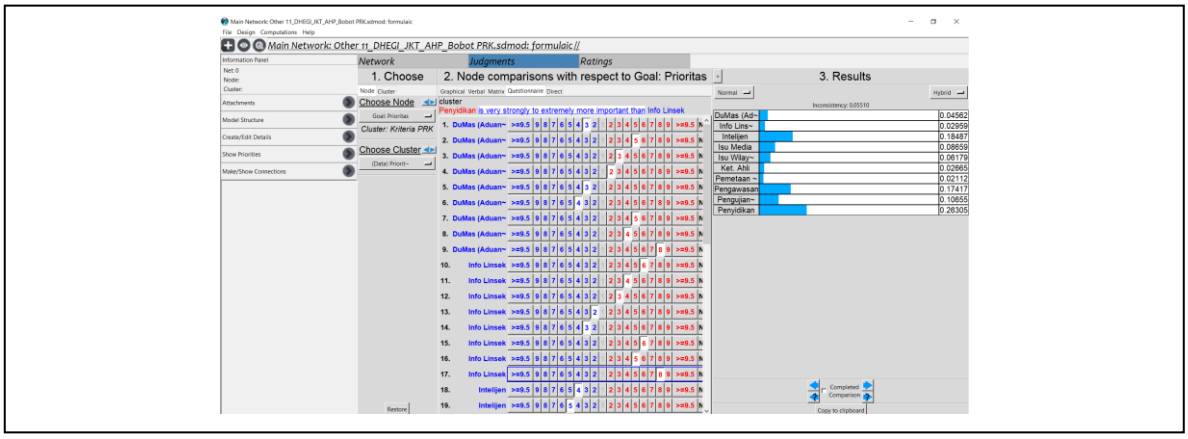


Figure 2. Interface for Assessing Crime Vulnerability Mapping Information Sources Using the AHP Method in SuperDecisions Software.

In the second stage, a qualitative approach was conducted through the completion of questionnaires by respondents to map respondent demographics and gather their opinions regarding the assessment of food and drug crime vulnerability. The qualitative approach focused on strengthening the quantitative assessment, particularly concerning respondents' perspectives on whether the crime vulnerability information sources accurately reflect actual crime risks, as well as collecting input for updating and improving the information sources.

## 3. Hasil dan Pembahasan

### 3.1. Mapping of Respondent Demographics for Crime Vulnerability Assessment

A survey was conducted with 33 respondents representing proportions of gender, education level, work experience, job position, and distribution across work units, which were obtained through an online survey. The detailed results of the demographic mapping of respondents for the assessment of food and drug crime vulnerability are presented in Figure 3.

