

## Analytical Hierarchy Process and Simple Additive Weighting Methods for Ranking Public Complaint Applications with ISO/IEC 25010

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**Abstract:** An integrated decision support framework for evaluating and ranking public complaint applications operated by city governments in West Java Province, Indonesia, is presented in this study. The Analytical Hierarchy Process is employed to derive expert-based weights for the ISO/IEC 25010 software quality criteria, while the Simple Additive Weighting method is applied to generate objective rankings of the applications. A research gap in the e-government domain is addressed, as limited studies have systematically implemented a multi-criteria decision-making approach that integrates expert consensus with quantitative evaluation for prioritizing digital public services. Data were collected through expert panel assessments and structured questionnaires administered across nine city-level complaint systems. Significant variations in software quality among the evaluated applications were identified, with Depok and Bandung achieving the highest scores of 0.8053 and 0.7593, respectively, while Bekasi and Cimahi obtained the lowest scores. Specific recommendations for improvement are provided based on the eight quality dimensions defined in the ISO/IEC 25010 model, and a replicable evaluation model for government stakeholders is proposed. A theoretical contribution is established through the extension of multi-criteria decision-making applications in evaluating e-government software quality using the comprehensive ISO/IEC 25010 framework. A practical contribution is delivered through the provision of a structured benchmarking tool that enables local governments to prioritize improvements in digital complaint systems based on measurable software quality indicators.

**Keywords:** AHP, ISO/IEC 25010, Public Complaint Applications, Ranking, SAW

### 1. Introduction

A significant transformation of public administration and an acceleration in the adoption of e-government initiatives worldwide have been driven by the rapid development of information and communication technology (ICT) [1][2][3]. E-government initiatives have been implemented by many cities in West Java Province [4][5]. The public complaint system is considered a component of smart city applications and is utilized to facilitate the submission of complaints or aspirations by the public regarding public services or urban security [6][7][8].

In the context of multi-criteria decision-making (MCDM), various methods have been applied to software evaluation, including the TOPSIS, PROMETHEE, and fuzzy-based approaches [9][10][11]. Distinct advantages are provided by the integration of the Analytical Hierarchy Process and the Simple Additive Weighting methods. Persistent challenges in ensuring quality, effectiveness, and user satisfaction continue to be observed despite substantial investments in digital platforms. Inconsistent functionality has been identified in many public complaint systems, indicating the necessity of software quality measurement to ensure the system's capacity to generate high-quality information [12][13]. The evaluation of software quality is therefore required to ensure system reliability, effective functionality, and a positive user experience.

System weaknesses can be identified and continuous improvement of digital public service platforms can be supported through proper quality assessment [14][15][16].

User satisfaction with website quality must be evaluated to ensure sustained usage of e-government software. Long-term organizational performance improvement can be supported through such evaluation. The importance of maintaining effective software maintenance practices has also been emphasized [17][18][19][20]. Software quality measurement can be conducted using the ISO/IEC 25010 model, while evaluation can be performed through the integration of the Analytical Hierarchy Process and Simple Additive Weighting methods [21]. The necessity of robust and adaptable frameworks for evaluating digital government services has been emphasized in recent international studies, particularly in addressing limitations related to stakeholder involvement and comprehensive assessment. The ISO/IEC 25010 Quality in Use model is recognized as an international standard for evaluating quality from the user perspective, including effectiveness, efficiency, and user satisfaction in meeting system requirements [22]. A structured evaluation of software quality can be conducted based on the product quality dimensions defined in ISO/IEC 25010, which consist of eight characteristics: functional suitability, performance efficiency, compatibility, usability, reliability, security, maintainability, and portability [23].

.. Nonetheless, the integration of the Analytical Hierarchy Process (AHP) and Simple Additive Weighting (SAW) methods offers distinct advantages. Despite significant investments in these digital platforms, there remain persistent challenges in ensuring their quality, effectiveness, and user satisfaction. Many public complaint systems suffer from inconsistent functionality. This is the reason why a software quality measurement is necessary to ascertain the system's capacity to generate high-quality information [12][13]. Therefore, evaluating software quality is essential to ensure system reliability, effective functionality, and a positive user experience. Proper quality assessment helps identify system weaknesses and supports continuous improvement of digital public service platforms [14][15][16].

In determining user satisfaction with the quality of the website, evaluation must be carried out to preserve ongoing usage of e-Government software. This evaluation is useful for improving organizational performance in the long term. It is important to maintain software maintenance practices [17][18][19][20]. Measurement of software quality standards using the ISO/IEC 25010 model and testing using the AHP and SAW methods [21]. International studies in recent years have also emphasized the necessity of robust, adaptable frameworks for evaluating the quality of digital government services, highlighting gaps in current approaches regarding stakeholder involvement and comprehensive assessment. ISO/IEC 25010 Quality in Use Model is an international standard method used to evaluate the quality of use by considering the user perspective, including the effectiveness, efficiency, and level of satisfaction of the website in meeting user needs [22]. ISO/IEC 25010 making the evaluation of the quality of the software system can be carried out specifically based on the dimensions of product quality which consist of 8 characteristics, namely functional suitability, performance efficiency, compatibility, usability, reliability, security, maintainability, and portability [23].

