

APPLICATION OF THE ANALYTICAL HIERARCHY PROCESS MODEL IN THE SELECTION OF AUDIT SOFTWARE AT THE SOUTHEAST SULAWESI REGIONAL INSPECTORATE

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Abstract. This study aims to determine the criteria and sub-criteria that are prioritised by auditors in determining the audit software used in the Southeast Sulawesi Regional Inspectorate. The researchers used a qualitative approach with the Multi-Criteria Decision Making (MCDM) method using the Analytical Hierarchy Processes (AHP) analysis tool. The research sample consisted of all auditors at the Southeast Sulawesi Regional Inspectorate. The results of data analysis at the Southeast Sulawesi Regional Inspectorate showed that technical functions were the main priority for auditors in selecting audit software, while vendor support criteria were low priority criteria. Based on the questionnaire results, the software used by auditors was Microsoft Excel, while ACL was the least used application with the lowest percentage. The Government Internal Supervisory Agency (APIP) currently uses Computer-Assisted Audit Techniques (TABK). Therefore, the selection of audit applications can be determined through the Analytical Hierarchy Process (AHP) approach to select audit applications in accordance with the needs of the Southeast Sulawesi Province APIP. The results of this study will later be added to the discussion of theory and literature on the application of AHP in government agencies and institutions at the regional level in decision-making on the use of computer-based government information systems. This study is limited to the sub-criteria of audit software and the main criteria for the use of audit software and statistical criteria.

Keywords: Analytical Hierarchy Process, Software, Audit, E-Government.

I. INTRODUCTION

Advances in information technology that increasingly support more efficient activities make business processes easier and increase the reliability of higher outputs. One of the impacts of this change in business processes is a shift in activities, particularly in the use of audit techniques, from traditional audits to electronic audit techniques. Basically, traditional audits, which prioritise procedures and controls using physical documents, are slowly falling out of use by various organisations that rely on audit services. The shift in audit procedures currently favours the use of electronic data in data processing on computer-based information systems (Darono, 2010). Demands for efficiency and effectiveness in the information technology (IT) environment have begun to drive the development of a new audit approach, which is known as Computerised Assisted Audit Tools and Techniques (CAATs).

CAATs are the use of tools and techniques to audit computer applications and obtain and analyse data (Paksi, 2019). CAATs are now widely used by auditors because they can increase effectiveness and efficiency in the audit process (Ahmi and Kent, 2013; Ebimobowei et al., 2013; Ghani et al., 2017). Various types of software are used for auditing activities, the most popular of which is Ms. Excel, which is the simplest to use for auditors. In addition, there are also ACL (Audit Command Language), Arbutus Analyzer, IDEA (Interactive

Data Extraction and Analysis) and DB Software (MS Access, SQL Server).

Many studies have been conducted on determining the priority of audit application use in an organisation (Ghani et al., 2017; Paksi, 2019; Rufandi, 2020). However, previous studies focused more on the application of AHP for audit applications in business organisations and external local government organisations. Therefore, the researcher was interested in conducting research on the application of AHP in audit applications within Internal Government Agencies or the Internal Government Supervisory Agency (APIP). This was driven by the slow implementation of technology in government institutions compared to business organisations and public agencies located in the centre (Ebimobowei et al., 2013).

The Southeast Sulawesi Regional Inspectorate is an APIP tasked with supervising the procurement of goods and services in Regional Apparatus Organisations (OPD). One of the tasks carried out by the Southeast Sulawesi Regional Inspectorate is auditing activities carried out as needed. The regional inspectorate is responsible to the Governor through the Regional Secretary, as regulated by the Regional Regulation (PERDA) concerning the Second Amendment to Southeast Sulawesi Provincial Regulation Number 5 of 2008 concerning the Organisation and Work Procedures of the Inspectorate, BAPPEDA and Regional Technical Institutions of the Province.

The Southeast Sulawesi Regional Inspectorate does not yet have a policy or standard for determining and selecting the appropriate audit software, so that Southeast Sulawesi Regional Inspectorate auditors are currently unaware of the criteria for selecting audit software. There are no internal policy standards, so the selection and determination of software such as this can lead to weak results in the audit's. Therefore, a model is needed to assist in the selection of audit software.