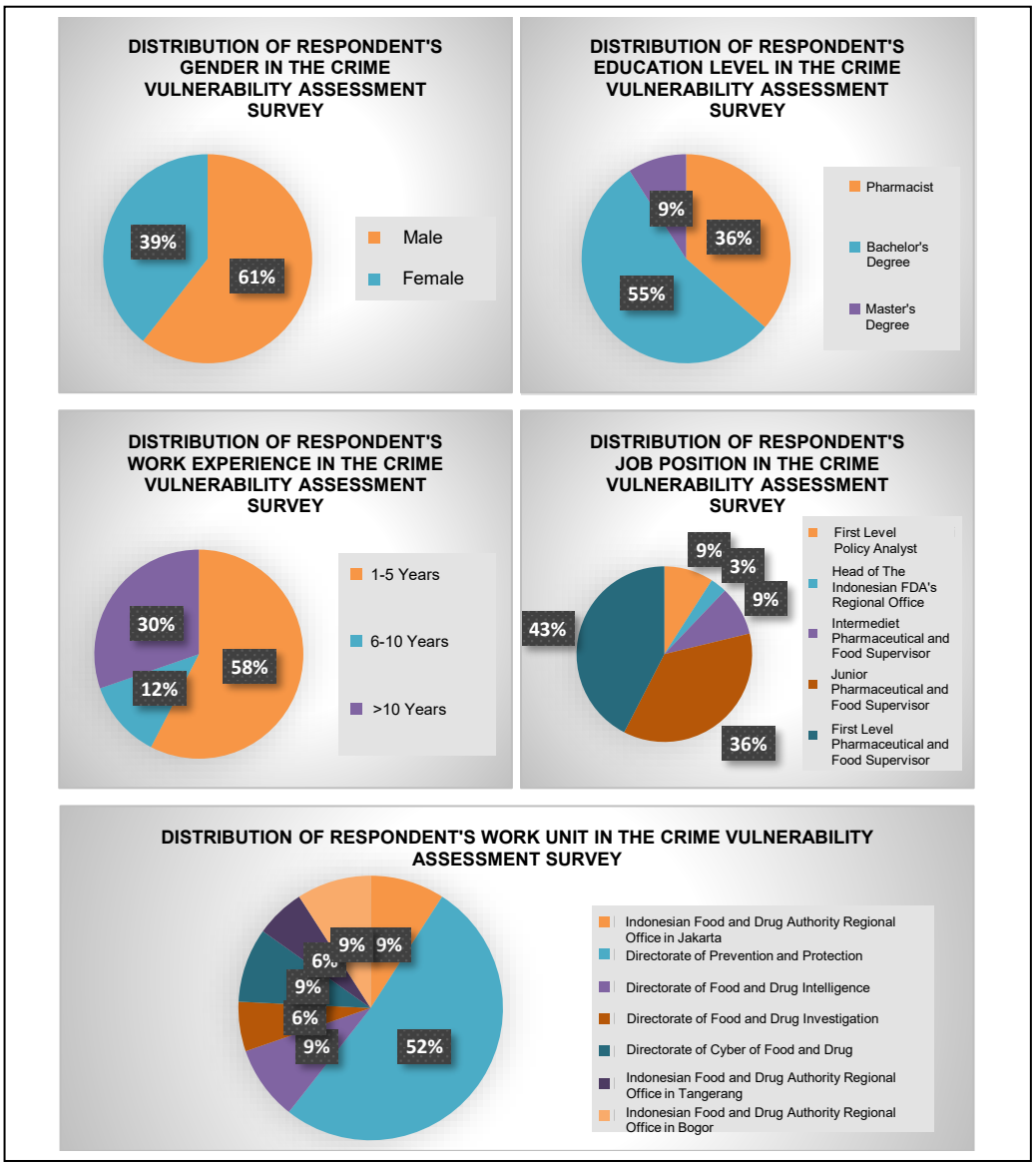


Figure 3. Demographics of Respondents for the Assessment of Food and Drug Crime Vulnerability

Based on gender distribution, the majority of respondents (61%) were male, while 39% were female. From an educational background perspective, most respondents (55%) held a bachelor's degree (S1), and the remaining 45% had higher education, including professional qualifications for pharmacists (36%) and a master's degree (S2) (9%). The majority of respondents were data input officers and crime vulnerability verifiers through the ADP information system, with 58% having 1–5 years of work experience, 12% having 6–10 years, and 30% having more than 10 years of experience. Regarding job positions, as reflected in work experience, the respondents were predominantly First Level Functional positions, consisting of First Level Pharmaceutical and Food Supervisors (43%) and First Level Policy Analysts (6%). In addition, 36% of respondents held positions as Junior Pharmaceutical and Food Supervisors, 9% as Intermediate Pharmaceutical and Food Supervisors, and 3% as Head of The Indonesian FDA's Regional Office. The respondents surveyed are individuals who have knowledge of and understand the process of crime vulnerability mapping. The majority of respondents (52%) are internal staff from the Directorate of Prevention and Protection, which manages the crime vulnerability map. The remaining respondents are from

external units, including Directorate of Food and Drug Investigations, Directorate of Food and Drug Intelligence, Directorate of Cyber of Food and Drug, the Indonesian Food and Drug Authority Regional Office in Tangerang, and Indonesian Food and Drug Authority Regional Office in Bogor.

### 3.2. Establishment of Crime Vulnerability Values Based on Crime Vulnerability Mapping Information Sources

The establishment of values for crime vulnerability mapping information sources aims to assign weights/scores to the crime vulnerability database, ensuring that the vulnerability reflects the actual risk level of a region to food and drug crimes rather than being assessed solely based on data frequency. The results of the assessment/weighting of crime vulnerability mapping information sources are presented in Figure 4.