Thomas L. Saaty created the decision support system AHP. This model describes multi-factor or multi-criteria problems into a hierarchical structure. The hierarchy consists of levels of objectives, factors, criteria, sub-criteria, and alternatives. With this hierarchical approach, complex problems can be broken down into more structured and systematic groups [24]. The alternative ranking stage uses the SAW method. The Simple Additive Weighting (SAW) method is widely used due to its simplicity and effectiveness in ranking alternatives through weighted summation of performance scores across multiple criteria. The SAW approach is advised to address selection issues in decision-making with several characteristics and multi-process decision-making systems [25].

Previous research was conducted by Afiah et.al discussions about the assessment of the sapawarga application using ISO 25001, users of the sapawarga application saw a 45.20% drop; this was caused by various factors including the server not responding, the challenge of locating information using three ISO/IEC 25010 criteria - functional suitability, usability, and performance

efficiency with importance levels of 24.9%, 23.2%, and 16.5%. Suggestions are made to raise the quality of these three traits. Further research Functional suitability, performance efficiency, portability, security and usability are the criteria applied. The findings of the evaluation in this paper using the ISO/IEC 25010 approach show that the functional appropriateness component meets the requirements with a value of  $x = 1$  (good), the performance efficiency aspect with an average score of 45.18, grade F for page speed and Yslow with an average score of 62.53, grade D and an average reaction time of 17.64 seconds (requires improvement), The portability feature employs three browsers and the findings indicate the website runs error-free (excellent); the usability feature has a SUS score of 57.38 on a D grade scale (needs improvement). The third study by Izzatillah [26] it assesses the performance of the GOJEK app according on ISO/IEC 25010. This paper combines features from the product quality model and the quality in use model. The product quality model emphasizes the factors of functional appropriateness, performance efficiency, compatibility, usability, dependability, and security. The outcomes of the measurement process are, the product quality dimension on Android devices is 79.30% and on iOS devices is 91.37%. While for the quality in use dimension is 76.22% of the maximum quality of the value of mobile application use which is 94.75%. This indicates that the GOJEK software performs well in product quality as well as quality in the utilization dimension or user viewpoint.

The difference between this research and previous research conducted by [26] is found in the SAW method and the purpose of the investigation. This study focuses on public complaint service systems on the dukcapil website in cities in West Java, and it uses the AHP and SAW approaches with eight criteria: functional suitability, performance efficiency, compatibility, usability, reliability, security, maintainability, and portability. This study aims to create a prototype of the ISO/IEC 25010 software quality model for government application priorities employing the AHP and SAW techniques on the complaint service system on the Dukcapil website in cities in West Java.

Implemented using different technologies, Decision Support Systems (DSS) and Business Intelligence (BI) systems serve different functions and users. Managers need to be able to examine and understand data from digital sources. Computer programs may, with current technology, effectively and efficiently support many decision-making activities [27]. Designed to enable the public in simply, swiftly, and openly filing complaints, comments, or reports connected to public services, a Public Complaint Application is a digital platform [28][29]. Citizens may check the status of their complaints using a tracking system and submit them with descriptions, locations, and supporting evidence including images [30][31]. This software promotes responsibility, speeds up the problem-solving process, and offers analytical data used for decision-making depending on public complaints by means of user verification, automated alerts, and a unique dashboard for government officials [32][33]. Usually utilized by the government, this app may be accessed via several channels including the web, mobile, or integration with well-known platforms such WhatsApp and SMS [34][35]. It also focuses on security issues including data encryption and role-based access control [36].

The evaluation of public complaint applications in e-government relies on established theories and frameworks from software quality assessment and multi-criteria decision making [37][38][39]. The ISO/IEC 25010 standard is recognized internationally for its comprehensive approach to software product evaluation, covering eight quality dimensions: functional suitability, performance efficiency, compatibility, usability, reliability, security, maintainability, and portability [40][41]. Numerous studies, both national and international, have confirmed that adherence to these criteria is associated with increased system effectiveness and user satisfaction. However, the implementation of these standards in the public sector often faces contextual challenges, requiring frameworks that can adapt to specific institutional needs.

To address the complexity of evaluating multiple applications across diverse quality attributes, multi-criteria decision-making (MCDM) techniques are widely applied in both research and practice [42][43]. Among these, the Analytical Hierarchy Process (AHP) is valued for its capacity to translate expert judgments into quantifiable weights for each criterion, ensuring consistency and consensus within the evaluation process [44][45]. The Simple Additive

Weighting (SAW) method, in contrast, is renowned for its simplicity and computational efficiency, enabling practical ranking of alternatives based on weighted scores. Several international studies have underscored the importance of combining expert-driven and quantitative methods to enhance the rigor and transparency of digital government assessments[46][47]. While some researchers have implemented either AHP or SAW in evaluating e-government or public sector applications, integrated approaches remain rare, particularly those leveraging the full ISO/IEC 25010 model[48][49]. Recent international literature points to a research gap in the application of adaptable, replicable, and stakeholder-sensitive evaluation models, especially for ranking digital platforms in complex governance environments.

In summary, this study adopts a combined AHP–SAW approach, rooted in the ISO/IEC 25010 framework, to enable a robust, context-aware, and transparent evaluation of public complaint applications at the city level. This theoretical foundation supports the development of decision support systems that address both methodological rigor and practical relevance for policymakers and practitioners in digital governance.

