Enhancing Regulatory Compliance in Indonesian Radio Broadcasting Through a Decision Support System Based on AHP and SAW

Indra Trianthono[1], Ravi Ahmad Salim[2]

[1,2]Business Information System, Gunadarma University, Depok, West Java - Indonesia
Email: inderatrianthono@gmail.com

Abstract— This study presents the development of a Decision Support System (DSS) to evaluate compliance among radio broadcasting institutions in Indonesia. The system integrates the Analytic Hierarchy Process (AHP) for weighting compliance criteria and the Simple Additive Weighting (SAW) method for ranking broadcaster performance. Using the Rapid Application Development (RAD) model and Unified Modeling Language (UML) tools, a prototype was developed with PHP and MySQL to support regulatory functions. The DSS includes six core use cases for data management, compliance evaluation, and reporting, enabling structured, transparent, and accurate assessments. Black-box testing confirmed functional reliability, while user acceptance evaluation based on the Technology Acceptance Model (TAM) indicated high perceived usefulness and ease of use. The results highlight the system's potential to enhance regulatory objectivity, efficiency, and scalability. Limitations include the absence of real-time data integration and content analysis. Future enhancements may incorporate AI and public dashboards to further improve broadcasting governance.

Keywords— AHP, compliance evaluation, decision support system, radio broadcasting, SAW, UML.

I. INTRODUCTION

In Indonesia, radio broadcasting continues to play a vital role in delivering information, education, and entertainment to the public, particularly in remote and underserved regions. As a public communication channel, radio is governed by strict regulations enforced by government bodies such as the Ministry of Communication and Informatics and the Indonesian Broadcasting Commission (KPI). These regulations aim to ensure that broadcasters operate ethically, lawfully, and in accordance with national broadcasting standards. However, monitoring and evaluating compliance across the archipelago remains a persistent challenge due to the manual nature of current evaluation mechanisms. These traditional approaches can be time-consuming and may be susceptible to inconsistencies and subjective judgment, which can undermine the reliability and objectivity of assessments [1], [2].

In light of these challenges, there is a growing need for a systematic, technology-driven approach to improve the monitoring and evaluation (M&E) of compliance within the broadcasting sector. A promising solution lies in the development of a Decision Support System (DSS) that integrates Multi-Criteria Decision-Making (MCDM) methods to more accurately assess broadcasters' compliance performance. Previous research supports the efficacy of MCDM techniques in regulatory and evaluation contexts. Notably, methods such as the Analytic Hierarchy Process (AHP) and Simple Additive Weighting (SAW) have been shown to enhance the accuracy, objectivity, and transparency of decision-making processes [3]. These techniques facilitate the assignment of appropriate weights to compliance criteria and enable a systematic ranking of broadcasting institutions based on their adherence to regulations.

To support the implementation of such a DSS, it is crucial to define clear technical and operational requirements. The proposed system is designed to operate on hardware equipped with at least an Intel i5 processor, 8 GB of RAM, and a minimum of 256 GB SSD storage—ensuring stable performance during data processing and analysis. On the software side, the system will run on Windows 10 or 11 and utilize MySQL as the database management system, offering dependable relational data storage capabilities. The backend will be developed using PHP for its flexibility and compatibility with MySQL, while Sublime Text will serve as the integrated development environment (IDE) for efficient code editing and debugging.

The DSS will rely on two primary data sources: (1) Licensing data, which provides details about broadcasting permits and compliance obligations, and (2) Broadcasting event reports, which document the actual content and scheduling of radio programs in relation to regulatory requirements. These data sources will be systematically used to evaluate compliance levels. To facilitate system design and communication among stakeholders, the architecture and process flows of the DSS will be modeled using Unified Modeling Language (UML). UML serves as a powerful tool for visualizing system architectures and ensuring clarity among all involved parties [4]. The primary actor defined within the system is the Admin, representing staff members from the Broadcasting M&E Team. This role encompasses the management of broadcasting data, setting compliance criteria, analyzing performance, and maintaining the system.

