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Factors Influencing the Adoption of Cloud-based Village Information System: A Technology-Organization-Environment Framework and AHP–TOPSIS Integrated Model

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ABSTRACT

Cloud-based service is a key area for growth in Indonesia, but there are still very few villages that have adopted a village information system based on cloud computing. This study investigates the factors influencing OpenSID adoption in cloud computing. The research was informed by the Technological Organizational Environmental (TOE) and combined two multi-criteria decision analysis methods, namely, AHP and TOPSIS to analyze the acceptance of cloud computing-based village information systems, the driving factors for adoption, and the selection of forms of OpenSID. The research focuses on the analysis of four dimensions namely organization, trust, innovation, and vendor. The sub-dimensions of each dimension include the organization (the technological readiness of actors, top management support, and firm size), Trust (security and privacy factors), innovation (compatibility, complexity, trialability, and relative advantage factors), and Vendor (vendor reputation, perceived price, and external support factors). Primary data was collected using a questionnaire and semi-structured interviews with respondents from the village government apparatus in Indramayu. The results of the study showed an open-source cloud-based village information system is the most suitable alternative solution for government at the village level in Indramayu, West Java Province. The results highlighted that the enablers that are critical for cloud adoption include Technology readiness, trust, technological innovation, and vendor. The barriers that are hindering cloud adoption are infrastructure readiness, understanding the use of cloud computing technology, low technical skills and knowledge, data integration issues, and data security. This research is a reference for developing a village information system based on cloud computing

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1. INTRODUCTION

Cloud technology is the most challenging area in the field of modern technology where assets (e.g., networking, servers, storage, applications, and services) can be rented and used by clients over the internet based on their requests and can be released expeditiously with minimal management effort or minimal service provider interaction [1]. The basic cloud computing model includes Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS), and Recovery as a Service (RaaS)[2]. The interest in the use of cloud computing is still relatively low. In 2020, Indonesia was ranked 12th out of 14 countries studied by the Asia Cloud Computing Association (ACCA, 2018) with a score of 55 in the Asia Cloud Computing Association's cloud readiness index, quite far from Malaysia (ranked 8th with a score of 68.5) and also Hong Kong (ranked 1st with a score of 81.9) [3].

In recent years, cloud computing-based village information systems as village information access services and other software-as-a-service (SaaS) products have begun to develop rapidly. Based on data from the OpenDesa Team, in 2022, the number of villages in Indonesia was 83381, but only 6.84% of the villages have adopted cloud computing. It indicates that very few villages have adopted cloud computing-based village information systems. Several obstacles for the government at the village level to adopt a village information system based on cloud computing include the lack of village apparatus skills in using information and communication technology, understanding of the application and workings of cloud computing so that migration runs smoothly, requiring technological infrastructure with high maintenance standards, requiring assistance in the form of training and implementation, both virtually and directly to all cloud computing users.

Software as a service (SaaS) is changing many industries by simplifying application deployment, installing applications on a cloud, and allowing users to access those applications via a web browser without installing the software on their local or laptop computer [4]. The development of Software as a service cloud computing data security governance, technological factors, and top management support is crucial [5]. By using Software as a service (SaaS), organizations can get several benefits in terms of improving services to village communities, facilitating access to information, providing promotional media for village community business products and village potential, and providing information on village population, area, and so on.

This study analyzed the factors that influence the acceptance of cloud-based village information systems. The TOE framework assessed, monitored, and managed risks across various processes and their overall integration [6]. AHP was applied to determine weights based on pairwise comparison matrices of other factors [7]. Meanwhile, TOPSIS was employed to prioritize previously identified risks. [8]. The AHP method was used to set priorities in the criteria for the adoption of a cloud-based village information system and the combination of AHP and TOPSIS was applied to analyze and select alternative solutions for the adoption of a cloud-based village information system. This study is expected to contribute to and enrich insights in studies and research related to the acceptance of cloud-based village information systems.