Despite the growing number of studies evaluating e-government systems, most existing research focuses on either the application of ISO/IEC 25010 or the use of individual MCDM techniques in isolation. Limited studies have explored the integration of expert-based weighting methods and quantitative ranking approaches within a unified evaluation framework, particularly for benchmarking multiple government applications simultaneously.

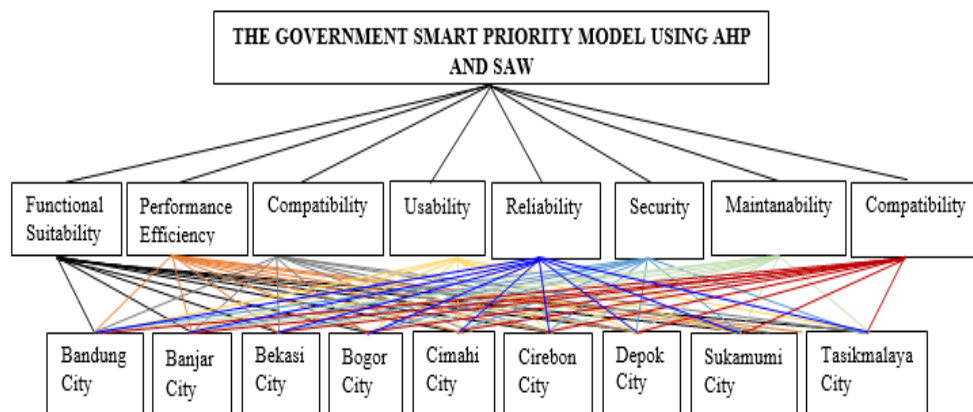
Therefore, this study addresses this gap by proposing an integrated evaluation framework that combines ISO/IEC 25010 with AHP and SAW methods. The main objectives of this study are: (1) to determine the relative importance of software quality criteria using expert judgment, (2) to evaluate the performance of public complaint applications across multiple cities, and (3) to generate a transparent and structured ranking model to support decision-making in digital public service improvement.

## **2. Research Method**

### **2.1. Research Design**

This study adopts a quantitative approach to evaluate and rank public complaint applications operated by city governments in West Java Province. The evaluation integrates the ISO/IEC 25010 software quality model with a multi-criteria decision-making approach using the Analytical Hierarchy Process (AHP) and the Simple Additive Weighting (SAW) method. The AHP method is used to determine the relative importance of the evaluation criteria, while the SAW method is applied to calculate the final ranking of the evaluated systems.

The research process begins with identifying the relevant software quality criteria based on ISO/IEC 25010. Subsequently, expert judgments are collected to perform pairwise comparisons among the criteria using the AHP method. The resulting weights are then used in the SAW calculation to evaluate the performance of public complaint applications across multiple cities. The overall research framework and evaluation process are illustrated in Figure 1, which shows the hierarchical model used for decision support in this study. At the top of the hierarchy is the main goal, which is to determine the optimal priority model. This goal is broken down into eight key evaluation criteria: Functional Suitability, Performance Efficiency, Usability, Reliability, Security, Maintainability, and Compatibility. These criteria are used to assess ten different city applications, namely those from Bandung, Banjar, Bekasi, Bogor, Cimahi, Cirebon, Depok, Sukabumi, and Tasikmalaya. The structure reflects a multi-criteria decision-making approach, where each application is evaluated based on its performance against the stated criteria, enabling a comprehensive and systematic prioritization process.



**Figure 1.** Government Smart Priority Model

## 2.2. ISO 25010/IEC Evaluation Criteria

ISO/IEC 25010 - division of quality model. The International Standards that comprise this section provide thorough quality models for software products, computer systems, data, IT services, and quality in use [50]. The evaluation of public complaint applications in this study is based on the ISO/IEC 25010 software quality model. This model defines eight key quality characteristics that are widely used to assess software systems. The criteria include functional suitability, performance efficiency, compatibility, usability, reliability, security, maintainability, and portability.

These criteria serve as the basis for evaluating the quality of the public complaint systems implemented by the city governments. Each criterion represents a specific dimension of software performance that affects the usability and effectiveness of the complaint management platform. The criteria are later used as evaluation attributes in the decision-making process using the AHP and SAW methods.

## 2.3. Analytical Hierarchy Process (AHP)

The Analytical Hierarchy Process (AHP) is widely used in multi-criteria decision making to derive priority weights from expert judgments through pairwise comparison matrices [51]. Expert judgments are collected from respondents with experience in software engineering and information systems in the public sector.

The pairwise comparison results are compiled into a comparison matrix representing the relative importance among the eight ISO/IEC 25010 criteria. The comparison matrix used in this study is presented in Table 1.

**Table 1.** List of Criteria

Criteria Code	Criteria Description
C01	Functional suitability
C02	Performance efficiency
C03	Compatibility
C04	Usability
C05	Reliability
C06	Security
C07	Maintainability
C08	Portability

After constructing the comparison matrix, the matrix is normalized in order to obtain the priority weights of each criterion. The normalization process converts the comparison values into proportional values, allowing the relative importance of each criterion to be clearly identified. The normalized matrix and the resulting priority weights are presented in Table 2.