The DSS will include six core use cases to support the end-to-end workflow of compliance evaluation. These include data management, criteria configuration, performance analysis, and report generation. By automating these processes, the DSS aims to enhance the efficiency, accuracy, and accountability of broadcasting oversight. Additionally, the integration of this system is expected to aid regulatory bodies in issuing well-

informed recommendations, conducting targeted interventions, and ensuring consistent supervision of the broadcasting sector.

In summary, the development of a DSS for evaluating broadcasting compliance represents a strategic advancement in the governance of Indonesia's media ecosystem. It addresses inefficiencies in existing evaluation methods and aligns with the national agenda for digital transformation and modernizing public sector services. By combining robust decision-making models with appropriate technological tools, this initiative has the potential to improve regulatory performance and uphold public trust in the broadcasting industry.

II. METHOD

This study employed a Research and Development (R&D) approach with the primary objective of designing and developing a Decision Support System (DSS) to evaluate compliance in radio broadcasting. The system was built using the Rapid Application Development (RAD) model, a software development methodology characterized by iterative prototyping, user feedback, and rapid delivery. The RAD approach was chosen due to its suitability for systems requiring swift deployment, active user involvement, and continuous refinement throughout the development lifecycle.

A. System Development with RAD

The RAD methodology consists of four main phases: (1) Requirements Planning, (2) User Design, (3) Construction, and (4) Cutover.

In the Requirements Planning phase, data were gathered through literature studies, analysis of regulatory documents, and discussions with stakeholders from the Broadcasting Monitoring and Evaluation Team. This phase helped identify the system's functional and non-functional requirements. During the User Design phase, prototypes were developed and refined iteratively based on stakeholder input. The system architecture was modeled using Unified Modeling Language (UML), including use case diagrams, activity diagrams, and class diagrams. UML is recognized for its effectiveness in visualizing and constructing artifacts of software systems, facilitating better communication among stakeholders [5], [6].

The Construction phase involved the actual development of the DSS using PHP as the backend programming language, MySQL as the database management system, and Sublime Text as the development environment. This phase emphasized the integration of technical specifications and design refinement ensuring a seamless user experience [7], [8].

The deployment of the prototype for testing, training for users (Admins), and planning for system assessment were all part of the Cutover phase.

B. System Evaluation

The evaluation of the DSS was conducted using two complementary methods: Black-Box Testing and User Acceptance Evaluation based on the Technology Adoption Model (TAM).

1) Black-Box Testing: This method was used to evaluate the system's functionality against its expected behavior without examining the internal code structure. Test cases were created for each use case within the DSS to verify that input processes produced the correct output and that the system met its specified functional requirements. The efficacy of this approach is well-documented, highlighting the importance of ensuring that software functions as intended from the perspective of the user [9], [10].

2) User Acceptance Evaluation (TAM-Based Interviews): To assess user perception and acceptance of the system, qualitative data were collected through semi-structured interviews with users from the Broadcasting Monitoring and Evaluation Team. The interview framework was based on the Technology Adoption Model (TAM), focusing on two key constructs:

a) Perceived Usefulness (PU): the degree to which users believe the DSS enhances their performance in monitoring and evaluating broadcasting compliance.

b) Perceived Ease of Use (PEOU): the degree to which users find the DSS easy to operate and interact with.

Interview responses were analyzed thematically to identify recurring insights and user feedback, which informed final adjustments to the system [11], [12]. This evaluation approach provided valuable input regarding system usability, practical relevance, and potential for institutional adoption.

This structured R&D approach leveraged the RAD model for effective system development and evaluation, ensuring that the final DSS meets the needs of its users while enhancing compliance monitoring in radio broadcasting in Indonesia. By utilizing UML for system architecture and adopting rigorous testing methods, the study aims to deliver a robust, user-friendly tool that promotes accountability and regulatory compliance within the broadcasting sector [9], [13].