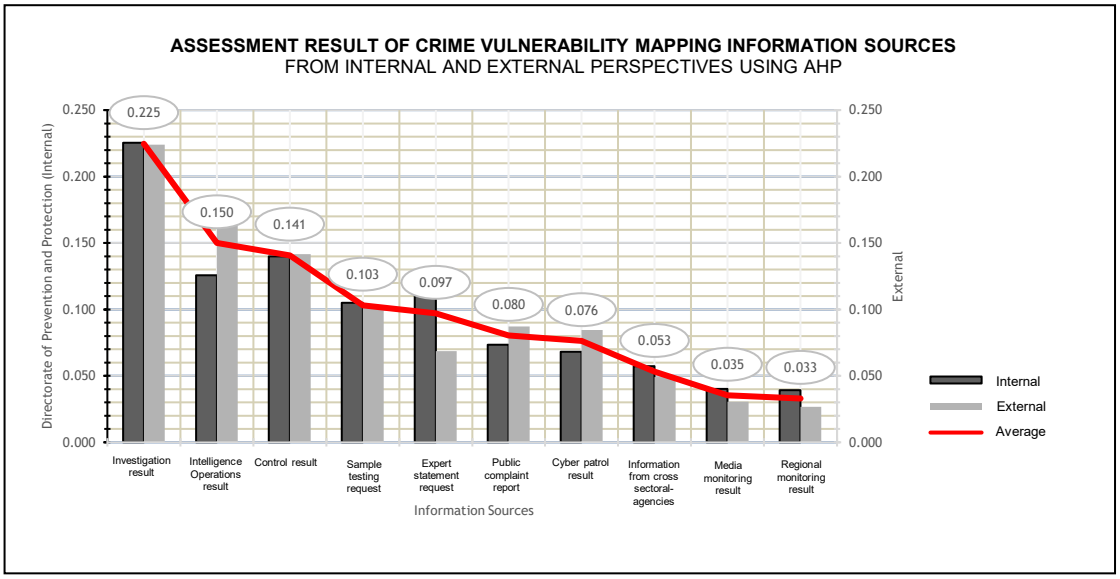


Figure 4. Assesment Result of Crime Vulnerability Mapping Information Sources from Internal and External Perspectives Using AHP

The assessment results indicated that the criteria with the highest weights in the evaluation of food and drug crime vulnerability were Investigation Results (0.225), Intelligence Operations Results (0.150), and Control Results (0.141). In detail, the explanation regarding the sources of crime vulnerability information is as follows:

Results of Food and Drug Investigations is the criterion with the highest weight in the assessment of food and drug crime vulnerability (0.225). This indicates that criminal offenses that are followed up through formal investigation processes constitute the most influential factual condition in depicting the vulnerability of food and drug crimes in a given region. Article 1, Number 2 of Law Number 8 of 1981 on the Criminal Procedure Code defines an investigation as a series of actions carried out by investigators, in accordance with procedures established by law, with the purpose of seeking and collecting evidence to clarify the occurrence of a criminal act and identify the suspects. At this stage, investigators have successfully identified key facts that can serve as a basis for prosecuting the offenders in court. Investigations provide greater legal certainty because the investigators' actions are conducted according to strictly regulated legal procedures, ensuring that the collected evidence carries stronger legal validity.

Results of Food and Drug Intelligence Operation carry a significant weight in evaluating food and drug crime vulnerability (0.150). According to Article 6 of Law Number 17 of 2011 on State Intelligence, one of the functions of national intelligence is investigative work, which constitutes a series of planned and directed efforts, tasks, activities, and actions to seek, collect, and process

information into actionable intelligence, which can then be used as input for policy formulation and decision-making. This process involves evaluating information, determining follow-up priorities, and validating reports to ensure data accuracy and relevance. In line with Rossmo (2021), the importance of intelligence results lies in the ability to assess the investigation situation by considering the nature of the initially collected information, the reliability of information sources, and the potential use of this data as valid evidence in case handling. In the context of crime vulnerability assessment, intelligence results provide a more comprehensive picture of crime patterns, perpetrators, and potential escalation in the food and drug sector.