**Table 2.** List of Alternatives

Criteria Code	Criteria Name
A01	Bandung City
A02	Banjar City
A03	Bekasi City
A04	Bogor City
A05	Cimahi City
A06	Cirebon City
A07	Depok City
A08	Sukabumi City
A09	Tasikmalaya City

To ensure that the judgments provided by the experts are reliable, a consistency test is conducted. The consistency of the comparison matrix is measured using the Consistency Index (CI) and Consistency Ratio (CR). The consistency test results are shown in Table 3, which indicates whether the comparison matrix meets the acceptable consistency threshold ( $CR < 0.1$ ). The validated weights obtained from this process are then used in the SAW calculation to evaluate the alternatives.

**Table 3.** Criteria Weight Calculation Results

Kriteria	C01	C02	C03	C04	C05	C06	C07	C08
C01	1,000	3,000	3,000	3,000	3,000	3,000	4,000	3,000
C02	0,333	1,000	3,000	2,000	3,000	3,000	2,000	4,000
C03	0,333	0,333	1,000	2,000	2,000	3,000	2,000	3,000
C04	0,333	0,500	0,500	1,000	3,000	3,000	2,000	3,000
C05	0,333	0,333	0,500	0,333	1,000	3,000	3,000	3,000
C06	0,333	0,333	0,333	0,333	0,333	1,000	3,000	3,000
C07	0,250	0,500	0,500	0,500	0,333	0,333	1,000	3,000
C08	0,333	0,250	0,333	0,333	0,333	0,333	0,333	1,000
<b>Total</b>	3,250	6,250	9,167	9,500	13,000	16,667	17,333	23,000

The ranking results reveal variations in the software quality performance of public complaint applications among the evaluated cities. Applications with higher scores demonstrate stronger performance across multiple ISO/IEC 25010 dimensions, particularly in usability, functional suitability, and system reliability. Conversely, several applications show lower performance in certain criteria such as security or maintainability, indicating areas that require further improvement. These results provide a structured evaluation framework for assessing digital public service systems and offer evidence-based insights that can assist local governments in improving the quality and effectiveness of their complaint management platforms.

The next step is to calculate the consistency. If the value is more than 10%, then the inconsistent data assessment must be corrected again. However, if the consistency ratio (CI/CR) less or equal to 0,1 then the calculation results can be stated as consistent. The next step is to calculate  $\lambda$  maximum by multiplying the unnormalized total value then multiplied by the priority weight of each criterion, then divided by the priority weight. Value  $\lambda$  The maximum obtained is:

$$\begin{aligned}\lambda \max &= \sum \lambda / n \\ \lambda \max &= (9,122 + 9,298 + 9,204 + 9,251 + 8,947 + 8,54 + 8,571 + 8,551) / n \\ &= 71,484 / 8 = 8,936 \\ \lambda \max &= 8,936\end{aligned}$$

The final step to test the consistency of the hierarchy is by calculating Consistency Index (CI). The aim is to find out whether the comparison matrix obtained from the results of the questionnaire filled out by respondents is consistent or not.

$$CI = (\lambda_{max} - n) / (n-1)$$

$$CI = (8,936 - 8) / 7 = 0,134$$

After obtaining the consistency index value (CI), then count Consistency Index (CR), The ratio value of the index with 8 criteria is

$$CR = CI / IR$$

$$CR = 0,134 / 1,41 = 0,095$$

Because of value  $CR < 0,1$  or 10% , This means that the respondents' preferences are consistent, meaning that the pairwise comparison matrix based on the main criteria is consistent and the resulting priority weights are reliable, so that the assessments given by the respondents in the questionnaire are considered appropriate.

The results of the AHP calculation produce the final priority weights for each ISO/IEC 25010 quality criterion. These weights represent the relative importance of each evaluation attribute in assessing the performance of public complaint applications. The summary of the criteria and their corresponding weights is presented in Table 4, which serves as the basis for the subsequent SAW evaluation process.

**Table 4.** Matrix Normalization Calculation and Priority Weights

Criteria	C01	C02	C03	C04	C05	C06	C07	C08	Weight Priority	%
C01	0,308	0,48	0,327	0,316	0,231	0,18	0,231	0,13	0,275	27,5%
C02	0,103	0,16	0,327	0,211	0,231	0,18	0,115	0,174	0,188	18,8%
C03	0,103	0,053	0,109	0,211	0,154	0,18	0,115	0,13	0,132	13,2%
C04	0,103	0,08	0,055	0,105	0,231	0,18	0,115	0,13	0,125	12,5%
C05	0,103	0,053	0,055	0,035	0,077	0,18	0,173	0,13	0,101	10,1%
C06	0,103	0,053	0,036	0,035	0,026	0,06	0,173	0,13	0,077	7,7%
C07	0,077	0,08	0,055	0,053	0,026	0,02	0,058	0,13	0,062	6,2%
C08	0,103	0,04	0,036	0,035	0,026	0,02	0,019	0,043	0,04	4%
<b>Total</b>	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	100%

#### 2.4. Simple Additive Weighting (SAW)

The Simple Additive Weighting (SAW) method is applied to calculate the final ranking of the public complaint applications. In this method, each alternative is evaluated based on the defined criteria and the corresponding weights obtained from the AHP analysis [52]. The first step in the SAW method is to construct a decision matrix containing the evaluation scores of each alternative across the defined criteria. Since the criteria may have different measurement scales, the decision matrix must be normalized before the ranking calculation is performed. The normalization process converts the original values into comparable values so that each criterion contributes proportionally to the final score. The normalization formula used in this study is illustrated in Figure 2.