2. RESEARCH METHOD

This research was conducted using qualitative and quantitative approaches. This research is conducted in two steps. The first stage is the factor ranking stage. The factors that have been arranged into the structure of the research hierarchical model were tested by research respondents using a questionnaire. Then the results of these respondents were analyzed using the AHP technique in order to obtain a ranking of the importance of the determinants of cloud-based village information system adoption. The results of the respondents were also tested for the level of inconsistency so that they met the requirements for acceptance. Based on the theory and variables obtained from the previous stage, the authors describe and formulate the structure of the AHP hierarchical model for the initial stage. This structure is carried out by modifying and combining several previous research models to form a new research model. The variables that have been formulated in the initial structure were evaluated by experts through semi-structured interviews with experts. In this interview, the experts provided suggestions regarding the design of the model and provided a more detailed description of the views of village officials on the implementation of a cloud-based village information system.

Next, the final hierarchical model design is described to facilitate problem-solving using the AHP method. Hierarchy development can be done by determining the objectives and the criteria used. The hierarchical structure can also assist in the stage of preparing the questionnaire and pairwise assessment between variables. The questionnaire was prepared following the AHP questionnaire model which accommodated pairwise comparisons and the rating scale recommended by Saaty. This questionnaire consists of 6 parts, where the first part is a question about the demographics of the respondents and the second to the sixth part is a pairwise comparison question for criteria and sub-criteria. From the results of data collection which was carried out for eight weeks both online and in print, the authors then conducted a temporary data recap and processing using Microsoft Excel 2016 and Google Sheets. Respondent data consisted of twelve village heads (71%), two village secretaries (12%), one head of financial affairs, and one head of social affairs and elements of regional apparatus (5.88%). These respondents understand village management because their daily work is related to management and decision-making in the village government. Of the total respondents, 12 respondents (70.59%) had used OpenSID, both cloud-based OpenSID and on-premise OpenSID, in their village government. Another four or 29.41% of respondents have never used OpenSID.

Then the data is entered into the Expert Choice 11 software so that it can easily perform matrix weighting calculations, both individually and in combination. Then this software can also provide the eigenvalues of each criterion and sub-criteria. After getting the eigenvalues, the writer can also get the inconsistency values directly through the same program. Then, the eigenvalues that have met the consistency requirements can be used to rank the overall criteria and sub-criteria. The largest eigenvalue is ranked at the top. After completing the processing and analysis of data using the AHP method. The next stage is to conduct a second interview to confirm the results of the analysis that has been carried out on the experts using the AHP method. In the second interview, the experts provided a broader picture of implementing a cloud-based village information system in actual field conditions. The interviews were conducted with three respondents who had filled out the AHP questionnaire previously. The interview duration ranged from 30-45 minutes and was recorded using an audio recording application.