There is a compatible model that can be applied to organisations in selecting audit software, namely the Analytical Hierarchy Process, often known as AHP. AHP was developed by Thomas L. Saaty in the 1980s to organise information and assessments when deciding on alternatives. The working principle of AHP is to simplify or break down problems through a clear hierarchy, enabling users to solve problems in a structured manner. Therefore, the researchers conducted this study with the aim of developing a structured method for the use of audit software at the Southeast Sulawesi Provincial Inspectorate in an effort to make the AHP model a support system for the current implementation of E-Government.

In practical terms, this research contributes to APIP, particularly the Southeast Sulawesi Inspectorate, by providing insight to the internal Southeast Sulawesi Inspectorate to determine the priority of software used by auditors and to identify the criteria considered by auditors in selecting software so that its implementation can be technically accountable.

II. RESEARCH METHODS

This research is qualitative in nature. In previous studies, research related to the implementation of AHP has been attributed as qualitative research (Creswell, 2018). The use of detailed hierarchical analysis to solve decision-making problems is consistent with a qualitative approach. Meanwhile, AHP is not used to generalise a situation because AHP only quantifies ideas, feelings, and emotions based on subjective assessments to be presented in a numerical scale. Different results may occur when using other samples. Third, AHP research has nothing to do with reliability issues in measuring variables.

Types and Collection of Data

The type of data used in this study is primary data, which is data obtained from *field research* directly (first-hand) or from primary sources. Primary data collection was carried out by filling out an AHP questionnaire that had been compiled based on established criteria to determine the priority of using audit software within the scope of the Southeast Sulawesi Inspectorate. The population in this study consisted of 23 auditor respondents, comprising 3 intermediate auditors, 18 junior auditors, and 2 first auditors. Based on the questionnaires distributed to the entire population, 12 questionnaires were completed by respondents. Therefore, the total response rate from participants was 52.18%, and 11 questionnaires were invalid (47.81%). The completed questionnaires were used as the main data to be processed using the Expert Choice (EC) Version 11.0 application. This application was used to determine priorities in decision making.

Data Analysis Technique

The data analysis technique used in this study was AHP, following the procedures applied based on the research framework developed by Maletič *et al.* (2014) and Setiawan (2014), which followed the previous AHP framework (Saaty, 1980), with the following details.

1. Defining the problem and setting objectives;
2. Identifying criteria and sub-criteria or policy selection and decision making;
3. Determining alternatives in policy selection for decision-making;
4. Establishing a hierarchical framework from *the top level* (criteria) to *the middle level* (sub-criteria) and the *lowest level* (list of alternatives);
5. Collecting information and empirical data;
6. Forming *a pairwise comparison* matrix for each element of criteria, sub-criteria and alternatives using a numerical scale matrix;
7. Establishing *judgements* on pairwise comparison calculations, where $n^*[(n-1)/2]$ reciprocal calculations will occur automatically;
8. Performing consistency tests;
9. Determining the global weight for each criterion and sub-criterion;
10. Determine the synthesis of results; and
11. Establishing the final ranking of the proposed alternatives.

Research Data Validity

Data validity testing is conducted to ensure the accuracy of research results. In qualitative research, to achieve valid research results, the research instruments in AHP are also calibrated by testing *the consistency ratio*. The purpose of this test is to ensure that participants' responses are consistent, thereby fulfilling logical consistency, one of the principles of AHP, *namely logical consistency*. If the CR value is ≤ 0.10 , the participants' answers can be accepted. For the reliability of the research data, the researcher used *the Case Study Protocol* (CSP).

III. RESULTS AND DISCUSSION

This study aims to reveal the priorities of the Southeast Sulawesi Inspectorate in selecting audit applications using the AHP approach, which is to establish criteria and sub-criteria for paired assessment metrics. As explained in the previous literature review, the researcher used the criteria and sub-criteria from the studies by Lin and Wang (2011) and Ertuğ and Girginer (2014). Regarding the identification of the resulting criteria, there are three main criteria, namely: vendor support factors (*vendor properties*), cost factors (*cost properties*), and technical s (*technical function properties*). Each main criterion has sub-criteria. The vendor sub-criteria consist of: technical support from the vendor, education and training from the vendor, and operating manuals. The cost sub-criteria consist of: acquisition costs, update costs, and employee training costs. The technical support sub-criteria consist of: data format support and operation display. Three *software* audits as alternatives for Southeast Sulawesi Inspectorate auditors are Ms Excel, ACL, and MySQL. The collected data are the results of respondents filling out the questionnaire.