$$R = \begin{Bmatrix} 1,0 & 0,629 & 1,000 & 1,0 & 0,436 & 0,250 & 1,0 & 1,0 \\ 0,6 & 0,701 & 0,571 & 0,6 & 0,564 & 0,333 & 0,5 & 0,6 \\ 0,4 & 0,423 & 0,364 & 0,4 & 0,449 & 0,5 & 0,5 & 0,4 \\ 0,6 & 1,000 & 0,267 & 0,6 & 0,718 & 0,333 & 0,5 & 0,4 \\ 0,6 & 0,216 & 0,231 & 0,4 & 0,436 & 0,5 & 0,5 & 0,6 \\ 0,6 & 0,557 & 0,245 & 0,6 & 0,744 & 0,5 & 0,5 & 0,6 \\ 1,0 & 0,794 & 0,667 & 0,8 & 0,859 & 0,333 & 1 & 0,8 \\ 0,6 & 0,526 & 0,800 & 0,6 & 0,962 & 0,500 & 0,5 & 0,4 \\ 0,4 & 0,546 & 0,522 & 0,2 & 1,000 & 1 & 0,25 & 0,2 \end{Bmatrix}$$

**Figure 2.** Matrix Normalization

After normalization, the normalized values are multiplied by the corresponding criterion weights obtained from the AHP method. The weighted values are then summed to obtain the final score for each alternative, which determines the ranking of the evaluated public complaint applications.

### **2.5. Sampling and Data Collection**

The population of this study consists of local government institutions in West Java Province, Indonesia, which provide digital public complaint services through official web-based platforms. These systems are typically managed by the Population and Civil Registration Offices (Dukcapil) and serve as communication channels between citizens and local governments for submitting public complaints and service requests.

The sampling technique used in this research is purposive sampling. Only city-level governments were selected as research samples because their digital public service systems are generally more mature and actively maintained compared to those of many district governments. Based on these considerations, nine city governments in West Java Province were selected as the research samples. The evaluated applications are the official public complaint service platforms of Bandung City, Banjar City, Bekasi City, Bogor City, Cimahi City, Cirebon City, Depok City, Sukabumi City, and Tasikmalaya City.

Data for the evaluation were collected using two main techniques: questionnaire-based assessment and direct system observation. The questionnaire was designed based on the eight software quality characteristics defined in the ISO/IEC 25010 model, namely functional suitability, performance efficiency, compatibility, usability, reliability, security, maintainability, and portability. Each criterion was translated into several evaluation indicators that reflect both technical system performance and user experience aspects of the public complaint applications.

The evaluation process involved five experts consisting of three academics specializing in software engineering and two practitioners with experience in public sector information systems. Each expert independently assessed the selected complaint applications using a five-point Likert scale ranging from 1 (very poor) to 5 (very good). The final score for each criterion was obtained by calculating the average value of the expert assessments.

The expert panel was selected using purposive criteria to ensure domain relevance and evaluation reliability. The selected experts have a minimum of five years of experience in software engineering, information systems, or public sector digital services. The inclusion of both academic and practitioner perspectives aims to balance theoretical rigor and practical relevance in the evaluation process. Although the number of experts is relatively limited, previous studies in AHP-based decision-making indicate that a small but qualified expert panel is sufficient to produce consistent and reliable weighting results, provided that consistency testing (CI and CR) is satisfied.

The collected data were then compiled into a decision matrix representing the performance of each application across the defined criteria. This matrix forms the basis for further analysis using the Analytical Hierarchy Process (AHP) to determine criterion weights and the Simple Additive Weighting (SAW) method to calculate the final ranking of the evaluated systems. To ensure reliability of the expert assessments, the evaluation results from all experts were averaged and cross-checked for consistency. Minor scoring discrepancies were discussed and resolved to maintain the stability of the evaluation matrix.

To ensure the validity of the evaluation instrument, the questionnaire items were developed based on the ISO/IEC 25010 software quality characteristics and reviewed by the expert panel before the evaluation process. This review ensured that each item appropriately represented the intended quality dimension. The use of multiple experts with professional experience in software engineering and public sector information systems also helped improve the reliability of the assessment results. The final evaluation scores were obtained by averaging the expert responses to minimize individual bias and enhance the consistency of the decision matrix.

To ensure transparency, the Likert-scale scores provided by each expert were aggregated using arithmetic mean values for each criterion and alternative. These aggregated scores were then used

to construct the decision matrix prior to normalization in the SAW method. In this study, the evaluation relies on expert-based assessment rather than large-scale user surveys, as the objective is to ensure consistency and domain validity in evaluating software quality attributes. The use of a limited number of qualified experts is consistent with established practices in AHP-based decision-making studies.

## 2.6. Research Procedure

The research procedure adopted in this study follows a structured workflow integrating the ISO/IEC 25010 software quality model with the Analytical Hierarchy Process (AHP) and the Simple Additive Weighting (SAW) method. The overall stages of the research process are illustrated in Figure 3.

Figure 3 illustrates the step-by-step research procedure implemented in this study. The process begins with the identification and selection of city-level public complaint applications as evaluation alternatives. Subsequently, an assessment instrument is developed based on the ISO/IEC 25010 software quality criteria to ensure comprehensive measurement of software attributes.

An expert panel is then recruited and briefed regarding the evaluation protocol to maintain consistency and reliability during the assessment process. Each expert evaluates the selected applications and performs pairwise comparisons among the evaluation criteria as part of the AHP method. These comparisons are used to calculate the relative weights of the criteria, while consistency testing is conducted to ensure the reliability of expert judgments.