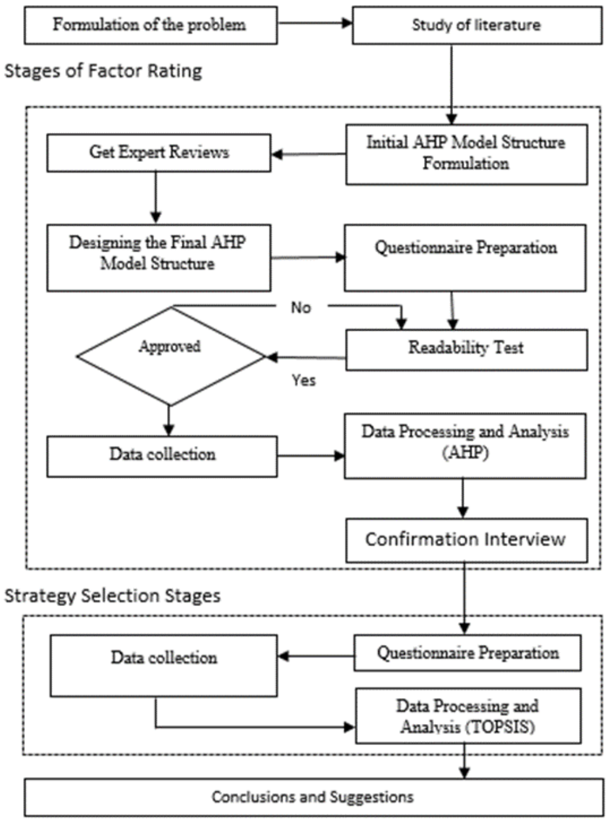

Figure 1. Research Stages

The second stage is the strategy selection stage. The author also conducts case studies on three village governments to choose a form of cloud-based OpenSID adoption. This was done to be able to answer the objectives of these two studies, namely to analyze the form of cloud-based OpenSID adoption that is suitable for village governments. The form of adoption of cloud-based OpenSID which is an alternative solution is cloud-based OpenSID which is open source and proprietary. Each respondent filled out a questionnaire prepared by the author to compare the two types of cloud-based OpenSID.

The results of completing the questionnaire were analyzed using the AHP-TOPSIS method to get the best alternative solution so that organizations can choose the right form of adopting cloud-based OpenSID. The TOPSIS and AHP methods have a decision support function with the best approach that produces the shortest distance from a positive ideal solution or the farthest distance from a negative ideal solution. This method was successfully applied with the same factor weights. To eliminate this significant weakness and enable in-depth analysis of alternatives based on the best ideal and worst ideal solutions, AHP was integrated with TOPSIS in this research. As a result, the new AHP-TOPSIS method can be configured more broadly for practical decision-making problems influenced by a number of alternatives and supported by an increasing number of alternatives and criteria in ranking differences.

Data processing was carried out using Microsoft Excel 2016 software using the TOPSIS formula which was entered manually. There are six steps taken in analyzing the response results. First, build a normalized decision matrix. The second builds a weighted normalized decision matrix. The weights used are the eigenvalues of each factor from the results of calculations using the AHP method. The third determines the positive and negative solutions. The fourth calculates the value of the separation between each alternative solution. The fifth calculates the relative closeness to the ideal solution. Then the alternative solutions are sorted based on the higher relative closeness value. Thus, it can be seen which form of cloud-based OpenSID adoption is most suitable for the respondents. The stages of the research used are shown in Figure 1.

The AHP-TOPSIS method is used to identify the most influential risks and find critical alternatives [9]. AHP is a measurement used to make decisions by making pairwise comparisons between factors through an importance scale [10], assessing various variables and creating a hierarchical structure by giving weight to each criterion to reduce the complexity of decision making [11]. Meanwhile, the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS), the ability to evaluate many alternatives uses a [12] pair of a positive ideal solution and a negative ideal solution as two reference points to rank a set of decision alternatives [13]. AHP-TOPSIS has been well applied in various research sectors where decision-makers give weights to criteria, which are calculated using AHP and greatly influence the results of recommendations calculated using TOPSIS, and provide good accuracy test results [14].

3. RESULTS AND DISCUSSION

The processing of primary data in this study began with an analysis of criteria based on the structure of the AHP hierarchical model, followed by an explanation of the analysis of the ranking of adoption factors and the results of the analysis of case study of alternative solution selection using the TOPSIS method.

3.1. Step 1: Criteria Validation by Experts Sub section 1

In the initial process of formulating the hierarchical model structure, several previous research models were used. Eleven previous studies were used as references in selecting the factors. There are several factors that have different names but have the same denotation from various previous studies. The definitions of each factor from previous studies were studied and combined into one factor. The names and definitions of the factors that had been combined were adjusted to the objectives to be achieved by this study. Table 1 describes the results of the literature study in the process of formulating the initial hierarchical structure.

Table 1. Hierarchical Model Structure Criteria

	Source										
	1	2	3	4	5	6	7	8	9	10	11
Technological readiness	v					v	v		v		v
Top management support	v			v		v	v		v		v
Firm size							v		v		v
Security	v		v				v	v	v	v	
Privacy	v		v	v	v		v	v			
Risk											
Compatibility		v	v				v			v	
Complexity	v						v		v		v
Trialability	v									v	
Relative advantage	v			v			v		v		v
Vendor Reputation				v			v				
Pricing Mechanism							v	v		v	
External support	v			v							

Annotation: 1.: (Alkhater et al., 2018), 2: (Raut et al., 2018), 3: (Alassafi et al., 2017), 4: (Liang et al., 2017), 5: (Phudphad et al., 2017), 6: (Hassan, 2017), 7: (Priyadarshinee et al., 2017), 8: (Gupta et al., 2013), 9: (Oliveira et al., 2014), 10: (Sabi et al., 2016), 11: (Junior et al., 2019).