Results of Food and Drug Control (average weight 0.141) also constitute an important criterion in identifying food and drug crime vulnerability. In this context, control refers to routine inspections of production and distribution facilities conducted by The Indonesian FDA, including the identification of criminal violations. The data obtained from these inspections not only reflect the compliance levels of business actors but also identify patterns of violations that may pose risks to public health. In line with situational crime prevention theory, Halford et al. (2024) emphasize that capable control is a key element in reducing target vulnerability while increasing the risk of apprehension for offenders. In the context of food and drugs, The Indonesian FDA's control functions as a situational control mechanism by exerting pressure on potential offenders to deter violations. This process also has a preventive effect, as consistent monitoring can reduce opportunities for crime by increasing business actors' awareness of the risks involved.

Sample Testing Requests from Law Enforcement Authorities (average weight: 0.103) play a crucial role in assessing the quality and safety of food and drug products. These data reflect the occurrence of crimes in a particular area, such as the circulation of adulterated beverages or the misuse of medicines and NAPPZA, which are the focus of police enforcement. Such requests not only provide insight into the intensity of crime but also illustrate the effectiveness of coordination between The Indonesian FDA and law enforcement authorities in handling food and drug crimes. Test results can reinforce evidence during investigations or in court, thereby supporting more effective law enforcement.

Expert Statements Requested by Law Enforcement Authorities in the Criminal Enforcement Process for Food and Drug Crimes (average weight 0.097) are crucial for evaluating crime vulnerability in the food and drug sector, as expert testimony is recognized as valid evidence under Article 184, Paragraph 1 of Law Number 8 of 1981 on Criminal Procedure. In criminal cases, expert statements are required to provide technical or scientific analysis of violation findings, strengthening the evidentiary basis in legal proceedings. These data not only indicate the complexity of the violations but also provide insights into crime patterns and vulnerability levels (Wulur, 2017). Although judges are not bound by expert testimony, it cannot be disregarded due to its relevance to the scientific accuracy underlying the case.

Public Complaint Reports (average weight 0.080) concerning suspected food and drug crimes serve as preliminary information on potential crime vulnerability. However, the level of public knowledge regarding criminal violations is a critical factor that affects the validity of reports. Therefore, multiple steps are still required to conclude that a particular region is truly vulnerable or affected by food and drug crimes. In 2022, according to The Indonesian FDA's Annual Report (2022), the agency received public complaints and information requests through the ULPK Central Unit, 73 technical units across Indonesia, and the HALOBPOM 1500533 Contact Center, with 1,554 cases (2.75%) classified as complaints. This represented an increase of 7.51% compared to 2021, highlighting the importance of regular monitoring of public complaints as a source of crime vulnerability information.

Result of Food and Drug Cyber Patrol Results (average weight 0.076) serve as a criterion for understanding the spatial distribution and potential patterns of food and drug crimes. In the context of crime vulnerability assessment, cyber patrol data play a critical role in detecting early threats, such as the circulation of illegal products on online platforms. However, limitations in data validation and difficulties linking digital evidence to offenders result in a lower weight compared to data from

investigations, intelligence, or direct supervision. According to Nawawi et al. (2023), identifying offenders, collecting evidence, and engaging the community are major challenges in enforcing cybercrime regulations.

Information technology, particularly user-generated content, is exploited by offenders to enhance the methods of distributing illegal food and drug products online. The online distribution of food and drugs poses a challenge in identifying regional vulnerability due to its borderless nature, allowing products to reach multiple regions, with sources originating both domestically and internationally (cross-border). Consequently, the accuracy in determining regional vulnerability requires further analysis, which also relies on the utilization of information technology in handling food and drug crimes. Since 1990, the U.S. Food and Drug Administration has developed data mining systems to accelerate the identification of potential safety issues in food and drug products and to assist in prioritizing safety concerns. This is considered essential for improved decision-making and real-time risk management of product safety issues.

Information from Cross Sectoral Agencies (average weight 0.053) emphasizes the importance of cooperation between different sectors in addressing food and drug crimes. Information such as the interception of illegal shipments by relevant agencies or reports from logistics service associations on the circulation of illegal products serves as an indicator of criminal activity. These data help identify distribution routes, smuggling methods, and vulnerable regions, enhancing the accuracy of crime vulnerability mapping. According to Garcia (2020), threat information collection must involve reviewing available data and coordinating with agencies possessing relevant intelligence. Law enforcement and intelligence agencies can further enrich perspectives for understanding the complexity of crime. Cross-sector collaboration allows for broader identification of threat patterns, from distribution networks to end consumers, facilitating more effective prevention and enforcement strategies.