Following the determination of criterion weights, the evaluation scores of each application are normalized and processed using the SAW method to obtain the final ranking of the alternatives. The results are then analyzed and interpreted to identify the relative performance of each system and to formulate recommendations for improving the quality of digital public complaint services. This structured workflow enhances methodological transparency and supports the reproducibility of the multi-criteria evaluation process for benchmarking e-government service platforms.

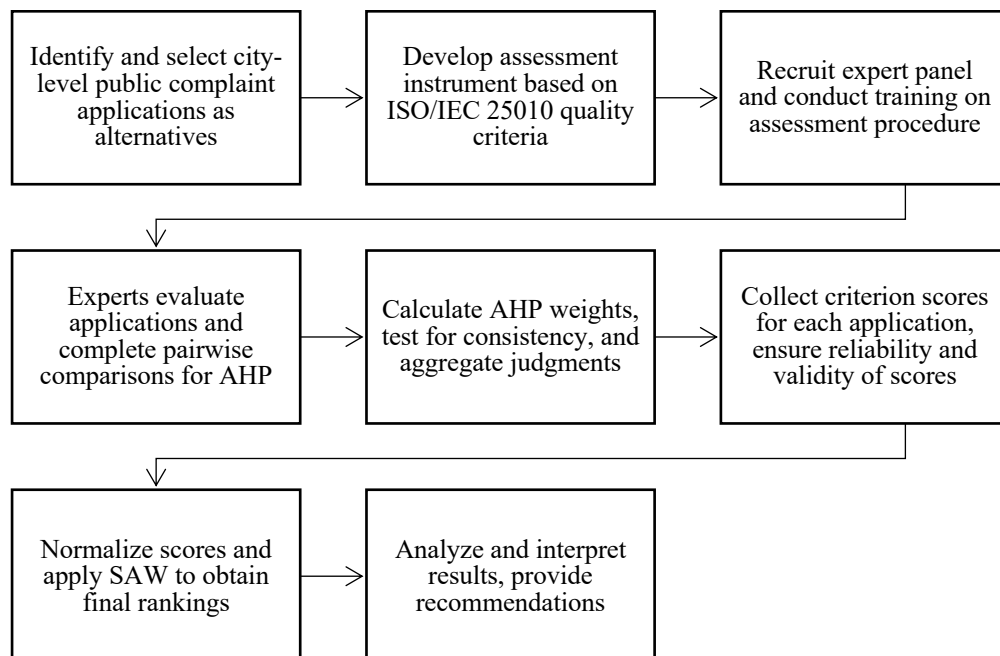


Figure 3. Research Step

### 3. Results and Discussion

The evaluation criteria used in the SAW calculation are further detailed in the assessment criteria table, which presents the criteria codes, criterion names, weight values, and the type of attribute (benefit or cost). These criteria serve as the reference for evaluating the performance of each public complaint application. The complete list of SAW assessment criteria is shown in Table 5.

**Table 5.** SAW Assessment Criteria

No.	Criteria Code	Weight Criteria	Criterion Name	Type
1	C01	28	Functional Suitability	Benefit
2	C02	19	Performance Efficiency	Benefit
3	C03	13	Compatibility	Cost
4	C04	12	Usability	Benefit
5	C05	10	Reliability	Benefit
6	C06	8	Security	Cost
7	C07	6	Maintanability	Benefit
8	C08	4	Portability	Benefit
<b>Total</b>		100		

To ensure consistency in the scoring process, a rating scale is defined to represent the performance level of each application under each criterion. The rating values range from Very Bad to Very Good and are converted into numerical scores from 1 to 5. This scale allows qualitative observations of system performance to be translated into quantitative values suitable for decision-making analysis. The scoring scale used in the evaluation process is presented in Table 6.

**Table 6.** Criterion Value

Weight	Score
Very Good	5
Good	4
Enough	3
Poor	2
Very Poor	1

Using the defined criteria and scoring scale, each public complaint application is evaluated according to its performance across the eight ISO/IEC 25010 criteria. The evaluation results are compiled into a decision matrix that represents the compatibility between each alternative and the evaluation criteria. This matrix forms the basis for further calculations in the SAW method. The decision matrix containing the rating values for each alternative is shown in Table 7.

It should be noted that not all criteria are measured using the Likert scale. While subjective criteria such as usability and functional suitability are evaluated using expert judgment on a five-point Likert scale, certain criteria such as performance efficiency and compatibility are derived from objective system measurements, including response time, load performance, and technical observations. Therefore, the values presented in Table 7 represent a combination of subjective expert scores and objective system performance metrics. These values are subsequently normalized in the SAW method to ensure comparability across different measurement scales.

**Table 7.** Rating Value of Alternative and Criteria Compatibility

Alternative	Criteria							
	C01	C02	C03	C04	C05	C06	C07	C08
A01	5	2	1	5	1	4	4	5
A02	3	2	2	3	1	3	2	3
A03	2	1	3	2	1	2	2	2
A04	3	5	4	3	1	3	2	2
A05	3	1	5	2	1	2	2	3
A06	3	1	4	3	1	2	2	3
A07	5	3	1	4	2	3	4	4
A08	3	1	1	3	3	2	2	2
A09	2	1	2	1	3	1	1	1

After carrying out the process of normalizing the values of each alternative for each criterion, the normalization matrix is obtained Figure 2. Since the criteria used in the evaluation may have different measurement scales, the decision matrix must be normalized before calculating the final ranking. The normalization process converts the original values into comparable values so that each criterion contributes proportionally to the final score. The normalized decision matrix obtained from this process is presented in Table 8.