III. RESULT

A. System Development Outcomes

This study successfully developed a Decision Support System (DSS) prototype to evaluate the compliance levels of radio broadcasters in Indonesia. Utilizing the Rapid Application Development (RAD) model, the system was built using PHP, MySQL, and deployed on a Windows-based environment with a minimum hardware requirement of Intel i5 processor, 8GB RAM, and 256GB SSD to ensure efficient processing.

The system design was modeled using the Unified Modeling Language (UML), which served as a powerful tool to illustrate system architecture, actors, workflows, and interactions in a manner that is understandable to both developers and stakeholders.

B. AHP and SAW Evaluation Results

Following the criteria weighting process using the Analytical Hierarchy Process (AHP) and the ranking of alternatives via the Simple Additive Weighting (SAW) method, the system was populated with data from 527 radio broadcasters, selected using the Slovin formula and Simple Random Sampling to ensure representativeness.

The AHP process identified the most critical evaluation criteria, including submission of annual reports, compliance

with local content quotas, and age-appropriate programming. The SAW method then computed compliance scores based on these weighted criteria, yielding ranked results across all sampled broadcasters. Public broadcasters generally scored higher in compliance due to their more rigid mandates and structured oversight mechanisms.

C. System Prototype Design and Use Case Implementation

1) Use Case Diagram

Post-weighting and ranking, the development phase proceeded with the design of the DSS prototype using UML.

A Use Case Diagram was created to visualize system functions in relation to the single actor involved—the Admin, representing Monev Team staff responsible for broadcasting compliance evaluation. The Admin is the only user with full operational access to manage broadcasters' data, configure criteria, perform compliance analyses, and generate reports.

2) Use Case Definition

The DSS incorporates six primary use cases, as detailed in Table 1. These use cases collectively support the end-to end workflow of compliance monitoring:

TABLE 1. Use Case Definition

Use Case	Description
Manage Broadcaster Data	Enables administrators to manage broadcaster data (licenses, reports, verifications).
Manage Evaluation Criteria	Allows administrators to define and manage compliance criteria and weights.
Manage Evaluation Results	Facilitates the entry and updating of broadcasters' compliance assessments.
Calculate Compliance Scores	Performs compliance scoring based on AHP-SAW logic.
View Compliance Reports	Allows the generation and viewing of compliance evaluation reports.
Manage Accounts	Enables administrators to manage system user accounts.

3) Use Case Scenarios

Each use case has been elaborated through detailed scenarios outlining steps, conditions, exceptions, and business rules. The following are examples:

a) Manage Broadcaster Data
Admin can add, update, or delete data entries with validations for report periods and licensing requirements.

b) Manage Evaluation Criteria
Admin can input or modify criteria and assign weights, ensuring total weight consistency as per AHP.

c) Calculate Compliance Scores
The system integrates data from AHP weighting and broadcaster performance to compute final scores using SAW.

d) View Report
Admin can generate various report formats (e.g., summary, detailed, comparative) with options to print or export.

Each scenario emphasizes preconditions (e.g., successful login), postconditions (e.g., data saved or updated), and exception handling (e.g., invalid inputs, calculation errors).

4) Sysem Prototype Interface

The prototype interface was developed using PHP and MySQL. The interface includes:

a) Dashboard

Summary of compliance scores and monitoring activities.

b) Data Managemen Modules
CRUD operations for broadcasters, criteria, and scores.

c) Report Module
Enables generation of structured evaluation outputs in PDF or CSV.

d) Calculation Module
Backend logic for integrating AHP and SAW algorithms in real-time.

e) User Management
Interface for managing user roles and access rights.

The design emphasizes usability and functionality for non-technical users within the Monev team, ensuring ease of operation and efficient task execution.

D. System Testing

1) Black-box Testing

The DSS underwent black-box testing to verify the functionality of all system features. Test cases confirmed that all modules, including data input, processing, and reporting, performed correctly according to specifications. The system was robust, with no major functional failures observed during testing. Complete test can be seen in Table 2.