Monitoring Results of Food and Drug Issues in Online/Traditional Media (average weight 0.035) is an important factor in providing information and raising public awareness about food and drug crimes. As a data source, media help map vulnerability by identifying crime patterns, locations, and types frequently reported. Media play a role in shaping public perception of crime, including trends and the frequency of reported cases. Garcia (2020) notes that threat information, including media sources, must be carefully evaluated to ensure data accuracy and relevance before use in vulnerability assessments

Monitoring Results of Food and Drug Regional Issues (average weight 0.033) refers to geographical and environmental factors influencing food and drug crime vulnerability. Differences in regional characteristics, including demographics, accessibility, and supervision levels, can affect crime rates. Location or regional context influences crime dynamics, as Eck & Weisburd (2015) explain that the presence of various facilities in an area can either increase or reduce crime risk. This occurs because such areas attract different types of activities, including those involving offenders. Ellis et al. (2019) further highlight that demographic factors, such as gender composition, race, ethnicity, social status, and immigrant background, are linked to crime patterns in a region. Additionally, local cultural trends, such as consumption habits or distribution patterns of food and drug products, can affect the potential for specific crimes in a region. Nonetheless, these potential data points require in-depth investigation to assign adequate weights in assessing crime vulnerability.

The assessment of crime vulnerability information sources indicates that respondents emphasized effective investigation processes, accurate intelligence collection, and intensive supervision as key steps in determining the level of food and drug crime vulnerability. These results align with the view that food and drug crime management must involve more holistic and integrated efforts. On the other hand, media issues and regional issues, despite having relatively lower average weights, still play important roles in law enforcement. Balanced media coverage and information on regional characteristics contributing to crime vulnerability help the public remain vigilant and engaged in crime prevention and disclosure. Although all threat data tested positively contribute to depicting the

actual food and drug crime situation, the differences in weights clearly indicate how respondents assessed the relative contribution of each criterion in decision making.

### 3.3. Exploration of Perceived Appropriateness of Crime Vulnerability Values

The assessment of crime vulnerability information sources in this study has provided a solid framework for identifying and collecting information related to food and drug crime vulnerability. Investigations constitute an important criterion for uncovering criminal acts, identifying perpetrators, and collecting evidence. Intelligence provides in-depth insights into illegal activities and trends related to food and drugs. Supervision assists in detecting violations and ensuring compliance with existing regulations. Laboratory testing offers information on the safety, authenticity, and quality of food and drug products. Expert statements provide critical perspectives for understanding technical and scientific aspects related to food and drugs. Public complaints offer insights from the consumer perspective and help identify potential issues. Online mapping and cross-sectoral information provide access to relevant geographical and situational data. Media and regional issues provide insights into public attention and emerging issues in specific media and regional contexts. However, it is important to recognize that each of these information sources has strengths and limitations that need to be considered. The results of the survey on the perceived appropriateness of crime vulnerability mapping information sources are presented in Figure 5.

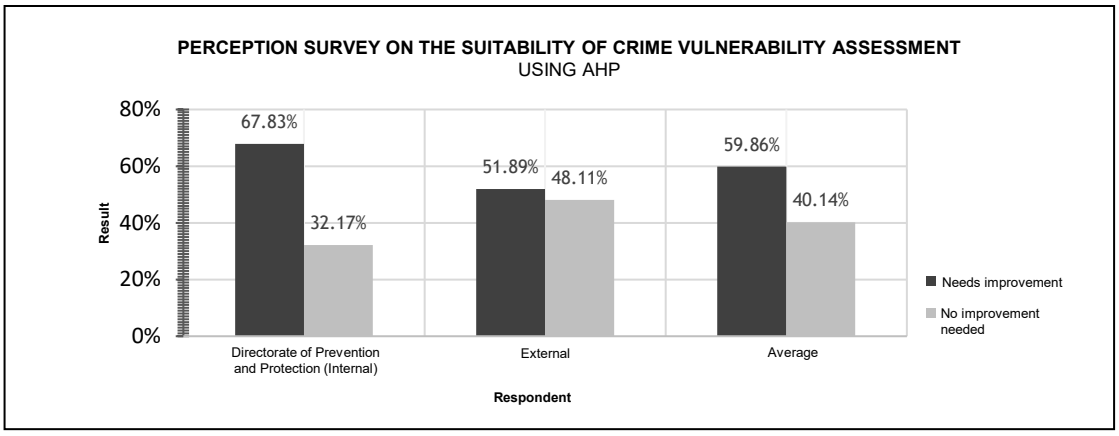


Figure 5. Perception Survey on The Suitability of Crime Vulnerability Assessment using AHP