The Technological-Organizational-Environmental (TOE) Framework is used to examine what factors from the technological context, organizational context, and environmental context influence the decision to adopt cloud computing by village governments in Indramayu. Each selected factor was grouped based on its dimensions. The dimensions proposed in this research model are technological readiness of actors, top management support, and firm size were grouped on the organization dimension; security and privacy factors were grouped in the trust dimension; compatibility, complexity, trialability, and relative advantage factors were grouped into the innovation dimension; vendor reputation, perceived price, and external support factors were grouped into the vendor dimension. The grouping of factors can be seen in Figure 2.

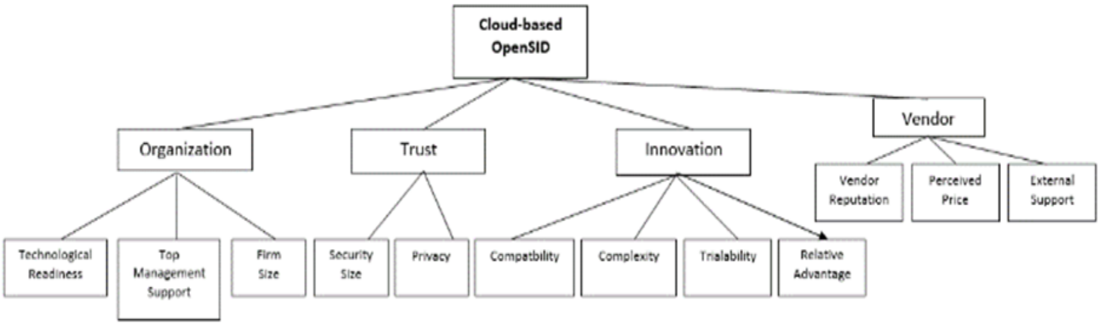

Figure 2. AHP Hierarchical Model Structure

3.2. Step 2: Factor Analysis Using AHP Method

The highest level of the AHP hierarchical structure was the goal to be achieved, namely the adoption of cloud-based OpenSID, followed by the criteria below it, namely organization, trust, innovation, and vendor. Each criterion had its own sub-criteria. Factor analysis using the AHP method was done by calculating pairwise comparison by inputting the priority vector of each respondent who completed the questionnaire into the Expert Choice 11 software. After inputting all the data from the questionnaire, then the matrix of aggregated opinion was calculated. After obtaining the geometric values for the matrix of aggregated opinion, then the eigenvalue for each criterion was obtained. Based on the eigenvalues of each criterion and sub-criteria of each criterion, then a global comparison of all sub-criteria was obtained, as presented in Table 2.

Table 2. Global Ranking and Eigenvalues of Sub-criteria

Sub-criterion	Eigenvalue	Ranking
Technological Readiness	0.183	1
Top Management Support	0.130	2
Firm Size	0.122	3
Security	0.053	9
Privacy	0.087	5
Compatibility	0.072	7
Complexity	0.058	8
Trialability	0.051	10
Relative Advantage	0.042	11
Vendor Reputation	0.093	4
Perceived Price	0.083	6
External Support	0.026	12

Figure 3 displays the eigenvalue of each criterion and its inconsistency value and exhibits the prioritized sub-criteria as a whole. After identifying the eigenvalues of each criterion and the sub-criteria of each criterion, then a global comparison of all sub-criteria was obtained. The most important sub-criterion was technological readiness, which was a sub-criterion of the organization criterion, with an eigenvalue of 0.183. The three sub-criteria of the organization criterion, namely technological readiness, top management support, and firm size, were in the top three in the ranking of sub-criteria globally.