TABLE 2. Black-box Testing Result

ID	Test Description	Expected Result	Actual Result	Conclusion
A01	Enter correct username "admin" and correct password "admin", then click the Login button	System accepts the input and navigates to the homepage	System accepts the input and navigates to the homepage	Success
A02	Enter correct username "admin" and incorrect password "admn", then click the Login button	System rejects the input and displays message "Incorrect username or password"	System rejects the input and displays message "Incorrect username or password"	Success
A03	Enter incorrect username "admn" and correct	System rejects the input and displays	System rejects the input and displays	Success

ID	Test Description	Expected Result	Actual Result	Conclusion
	password "admin", then click the Login button	message "Incorrect username or password"	message "Incorrect username or password"	
A04	Enter incorrect username "admn" and incorrect password "admn", then click the Login button	System rejects the input and displays message "Incorrect username or password"	System rejects the input and displays message "Incorrect username or password"	Success
A05	Leave both username and password empty, then click the Login button	System rejects the input and displays message "Incorrect username or password"	System rejects the input and displays message "Incorrect username or password"	Success
B01	Click +New Input button, fill in broadcaster data, then click Save	System accepts and saves broadcaster data to the database	System accepts and saves broadcaster data to the database	Success
B02	Click +New Input button, fill in broadcaster data, then click Cancel	System returns to the broadcaster data page	System returns to the broadcaster data page	Success
B03	Click Import, choose file for broadcaster data, click Open, then click Save to upload	System accepts and saves broadcaster data to the database	System accepts and saves broadcaster data to the database	Success
B04	Click Import, choose file for broadcaster data, click Open, then click Cancel	System returns to the broadcaster data page	System returns to the broadcaster data page	Success
C01	Click +New Input button, fill in alternative data, then click Save	System accepts and saves alternative data to the database	System accepts and saves alternative data to the database	Success
C02	Click +New Input button, fill in alternative data, then click Cancel	System returns to the alternative data page	System returns to the alternative data page	Success
C03	Click Import, choose file for alternative data, click Open, then click Save to upload	System accepts and saves alternative data to the database	System accepts and saves alternative data to the database	Success
C04	Click Import, choose file for alternative data, click Open, then click Cancel	System returns to the alternative data page	System returns to the alternative data page	Success
C05	Click Edit, update alternative data for broadcaster, then click Save	System accepts and saves the updated alternative data to the database	System accepts and saves the updated alternative data to the database	Success
C06	Click Edit, update alternative data for broadcaster, then click Cancel	System returns to the alternative data page	System returns to the alternative data page	Success
C07	Click Delete to remove alternative data	System deletes the alternative data and saves the change to the database	System deletes the alternative data and saves the change to the database	Success
D01	Click +New Input button, fill in criteria data, then click Save	System accepts and saves the criteria data to the database	System accepts and saves the criteria data to the database	Success
D02	Click +New Input button, fill in criteria data, then click Cancel	System returns to the criteria data page	System returns to the criteria data page	Success
D03	Click Edit, update criteria data for broadcaster, then click Save	System accepts and saves the updated criteria data to the database	System accepts and saves the updated criteria data to the database	Success
D04	Click Edit, update criteria data for broadcaster, then click Cancel	System returns to the criteria data page	System returns to the criteria data page	Success
D05	Click Delete to remove criteria data	System deletes the criteria data and saves the change to the database	System deletes the criteria data and saves the change to the database	Success
D06	Click AHP Criteria Value, input pairwise comparison data, then click Save	System accepts and saves the AHP criteria value data to the database	System accepts and saves the AHP criteria value data to the database	Success
D07	Click AHP Criteria Value, then click Reset to restart calculation	System resets and restores the initial view of the criteria value data	System resets and restores the initial view of the criteria value data	Success
D08	Click Calculate AHP Weights, then click Save Weights to store AHP results	System calculates and displays the AHP weights and saves the data to the database	System calculates and displays the AHP weights and saves the data to the database	Success
E01	Click +New Input button, fill in sub-criteria data, then click Save	System accepts and saves the sub-criteria data to the database	System accepts and saves the sub-criteria data to the database	Success
E02	Click +New Input button, fill in sub-criteria data, then click Cancel	System returns to the sub-criteria data page	System returns to the sub-criteria data page	Success
E03	Click Edit, update sub-criteria data for broadcaster, then click Save	System accepts and saves the updated sub-criteria data to the database	System accepts and saves the updated sub-criteria data to the database	Success
E04	Click Delete to remove sub-criteria data	System deletes the sub-criteria data and saves the change to the database	System deletes the sub-criteria data and saves the change to the database	Success