The survey results indicate that 59.86% of respondents, both from the Directorate of Prevention and Mitigation and external stakeholders, believe that the current crime vulnerability information sources do not accurately reflect actual conditions and therefore require improvent or adjustment. Improvement to the crime vulnerability mapping information sources for assessing food and drug crime vulnerability in a region can be classified into several scopes, as explained in Table 1.

**Tabel 1.** Scope and Description of Improvements in the Assessment of Food and Drug Crime Vulnerability

| Scope of Improvement | Description of Improvement |
|---|---|
| Crime Vulnerability Assessment | Vulnerability values are still accumulated based on the intensity of data input by technical units, so the weighting of information sources is important to reflect the actual vulnerability of food and drug crimes accurately. |
| Clustering of Information Sources | Clustering is needed to avoid repetition of information sources with similar meanings, for example:<br>1. Investigation data, expert statements, and laboratory testing results requested by law enforcement are grouped into a single criterion: food and drug case data or pro-justitia data.<br>2. Media issue data and regional issue data are grouped into a single criterion: media issue data |
| Elaboration of Information Sources | In general, existing information sources can represent the actual condition of food and drug crimes; however, to enrich vulnerability data, elaboration is required using dynamic strategic environmental conditions that illustrate complex interactions among vulnerability factors. Additionally, vulnerability data can be supplemented by publications from journals, theses, or survey data from authorized institutions. |

It is clear that vulnerability cannot be determined exclusively based on crime vulnerability mapping information sources. Other aspects, such as legal regulations, government policies, supervision infrastructure, public participation, and economic, social, and cultural factors, must also be considered.

According to Eck & Weisburd (2015), crime occurs due to the absence or ineffectiveness (capacity) of control when offenders encounter their targets. Clear, firm, and effective legal regulations are required to protect the public from food and drug crimes. Good government policies in the supervision of food and drugs, including segregation and delegation of authority to local governments, also have strong potential to support the reduction of crime vulnerability. Synergy among government entities must be strengthened with clear plans and strategies for prevention, enforcement, and legal action against food and drug crimes. Additionally, adequate supervision infrastructure—including regulatory agencies, testing laboratories, monitoring systems, and supporting facilities—can support early detection, evidence collection, and law enforcement against food and drug crimes. Deficiencies in supervision infrastructure may create gaps in law enforcement and increase vulnerability.

Crime vulnerability can also be influenced by social, economic, cultural, and environmental conditions, such as employment availability, economic inequality, low education levels, social interactions, cultural background, and physical environmental conditions that facilitate criminal opportunities, such as unmonitored areas and access to targets and escape routes Barnum et al. (2017). Understanding the social and cultural context is crucial for designing effective prevention strategies. Active public participation in reporting, detecting, and providing information on food and drug crimes is vital. Informed and engaged communities can help identify illegal or high-risk practices and provide valuable information to law enforcement. A public aware of food and drug crime risks can serve as an effective “eyes and ears” in prevention and enforcement efforts.

### 3.4. Crime Vulnerability as a Database for the Redesigned Enforcement Planning System

Crime forecasting is a complex issue in criminology and urban security research. This process involves analyzing and modeling various factors, including environmental and demographic variables that may influence crime. To assess the crime situation, structure, and future trends in a region over a specific period, various methods are applied, including crime hotspot detection. This method has proven effective in identifying spatial and temporal crime distribution patterns, involving

the identification of high-risk areas, typically based on the geographical location of criminal incidents. (Deng et al., 2023).