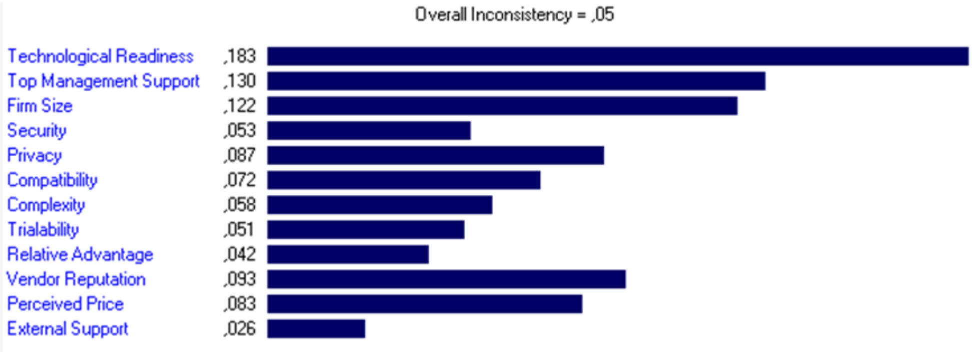

Figure 3. Eigenvalues and inconsistency values of sub-criteria globally

The vendor criterion ranked second out of the four criteria and made the vendor reputation sub-criterion rank fourth in the global sub-criteria ranking with an eigenvalue of 0.093. Then, the perceived price was in sixth place with an eigenvalue of 0.083. Meanwhile, external support had the lowest position with an eigenvalue of 0.026. Vendor reputation is an important factor because Indramayu in West Java Province is a somewhat underdeveloped region that has few human resources who are proficient in using web-based technology, especially for e-government. Based on these results, it is understandable why vendor reputation was more important than price or external support.

Furthermore, there were two sub-criteria of the innovation criterion that ranked just below the perceived price sub-criterion, which were compatibility and complexity, with eigenvalues of 0.0072 and 0.058, respectively. The ability of cloud-based OpenSID to make village governance more effective, efficient, and productive is crucial. In addition, cloud-based OpenSID must also be able to adapt its use to the business processes and culture of the organization so that the village administration gets optimal benefits. Two other sub-criteria of the innovation criterion, namely trialability and relative advantage, were in the bottom three or more precisely, in tenth and eleventh places with eigenvalues of 0.0051 and 0.042, respectively.

The trust criterion, which was in third place among the four criteria, made the privacy sub-criterion occupy the fifth place in the global ranking of sub-criteria with an eigenvalue of 0.087. Then, security was in ninth place with an eigenvalue of 0.053. Privacy is an important factor because OpenSID will store personal data of villagers. Therefore, the ability of OpenSID to maintain the confidentiality of data is very important to consider. Account role separation needs to be prioritized so that each account cannot create, view, change, or delete confidential data at will.

3.2.1. Factor Ranking Validation by Experts

The results of the factor ranking analysis that had been done before were then validated by the experts who were respondents to the previous questionnaire. It was done to discover whether or not the factor ranking results were accepted by experts and to obtain qualitative reasons for the results. The first expert, who works as Head of Informatics at the Communication and Informatics Office of Indramayu Regency, believes that in adopting cloud-based OpenSID, organization is the most important factor. More specifically, this expert also explained that village head has the most important role in the adoption of cloud-based OpenSID. According to the second expert, cloud-based OpenSID can be adopted if the top management has granted an approval. Without approval from top management, cloud-based OpenSID will be difficult to adopt. The third expert also agreed with the results and argued that top management remains the main gate for the adoption of OpenSID, provided that village government is ready and really needs it.

The three experts interviewed agreed with the results of the rankings done in this study. Organization is the most important criterion in the adoption of cloud-based OpenSID compared to other criteria. In terms of the organization criterion, technological readiness is the preferred factor, followed by top management support. In the trust criterion, privacy is more considered than security, although both are equally important. In the innovation criterion, compatibility is the most prioritized factor compared to other factors. Finally, good reputation of a vendor is more considered than other factors such as perceived price and external support.