Figure 1 shows the decision hierarchy based on the modified criteria, sub-criteria, and alternatives. Furthermore,

the AHP questionnaire was compiled based on the problem hierarchy as shown in Figure 2. A questionnaire or survey is a list of questions given to respondents (Kisworo & Sofana 2017; Rufandi, 2020).



Figure 1. AHP hierarchy structure in the selection of software for the Southeast Sulawesi Inspectorate

Source: ExpertChoice (2024)

However, the questionnaire submitted was different from the usual ones because the questionnaire statements in AHP were compiled in the form of paired comparison questions containing a numerical scale. The numerical scale consists of choices ranging from 1 to 9 (Hartono, 2018). This questionnaire has been tested for validity and reliability based on research conducted by Saaty and Vargas (2012).

Results of the Ranking of Criteria and Sub-Criteria

The main criteria in selecting Audit *Software* at the Southeast Sulawesi Inspectorate are vendor support, cost, and technical functions. The following are the results of data analysis using the *Expert Choice* application shown in Figure 2.



Figure 2. Comparison of Criteria

Based on Figure 2, the results of the criteria comparison test show that the criterion with the highest value is technical functions with a value of 0.413 (or equivalent to 41.3%), which is the criterion that respondents consider most important in selecting audit *software*. Next, the cost criterion has a percentage of 32.7% and vendor support is the lowest at 26%. This shows that auditors prioritise technical functions in audit applications over other criteria.

Sub-criteria are used to determine the weighting of the criteria that have been determined with the same assessment as the criteria weights described earlier. The first comparison was made on the vendor support criterion, whose sub-criteria consist of technical support, educational support, and operating manuals. The ranking results can be seen in Figure 3 for the following technical function sub-criteria.



Figure 3. Comparison of Vendor Support Sub-Criteria

Based on Figure 3, which shows the results of testing the vendor support sub-criteria, educational support received the highest score of 58.8%. This result indicates that application

users consider training on the use of audit applications to be important in supporting their understanding of the application, which is the basis for selecting audit applications within the scope of the Southeast Sulawesi Inspectorate. Furthermore, the operation manual has a percentage of 23.6% and technical support has a percentage of 17.5%.



Figure 4. Comparison of Cost Sub-Criteria

Furthermore, the cost criteria consist of sub-criteria for employee training costs, as shown in Figure 4, acquisition costs, and update costs. Based on the ranking results, employee training costs have a score of 51.2%. This is because many employees within the Southeast Sulawesi Inspectorate do not yet understand how to use the audit application, so when selecting an application, users prioritise spending on employee training. Meanwhile, acquisition costs have a score of 25.4% and update costs have a score that is not much different from acquisition costs at 23.4%.



Figure 5. Comparison of Technical Function Sub-Criteria

Technical function criteria are the highest criteria in determining the use of audit applications within the Southeast Sulawesi Inspectorate. These criteria have sub-criteria, including operational display and data format support. Based on the ranking results shown in Figure 5, the operating display is far more important than data format support, with a percentage of 50.4% and data format support at 49.6%. This shows that audit application users place far more importance on applications with a simpler and easier-to-use display than on data that is more easily integrated with other databases in the application.

Alternative Ranking Results

The results of the alternative ranking of audit software selection in determining the software/applications used within the scope of the Southeast Sulawesi Inspectorate show that Microsoft Excel is the application most chosen by auditors, with a percentage of 44.4%. Furthermore, MySQL is the second most preferred *software* among auditors with a percentage of 34.2%, while ACL is the *software* with the lowest priority level at 21.4%.