**Table 8.** Result Public Complaint Applications

City	C01	C02	C03	C04	C05	C06	C07	C08	Final Score
<b>Depok</b>	0.137	0.145	0.082	0.110	0.083	0.058	0.060	0.043	0.8053
<b>Bandung</b>	0.135	0.142	0.080	0.108	0.082	0.056	0.059	0.041	0.7593
<b>Sukabumi</b>	0.102	0.109	0.061	0.080	0.064	0.045	0.046	0.019	0.594
<b>Bogor</b>	0.100	0.105	0.059	0.077	0.062	0.043	0.044	0.019	0.5685
<b>Banjar</b>	0.096	0.101	0.056	0.074	0.059	0.041	0.041	0.017	0.495
<b>Cirebon</b>	0.090	0.095	0.053	0.070	0.056	0.039	0.038	0.015	0.442
<b>Tasikmalaya</b>	0.084	0.089	0.049	0.065	0.052	0.036	0.035	0.011	0.4378
<b>Cimahi</b>	0.071	0.075	0.041	0.053	0.043	0.029	0.028	0.015	0.4073
<b>Bekasi</b>	0.069	0.073	0.039	0.051	0.041	0.027	0.026	0.014	0.3607

The weighted score distribution presented in Table 8 provides a more granular view of the performance of each public complaint application across the eight ISO/IEC 25010 quality dimensions. Unlike the final ranking alone, this breakdown enables identification of specific strengths and weaknesses contributing to each city's overall performance.

Depok and Bandung achieve consistently high scores across the most influential criteria, particularly Functional Suitability (C01), Performance Efficiency (C02), and Usability (C04). Given that these criteria received the highest priority weights in the AHP analysis, their balanced performance significantly contributes to the top overall ranking of these cities. This indicates that the effectiveness of complaint handling features and system responsiveness are critical drivers of overall software quality in digital public services.

In contrast, Bekasi and Cimahi exhibit lower weighted contributions in Usability (C04) and Security (C06), two dimensions that directly affect user trust and operational reliability. The relatively weaker performance in these criteria explains their lower final scores despite moderate results in other attributes. This finding suggests that deficiencies in interface design and data protection mechanisms disproportionately impact overall system evaluation.

Furthermore, mid-ranked cities such as Bogor and Sukabumi demonstrate uneven performance patterns, where moderate functional capability is not always accompanied by comparable reliability or maintainability levels. This imbalance highlights the importance of addressing software quality dimensions holistically rather than improving isolated components. By presenting criterion-level weighted contributions, the analysis enhances transparency in the decision-making process and strengthens the interpretability of the AHP-SAW integration model.

### 3.1 Discussion

The findings of this study are consistent with previous research emphasizing the importance of usability, performance efficiency, and functional suitability in determining the effectiveness of e-government systems [43][45]. Similar studies have shown that usability and system responsiveness are key factors influencing user satisfaction and system adoption in digital public services.

These findings reinforce the argument that software quality evaluation in e-government should not be limited to technical performance alone, but must also consider user-centered attributes such as usability and reliability. This aligns with recent studies highlighting that user experience plays a crucial role in the success and adoption of digital public services. Therefore, integrating multiple quality dimensions using a structured decision-making approach provides a more comprehensive understanding of system effectiveness.

However, unlike prior research that typically applies a single evaluation method, this study integrates AHP and SAW within the ISO/IEC 25010 framework, enabling both expert-driven weighting and quantitative ranking. This integrated approach provides a more comprehensive and transparent evaluation compared to previous studies that rely solely on qualitative or single-method assessments. The evaluation results reveal significant differences in the quality of public complaint applications implemented

by city governments in West Java Province. Using the integrated ISO/IEC 25010 quality framework and the AHP–SAW decision-making approach, the study provides a systematic comparison of software quality across the evaluated systems. The importance of each evaluation criterion is determined through the AHP method, and the resulting weights are summarized in Table 4. These weights indicate that certain software quality attributes play a more influential role in determining the overall system performance. Criteria such as functional suitability, usability, and performance efficiency receive relatively higher weights, reflecting their critical importance in ensuring effective public complaint services.

To ensure consistent assessment across all alternatives, the evaluation process uses a standardized scoring scale, as shown in Table 6. This scale converts qualitative assessments into quantitative values, enabling systematic comparison among the evaluated systems. Using this scoring framework, each complaint application is evaluated based on the defined ISO/IEC 25010 criteria. The compatibility values between each application and the evaluation criteria are presented in Table 7, which represents the decision matrix used in the SAW calculation. The results indicate noticeable variations in the performance of public complaint applications among different cities. Some systems demonstrate stronger performance in usability and functional suitability, suggesting that these platforms provide more accessible and efficient interfaces for handling public complaints.