Compared to other factor dimensions such as trust, innovation, and vendor, the factor dimension that had the most influence on the adoption of cloud-based OpenSID by village governments in Indramayu was organization. This is in line with the results obtained in the studies by [15][16][17]. In the organization dimension, technological readiness [17] was the most influential factor among the other two factors, namely top management support and firm size. This study also discovered that in the dimension of trust, privacy was a factor that was more considered than security. A study on privacy concerns for health informatics as a service (HIaaS)[18] also concludes that privacy concern factor prevents users from adopting HIaaS. It may happen because the general use of cloud does not pay much attention to the confidentiality of information. However, OpenSID and health information system that stores confidential data must ensure that the confidentiality of the stored data is guaranteed.

3.2.2. Selection of Form of Adoption of Cloud-based OpenSID

In addition to analyzing the factors influencing the adoption of cloud-based OpenSID using AHP, a case study was also conducted on three village governments that were respondents in order to choose alternative solutions using TOPSIS. Respondents in this case study were selected from respondents of the AHP questionnaire who had provided additional reviews via semi-structured interviews at the stage of validating the results of the factor rankings. Case study was conducted to provide an overview of the forms of adoption of cloud-based OpenSID that are suitable for village governance. There are two types of cloud-based OpenSID that become alternative solutions, namely open source (S1) and proprietary (S2) cloud-based OpenSID. Based on these alternative solutions, the AHP hierarchical structure was also developed to an alternative level. Figure 4 illustrates the hierarchical structure of AHP down to the alternative level.

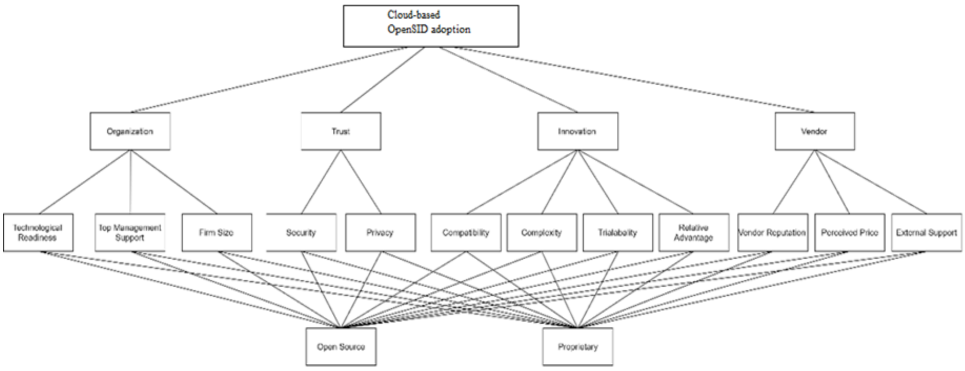

Figure 4. AHP Hierarchical Structure and Alternative Solutions

Respondents in this case study were selected from respondents of the AHP questionnaire who had provided additional reviews via semi-structured interviews at the stage of validating the results of the factor rankings. They were:

a. Dermayu Village. This village previously used open source cloud-based OpenSID before finally switching to using proprietary cloud-based OpenSID.

Step 1: Making a normalized decision matrix. Based on the questionnaire completion by the respondents, the completion results were obtained and are presented in table 3.

Table 3. Matrix representation of alternative solutions for respondent 1

	TR	TMS	FS	SE	PR	CP	CX	TR	RA	VR	PP	ES
S1	8	7	6	7	7	8	8	8	8	9	9	9
S2	9	6	6	6	6	8	8	10	8	8	8	8

This process transforms various dimensional attributes into non-dimensional attributes and allows comparisons between the attributes. The procedure is to take the output of each criterion and then divide it by the norm of the overall output vector of the criteria. Suppose that the matrix obtained from data collection is represented in the equation 3.1

$$D = \begin{array}{c} \\ A_1 \\ \dots \\ A_n \end{array} \begin{array}{ccc} F_1 & F_2 & F_n \\ \multicolumn{3}{c}{\left[\begin{array}{ccc} C_{11} & C_{12} & C_{1n} \\ \dots & \dots & \dots \\ C_{m1} & C_{m2} & C_{m3} \end{array}\right]} \end{array} \tag{3.1}$$

In matrix A_n, it is stated that the i-th alternative solution is $i = 1,2,...,m$. F_j represents the j-th criterion that is related to the i-th alternative solution. C_{ij} shows the combined value of all existing data. Because there were more than one data, the average of each data in the same row and column was calculated. An r_{ij} element of the normalized decision matrix R can be calculated as follows:

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} x_{ij}^2}} \tag{3.2}$$

Consequently, each attribute had the same length unit of the vector. Next, the matrix representation was normalized (table 4).