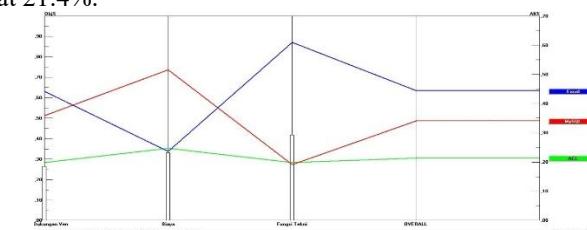


Figure 6. Sensitivity Test of Alternative Audit Software Use

Source: Expert Choice (2024)

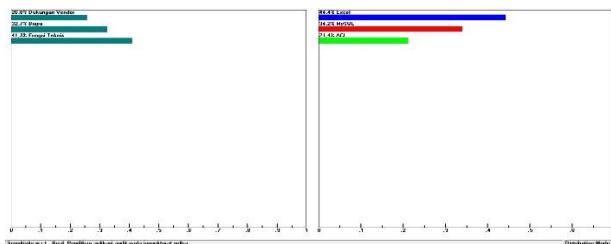


Figure 7. Dynamic Test of Alternative Audit Software Use
Source: Expert Choice (2024)

The high priority given to Microsoft Excel *software* is based on its superiority in most criteria/sub-criteria, except for the cost criterion, because Microsoft Excel *software* does not have significant costs in *software* development and operation and is not superior in all cost sub-criteria compared to other *software*. The following is a picture of the priority percentages and criteria for the use of audit *software* within the scope of the Southeast Sulawesi Inspectorate.

Consistency Test

When making decisions, it is important to conduct a consistency test to ensure that the decision is not based on random considerations (Hartono, 2018). In determining the consistency of criteria and sub-criteria, the CR (*Inconsistency Ratio*) value is used to determine which value is produced from the maximum eigen calculation, which is the geometric mean of paired comparisons multiplied by their relative priority. Based on the Saaty (2012) model, a decision can be accepted if the CR value is ≤ 0.10 , even though there are still differences in the participants' answers. Conversely, if the CR value is ≥ 0.10 , the evaluation must be repeated until a consistent matrix is created. Consistency checks are based on the participants' answers when filling out the AHP questionnaire. Table 2 below shows the consistency values (CR) of the participants.

Table 1. Inconsistency Ratio Comparison Between Elements of the Respondent Data Combination Matrix

No	Comparison Matrix Elements
1	Comparison of the selection of Audit <i>Software</i> for the Southeast Sulawesi Inspectorate
2	Level 1. Vendor Support
3	Level 1. Cost
4	Level 1. Technical Function
5	Level 2. Technical Support
6	Level 2. Educational Support
7	Level 2. Operating Manual
8	Level 2. Acquisition Cost
9	Level 2. Update Fee
10	Level 2. Employee Training Costs
11	Level 2. Data Format Support
12	Level 2. Operational Display

Source: Expert Choice (2024)

Based on the Inconsistency Ratio value, it can be concluded that the paired comparison has a consistent ratio value (CR ≤ 0.10), where the inconsistency value is less than 10% or acceptable to continue the AHP analysis (Saaty, 2012). The overall inconsistency of participants in the selection of audit *software* is 0.01.

IV. CONCLUSIONS

The Southeast Sulawesi Inspectorate requires a model to determine the various criteria that auditors consider when selecting audit *software*. The model developed by the researcher is the AHP model, which can produce a final decision from various alternative choices. This study aims to investigate the factors that influence audit *software* within the scope of the Southeast Sulawesi Inspectorate using the AHP model. Based on the results of data analysis and discussion in this study, it can be concluded that auditors at the Southeast Sulawesi Inspectorate highly prioritise the technical functions of audit *software* with a weight of 41.3%. After this criterion, auditors consider cost with a weight of 32.7% and vendor support with a weight of 26%. The importance of this finding is that APIP in Southeast Sulawesi does not prioritise the cost criterion. This is in line with research conducted by Ertug and Girginer (2014); Rufandi (2020), which states that the cost (financial) criterion is not significantly considered when *software* is purchased using the office's budget allocation. Furthermore, the technical support sub-criterion ranked lowest with a percentage of 17.5%. This indicates that auditors did not consider the support aspects provided by vendors for the system, implying that auditors tended to use audit applications without considering the systems provided by vendors. Therefore, it is hoped that management will consider this sub-criterion in the development of audit *software*. The results of testing the priority of alternative applications based on all criteria and sub-criteria in the selection of audit *software* for the Southeast Sulawesi Inspectorate are as follows: first is Microsoft Excel, followed by MySQL, and last is ACL. These results are taken into consideration by the Southeast Sulawesi Inspectorate because, according to Rufandi's (2020) research, the main influence on an auditor's decision to use audit *software* or not is the organisation. Additionally, the overall inconsistency of participants in selecting audit *software* is 0.01.

CR REFERENCE	Value
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