The final ranking results presented in Table 8 show that certain city governments achieve higher overall scores due to consistent performance across multiple software quality dimensions. Cities with higher rankings typically demonstrate balanced performance in usability, reliability, and performance efficiency, which are critical attributes for effective digital public services. The evaluation also indicates potential relationships between certain quality attributes. For instance, applications with higher usability scores tend to also demonstrate better reliability performance. This relationship suggests that well-designed user interfaces often reflect more structured system architectures and testing processes, which ultimately contribute to improved system stability.

A closer examination of the results reveals that the lower rankings of Bekasi and Cimahi are mainly influenced by weaker scores in usability and security criteria. These results suggest that the interface design and data protection mechanisms of these platforms may require improvement to ensure more effective public complaint management. In contrast, the higher scores achieved by Depok and Bandung are supported by relatively balanced performance across functional suitability, reliability, and performance efficiency, indicating more mature system management and infrastructure support.

Conversely, lower-ranked systems tend to show weaknesses in specific criteria such as security, compatibility, or maintainability. These weaknesses may indicate limitations in system design, infrastructure support, or maintenance practices. Therefore, continuous evaluation and improvement are necessary to enhance the quality and sustainability of digital complaint management systems.

The evaluation also indicates potential relationships between several software quality attributes. Applications with higher usability scores tend to also demonstrate stronger reliability and functional suitability performance. This relationship suggests that systems designed with clearer interfaces and structured workflows are more likely to maintain stable operation and consistent service delivery. Such interdependencies among quality attributes highlight the importance of addressing software quality in an integrated manner rather than improving each dimension in isolation.

From a governance perspective, the results highlight the importance of systematic software quality evaluation in supporting digital transformation within local governments. The integration of ISO/IEC 25010 with multi-criteria decision-making techniques such as AHP and SAW provides a structured approach for assessing and improving public sector information systems. Improving the quality of public complaint applications can directly influence citizen satisfaction with public services. Faster response times, reliable system performance, and user-friendly interfaces can enhance transparency, strengthen trust in government institutions, and encourage greater public participation in digital governance.

Overall, the proposed evaluation framework can serve as a practical decision-support tool for government institutions seeking to benchmark and improve the performance of their digital public service platforms. In addition to identifying the relative performance of each public complaint application, the evaluation results also provide important insights into specific areas that require improvement. By examining the ISO/IEC 25010 quality dimensions used in this study, several technical recommendations can be formulated to enhance the effectiveness and sustainability of digital complaint management systems. These recommendations are derived from the observed weaknesses across several criteria, particularly usability, security, and maintainability. Table 9 summarizes the recommended improvement strategies based on each quality dimension to assist local governments and system developers in prioritizing system enhancement efforts.

**Table 9.** Technical Recommendations for Improving Public Complaint Applications

Quality Dimension	Identified Issue	Technical Recommendation
Functional Suitability	Some complaint systems provide incomplete complaint categories and limited service integration	Expand complaint categories and integrate complaint platforms with other municipal service systems
Performance Efficiency	Several applications show slow response times and unstable server performance	Optimize server capacity, improve database queries, and implement load balancing mechanisms
Compatibility	Limited compatibility across devices and browsers	Ensure responsive web design and conduct cross-browser testing for multiple platforms
Usability	User interface complexity and unclear navigation structure	Simplify interface design, improve navigation flow, and provide user guidance features
Reliability	System interruptions during complaint submission or tracking	Implement system monitoring tools and strengthen system backup mechanisms
Security	Weak authentication mechanisms and insufficient data protection	Apply stronger authentication methods, encrypted data transmission, and role-based access control
Maintainability	Difficulty in updating system modules and fixing bugs	Adopt modular system architecture and implement regular maintenance schedules
Portability	Some systems cannot be accessed optimally on mobile devices	Develop mobile-friendly interfaces and support multiple operating environments

#### 4. Conclusions

This study evaluates the quality of public complaint applications implemented by city governments in West Java Province using the ISO/IEC 25010 software quality model combined with the Analytical Hierarchy Process (AHP) and Simple Additive Weighting (SAW) methods. The results show that the evaluated systems demonstrate varying levels of performance across the defined quality criteria. The ranking results indicate that some city governments provide more reliable and user-friendly digital complaint services, while others still require improvements in several quality dimensions such as security, compatibility, and maintainability. These findings highlight the importance of systematic evaluation in understanding the performance of digital public service platforms.

This research contributes to the development of decision-support approaches for evaluating e-government systems. By integrating the ISO/IEC 25010 quality framework with the AHP and SAW multi-criteria decision-making methods, this study proposes a structured evaluation model that enables objective comparison of software quality across multiple public complaint applications. The combination of these methods allows decision-makers to determine the relative importance of evaluation criteria and generate transparent rankings of system performance.

From a practical perspective, the findings of this study provide useful insights for local governments in improving the quality of their digital public complaint systems. The evaluation results can help policymakers and system developers identify priority areas for system enhancement, particularly in aspects related to usability, reliability, and security. By continuously monitoring and improving these quality dimensions, government institutions can enhance citizen engagement and strengthen the effectiveness of digital public services.

Future research can expand this study by including a larger number of government institutions or by comparing complaint systems across different provinces or countries. In addition, further studies may incorporate other evaluation frameworks or decision-making methods to enrich the assessment of digital public services. Integrating user satisfaction analysis or real usage data could also provide deeper insights into the effectiveness and adoption of public complaint applications in supporting e-government initiatives. Because the study focuses on city-level governments within a single province, the findings may not fully represent the diversity of digital governance practices across Indonesia

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