Table 4. Normalized matrix of alternative solutions for respondent 1

	TR	TMS	FS	SE	PR	CP	CX	TR	RA	VR	PP	ES
S1	0,664	0,581	0,498	0,581	0,581	0,664	0,664	0,664	0,664	0,747	0,747	0,747
S2	0,747	0,498	0,498	0,498	0,498	0,664	0,664	0,830	0,664	0,664	0,664	0,664

Then, a weighted normalized decision matrix was constructed, which can be seen in table 5. The weighted normalized matrix was obtained by multiplying the normalized decision matrix (Equation $r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} x_{ij}^2}}$) see equation 3.3

with the weight of the AHP eigenvalue, as in Equation

$$v_{ij} = r_{ij} * w_j \forall i, j. \tag{3.3}$$

Table 5. Weighted Normalized matrix of alternative solutions for respondent 1

	TR	TMS	FS	SE	PR	CP	CX	TR	RA	VR	PP	ES
S1	0,121	0,075	0,060	0,030	0,050	0,047	0,038	0,033	0,027	0,069	0,062	0,019
S2	0,136	0,664	0,060	0,026	0,043	0,047	0,038	0,048	0,033	0,027	0,061	0,055

Furthermore, positive and negative ideal solutions denoted as A+ and A- were determined, presented in Table 6. Positive and negative ideal solutions can be obtained by the following equation 3.4 or 3.5

$$A^{+} = \{(max_j v_{ij} | i \in I), (min_j v_{ij} | i \in I'); \forall j\} = \{v_1^{+}, v_2^{+}, \dots\} \tag{3.4}$$

and the following equation:

$$A^{-} = \{(min_j v_{ij} | i \in I), (max_j v_{ij} | i \in I'); \forall j\} = \{v_1^{-}, v_2^{-}, \dots\} \tag{3.5}$$

where I and I' are associated with consequential attribute gain and loss.

Table 6. Positive and negative ideal solutions for respondent 1

	TR	TMS	FS	SE	PR	CP	CX	TR	RA	VR	PP	ES
A^{+}	0,136	0,075	0,060	0,030	0,050	0,047	0,038	0,048	0,033	0,069	0,062	0,055
A^{-}	0,121	0,064	0,060	0,026	0,043	0,047	0,038	0,033	0,027	0,027	0,061	0,019

After that, the distance between each positive alternative solution, denoted by S+, and the distance between each negative solution, denoted by S-, were calculated and the results are presented in Table 7. The shortest and farthest distances for each alternative solution can be calculated using the equations 3.6 and 3.7

$$S_i^{+} = \sqrt{\sum_{i=1}^{n} (v_{ij} - v_i^{+})^2} \forall j \tag{3.6}$$

$$S_i^- = \sqrt{\sum_{i=1}^{n}(v_{ij} - v_i^-)^2}\,\forall j \qquad . \qquad (3.7)$$

Furthermore, the value of *Vi* was calculated to determine the order of the best alternative solutions. The relative closeness to the ideal solution can be determined as in this equation: $V_i = \frac{D_i^-}{(D_i^- + D_i^+)}$

Table 7. The distance between each positive and negative alternative solution and the relative closeness of the ideal solutions for respondent 1

	S^+	S^-	Vi	Solution
S1	0.0417	0.0438	0.511	*Open source*
S2	0.0438	0.0417	0.4881	*Proprietary*

Alternative solutions were sorted by setting priorities based on the value of V_i. The higher the value of *Vi* in a solution was, the higher the ranking of the solution in Table 4 would be. In the results of sorting alternative solutions obtained as shown in Table 7, it is evident that the alternative solution that is suitable for use by Dermayu Village in Indramayu (respondent 1) is open source cloud-based OpenSID.

b. Rembatan Wetan Village. This village has never used any cloud-based OpenSID before, but has developed OpenSID with a population module. Like the calculation for respondent 1, the results obtained for respondent 2 are displayed in Table 8. Through the results of sorting the alternative solutions obtained by calculation as previously done, it is apparent that the alternative solution that is suitable for use by Rembatan Wetan Village in Indramayu (respondent 2) is open source cloud-based OpenSID.