2) User Acceptance (TAM Evaluation)

User acceptance was evaluated using the Technology Acceptance Model (TAM). Semi-structured interviews with staff from the Broadcasting Monitoring and Evaluation (Monev) Team revealed high levels of Perceived Usefulness (PU) and Perceived Ease of Use (PEOU). Respondents

acknowledged the system's ability to:

a) Streamline compliance evaluation processes.
b) Minimize subjectivity and increase transparency.
c) Provide actionable insights for policy-making.

E. Discussion

The integration of AHP and SAW methods into the DSS significantly enhanced the objectivity and transparency of compliance evaluations. Compared to traditional manual evaluations, this system provides:

1) Consistency: By standardizing evaluation logic and criteria application.
2) Efficiency: Through automation of complex calculations and report generation.
3) Scalability: The system can accommodate additional broadcasters, criteria, or regions with minimal adjustments.
4) Decision Support: Real-time rankings help regulators prioritize interventions and policy responses.

The use of actual field verification data also addresses a critical research gap in previous studies, which largely relied on simulations or secondary data. Furthermore, the use of UML modeling and structured system design supports future enhancements and potential integration with national compliance monitoring platforms.

Despite its strengths, the system has some limitations. These include the lack of real-time data integration with broadcaster submissions, absence of content analysis for program compliance, and limited stakeholder access (restricted to internal use). Future development could include integration with big data analytics, incorporation of AI-based content classification, and expansion into a public-facing compliance dashboard.

IV. CONCLUSION

This study developed a Decision Support System (DSS) to evaluate the compliance of radio broadcasting institutions in Indonesia by integrating the Analytical Hierarchy Process (AHP) and Simple Additive Weighting (SAW) methods. The system was designed to address ongoing challenges in manual and subjective compliance evaluations, which often undermine the objectivity and efficiency of regulatory oversight. Using the Rapid Application Development (RAD) approach and Unified Modeling Language (UML) tools, a functional and user-focused DSS prototype was successfully constructed.

The AHP method enabled the assignment of appropriate weights to each compliance criterion based on expert input and regulatory standards. These weighted criteria were then used in the SAW method to calculate and rank the compliance scores of 527 broadcasting institutions, selected using Slovin's formula and a simple random sampling technique. The results showed that the combined use of AHP and SAW produced a structured, transparent, and accurate compliance evaluation framework.

System testing using black-box methods confirmed that all functions performed as expected. In addition, user acceptance evaluation based on the Technology Acceptance Model (TAM) indicated favorable perceptions regarding the system's

usefulness and ease of use. Users recognized the system's ability to streamline the evaluation process, reduce subjectivity, and support data-based decision-making in the broadcasting sector.

The DSS was developed with six main use cases that allowed the administrator, representing the Broadcasting Monitoring and Evaluation Team, to manage broadcaster data, configure compliance criteria, input assessment results, calculate compliance levels, generate evaluation reports, and manage user accounts. The prototype, developed using PHP and MySQL, emphasized operational effectiveness, ease of use, and administrative control.

This research provides both theoretical and practical contributions by offering a technology-supported model for evaluating compliance in broadcasting. It fills a critical gap in existing studies by incorporating real field data into a structured decision-making tool that enhances both the accuracy and accountability of compliance assessments.

Despite its strengths, the system has certain limitations. It does not yet include integration with real-time reporting systems, automated content analysis, or broader multi-user access. Future improvements should consider the adoption of big data analytics, artificial intelligence for content evaluation, and the development of public-facing dashboards to promote transparency and wider stakeholder engagement.