Currently, institutions in most countries actively work on crime prevention. The establishment of monitoring and warning systems has become a mandatory tool for territorial management (Quesada-Ruiz et al., 2023). In line with this, to achieve The Indonesian FDA's vision and mission, integrated efforts are implemented in focus areas and loci of food and drug supervision. The policy direction to be implemented by the Deputy of Law Enforcement includes increasing public understanding, awareness, and participation in food and drug supervision through: enhancing stakeholder engagement for crime prevention and training; strengthening law enforcement activities, including expanding and improving the quality of investigations through enhanced monitoring of illegal food and drug circulation online and offline and accelerating case resolution; improving the quality of human resources in the Deputy of Law Enforcement and stakeholders, performance accountability, and institutional capacity through the development of analysts, intelligence officers, and Civil Servant Investigators (PPNS).

During the implementation of the 2020–2024 Strategic Plan, the output produced by The Indonesian FDA regional offices related to enforcement was the number of food and drug criminal cases, with output achievement based solely on investigative activities conducted by The Indonesian FDA regional offices. This approach is considered no longer relevant to The Indonesian FDA's organizational development. Therefore, improvement are needed for outputs and output indicators that reflect the overall performance of enforcement-related regional offices, with specific targets to be achieved. These adjustments should take into account the weighted results of food and drug crime vulnerability data. The weighting of crime vulnerability data indicates data quality and reflects the enforcement activities conducted by regional offices, which are directly related to the required budget.

The results of the self-assessment on the weighting of crime vulnerability information sources can serve as a tool to determine food and drug crime vulnerability in a relevant and measurable way. Weighting should be carried out comprehensively through surveys of the food and drug crime ecosystem, supported by experts competent in crime prevention, so that in the future, the "Food and Drug Crime Vulnerability Index" can be proposed as a measurable output indicator to achieve the strategic objectives of the Deputy of Law Enforcement.

### 3.5. Research Limitations

The study on the development of food and drug crime vulnerability values has several limitations that must be considered. Currently, such studies are rarely conducted by supervisory institutions abroad, indicating that the framework for food and drug crime vulnerability values has not yet become a primary focus of international research. Therefore, the limited literature and data from similar studies in other countries may affect the accuracy and generalizability of the findings.

Secondly, the limited scope of survey respondents is another important aspect. Although the study involved respondents from the Deputy of Law Enforcement and enforcement officers from The Indonesian FDA regional offices, weighting should be carried out comprehensively through surveys of the food and drug crime ecosystem, supported by experts in the field of crime prevention. Furthermore, benchmarking with relevant institutions is necessary to ensure the relevance and validity of the proposed food and drug crime vulnerability indicators.

## 4. Conclusion

Based on this study, it can be concluded that each information source carries a different weight, with the highest weights in assessing food and drug crime vulnerability assigned to Result of Food and Drug Investigation (0.225), Result of Food and Drug Intelligence Operations (0.150), and Result of Food and Drug Control (0.141). A holistic assessment of crime vulnerability is necessary to reflect

the actual vulnerability of food and drug crimes accurately. It is essential to review crime vulnerability mapping information sources, particularly clustering factors related to legal regulations, government policies, supervision infrastructure, public participation, and economic, social, and cultural factors.

The results of the self-assessment on the weighting of crime vulnerability information sources can serve as a tool to determine food and drug crime vulnerability in a relevant and measurable way. However, this study still has limitations regarding the completeness of literature sources and the scope of survey respondents. Weighting should be conducted comprehensively through surveys of the food and drug crime ecosystem, supported by experts competent in crime prevention, so that in the future, the "Food and Drug Crime Vulnerability Index" can be proposed as a measurable output indicator to achieve the strategic objectives of the Deputy of Law Enforcement and directly reflect the planning of enforcement activities to be conducted by The Indonesian FDA regional offices.

As a collective effort to diversify the performance of the Enforcement Division during the 2025–2029 RPJMN period, further collaboration among cross-sector stakeholders within the enforcement function is proposed to develop criteria and weights for crime vulnerability information capable of measuring regional risk levels in terms of food and drug crimes. Through these efforts, it is expected that actual issues related to food and drug enforcement can be objectively represented, allowing the proposed "Food and Drug Crime Vulnerability Index" to be adopted as one of the output indicators in the program targets of the Deputy of Law Enforcement in the next RPJMN period.

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