Table 8. The distance between each positive and negative alternative solution and the relative closeness of the ideal solutions for respondent 2

	S^+	S^-	Vi	Solution
S1	0.0539	0.0916	0.6295	*Open source*
S2	0.0916	0.0539	0.3704	*Proprietary*

c. Telukagung Village. This village has never used any cloud-based OpenSID before. Actually, Telukagung Village had tried to use open source and proprietary cloud-based OpenSID, but the top management decided to postpone the use of OpenSID. The same calculation was also done for Telukagung Village, which was respondent 3. The calculation results are presented in table 9 and indicate that an alternative solution that is suitable for use by Telukagung Village in Indramayu (respondent 3) is open source cloud-based OpenSID. This is in line with the opinion of respondents who feel that according to the culture and needs of the village administration, open source cloud-based OpenSID is more suitable for use.

Table 9. The distance between each positive and negative alternative solution and the relative closeness of the ideal solutions for respondent 3

	S^+	S^-	Vi	Solution
S1	0.0551	0.0562	0.5048	*Open source*
S2	0.0562	0.0551	0.4951	*Proprietary*

The three villages became the objects of a case study in selecting the best alternative solution to the adoption of cloud-based OpenSID. An analysis of alternative solutions using the AHP-TOPSIS method showed that the three villages are more suitable for using open-source cloud-based OpenSID than proprietary cloud-based OpenSID. Open source reduces risk to village governments and makes IT more affordable to village governments by reducing costs, providing transparency, preventing government at village level from vendor lock-in, being available free of charge from source code and open source software, and providing flexibility in the choice of supporting [19], integration costs, benefits derived from use, and potential risks [20].

4. CONCLUSION

The criterion most considered by governments at the village level in Indramayu in the adoption of cloud-based OpenSID is the organizational criterion. Before adopting cloud-based OpenSID, governments at the village level need to first consider the needs and conditions of their organizations. The condition of the village government must continuously strengthen by conducting training mentoring and strategic guidance on the overall function and development of OpenSIDSID. The second most considered criterion is trust. The government at the village level will assess whether or not the cloud-based village information system is safe and can guarantee data confidentiality because data regarding human resources in government at the village level is very sensitive and confidential. OpenSID is developed continuously by the OpenSID community so that OpenSID security continues to improve and security improvements are always given priority at each release and it requires the provision of dedicated resources to ensure data security. Furthermore, innovation from technology is the third most considered criterion. The use of cloud computing for OpenSID has technological challenges including understanding the use of cloud computing technology, low technical skills and knowledge, data integration issues, and data security. The last criterion that is least considered is vendor. The application of OpenSID needs to consider vendor lock-in (limited use of technology, solutions or services owned by vendors or vendor partners). Vendor lock-in refers to actions taken by various service providers to ensure that customers will experience difficulties when trying to migrate out of the vendor ecosystem.

The sub-criterion of the organization criterion that is most considered in the adoption of cloud-based OpenSID is technological readiness. Furthermore, government at the village level needs to prepare infrastructure readiness and human resources. Regarding the trust criterion, the sub-criteria that is most considered by governments at the village level in Indramayu in the adoption of cloud-based OpenSID is privacy. It is because cloud-based OpenSID will store important and confidential data such as population data. Only then will the organization assess the ability of cloud-based OpenSID to maintain the security of their data from damage, threat, loss, or attack. In the innovation criterion, the sub-criterion that is considered the most by governments at the village level in Indramayu in the adoption of cloud-based OpenSID is compatibility. Governments at the village level consider that cloud-based OpenSID will ease administrative burdens and can even solve existing problems. Cloud-based OpenSID must be able to adapt to the business processes and culture of an organization. Not least of all, the sub-criterion of the vendor criterion that is most considered in the adoption of cloud-based OpenSID is vendor reputation.

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