In summary, the proposed DSS represents a significant advancement in modernizing compliance monitoring within Indonesia's broadcasting sector. It supports regulatory functions, enhances institutional efficiency, and contributes to a more data-driven, transparent, and accountable media governance environment.

REFERENCES

[1] Y. Chen, "Application of Analytic Hierarchy Process (AHP) and Simple Additive Weighting (SAW) Methods in Mapping Flood-Prone Areas," 2021. doi: 10.3233/FAIA210274.

[2] D. Kurniawati, F. N. Lenti, and R. W. Nugroho, "Implementation of AHP and SAW Methods for Optimization of Decision Recommendations," *J. Int. Conf. Proc.*, vol. 4, no. 1, pp. 254–265, Jul. 2021, doi: 10.32535/jicp.v4i1.1152.

[3] M. M. Hidayat, M. N. Hamidah, and R. W. Prastyawan, "Decision Support System for Selecting Order Types Using the SAW-AHP Method," *JEECS (Journal Electr. Eng. Comput. Sci.*, vol. 5, no. 2, pp. 885–898, Dec. 2020, doi: 10.54732/jeecs.v5i2.92.

[4] Y. Yang, W. Ke, J. Yang, and X. Li, "Integrating UML With Service Refinement for Requirements Modeling and Analysis," *IEEE Access*, vol. 7, pp. 11599–11612, 2019, doi: 10.1109/ACCESS.2019.2892082.

[5] A. Costa, S. Cavalheiro, L. Foss, and L. Ribeiro, "From UML diagrams to simulink models," in *Proceedings of the 30th Annual ACM Symposium on Applied Computing*, New York, NY, USA: ACM, Apr. 2015, pp. 1547–1552. doi: 10.1145/2695664.2695869.

[6] F. Alhumaidan, "A Critical Analysis and Treatment of Important UML Diagrams Enhancing Modeling Power," *Intell. Inf. Manag.*, vol. 04, no. 05, pp. 231–237, 2012, doi: 10.4236/iim.2012.45034.

[7] L. Foss, S. A. da C. Cavalheiro, N. N. Bisi, V. S. Pazzini, L. B. De Brisolara, and F. R. Wagner, "From UML to SIMULINK CAAM: Formal Specification and Transformation Analysis," *Rev. Informática Teórica e Apl.*, vol. 20, no. 1, p. 102, Jan. 2013, doi: 10.22456/2175-2745.25202.

[8] R. Song and T. Liu, "Design and Implementation of Object-Oriented Teaching Aid System Based on UML Language," *Adv. Mater. Res.*, vol. 760–762, pp. 2095–2099, Sep. 2013, doi: 10.4028/www.scientific.net/AMR.760-762.2095.

[9] N. Majma and S. M. Babamir, "Software test case generation

&amp; test oracle design using neural network," in *2014 22nd Iranian Conference on Electrical Engineering (ICEE)*, IEEE, May 2014, pp. 1168–1173. doi: 10.1109/IranianCEE.2014.6999712.

[10] Z. Zhang, "Test Suite Augmentation via Integrating Black- and White-Box Testing Techniques," *Int. J. Performability Eng.*, 2018, doi: 10.23940/ijpe.18.06.p24.13241329.

[11] S. Shcherban, "Multiclass Classification of Four Types of UML Diagrams from Images Using Deep Learning," Jul. 2021, pp. 57–62. doi: 10.18293/SEKE2021-185.

[12] I. Wardani and A. K. Batubara, "Library Service System In Pocket (Online Book Reservation) North Sumatra Provincial Library And Archives Office," *JURTEKSI (Jurnal Teknol. dan Sist. Informasi)*, vol. 9, no. 3, pp. 437–444, Jun. 2023, doi: 10.33330/jurteksi.v9i3.2410.

[13] D. A. AbdulMonim, Z. H. Muhamad, and B. Alathari, "Using the Object Mapping Approach from Analysis to Implementation for Developing Student Registration System," *Indones. J. Electr. Eng. Comput. Sci.*, vol. 14, no. 2, p. 1030, May 2019, doi: 10.11591/ijeecs.v14.i2.pp1030-1038.