Decision Support System for Cloud Computing Service Selection Using the Weighted Product Method

Dedi Saputra[1*], Kudiantoro Widianto[2], Tyas Setiyorini[3], Ibnu Alfarobi[4]

[1] Information System, Universitas Bina Sarana Informatika, Indonesia.
[2] Information Technology, Universitas Bina Sarana Informatika, Indonesia.
[3] Technical Information, STMIK Nusa Mandiri, Indonesia.
[4] Computer Engineering, Universitas Bina Sarana Informatika, Indonesia.

[*] Corresponding author:
Email: dedi.dst@bsi.ac.id

Abstract.

The selection of cloud computing services requires careful consideration and review. Some aspects of the criteria that must be considered such as direct selection between services that take a long time and need to be done repeatedly. Decision Support System with Weighted Product (WP) method is an effective method because the time needed for calculation is much shorter. The purpose of this research is to apply Weighted Product (WP) method in the decision support system to choose cloud computing services where as a case study is PT Deptech Digital Indonesia, so that it can make it easier for companies to make decisions according to their needs. The calculation results using the WP method give preference to the top 3 services: Google Cloud, Amazon Web Services and Microsoft Azure. This proves that research with the WP method can be applied to various services that will be used in the future according to predetermined criteria. Based on these results, the system can recommend cloud computing services according to the needs and a good level of accuracy.

Keywords: *Cloud Computing, Decision Support System, Weighted Product Method.*

1. INTRODUCTION

Cloud computing service is a set of technologies that serves to empower the internet as a server center used to manage data as well as user applications [1]. Utilization of cloud computing does not require special expertise because the entire infrastructure or information system is controlled by cloud computing devices [2], to manage digital-based services over the internet network.

Making users feel comfortable in accessing our website or digital services on the internet is a difficult problem, therefore the appropriate infrastructure will certainly be one of the main keys in providing a good user experience to users. Because according to many experts say that the user experience offered is an indicator of the success of a

site [3][4], therefore the accuracy in choosing cloud computing services will help us in developing services tobe better in terms of scalability, stability, flexibility and service performance. In choosing cloud computing services there are also risk factors that must be taken into account. Usually these risks have been anticipated by the users. One of the risks is service level in the form of inconsion of service providers, so users must understand the service level obtained, both about transaction response time, data protection and data speed recovery [5].

One of the main problems is the selection of cloud computing services, because there are many aspects that need to be considered, one of which is the performance of the service, we need to make sure that the available services are able to work properly and are not constrained [6], this is a problem that is often encountered because it certainly requires experience in using various cloud computing service providers in order to beable to comparing several service options to be used.. The comparative system of existing cloud service providers has a list of cloud service providers that are limited and complex enough to use [7]. Another problem is when comparing some services, which are used as objects of comparison, namely two or more service providers, this will take time to analyze each service, because it does not understand the advantages and disadvantages of the types of cloud computing services themselves, so it takes an analysis that provides a comparison of performance both in terms of service and service performance [8].

In order to overcome the drawbacks of working with human expert, a computer program of decision support systems (DSS) which able to process data using expert's knowledge can be used as a tool to help people with no experience to make decision like an expert [9]. By utilizing a decision support system we can analyze which service providers are appropriate and as needed, through the parameters of assessment in accordance with the criteria that have been determined.

According to B. Andika in [10] Decision support system is a collection of model-based data processing and assessment procedures used to assist in making decisions.

Here are some characteristics of the decision support system:

1. Provide support in decision making in semi-structured and unstructured situations.
2. Support in all phases of the decision making process, namely intellegence, design, choice and implementation.
3. Increase the effectiveness of the efficiency of decision making
4. users in modifying as well as developing their own simple system

The purpose of the decision support system is to assist decision making from a set of alternatives obtained from information that has been processed or available previously using a decision-making model.

Decision making is a set of alternative selection process actions used to obtain results in order to achieve a specific goal. Decision making on a problem can be done with a systematic approach through the process of collecting data into information and coupled with factors that need to be considered in decision making [11].

According to Rina Widyasari in [12] in the decision making process there are steps that need to be done are as follows:

1. Intelligence Phase

At this stage what is done is to find classification, decomposition, and ownership of problems. At this stage, there is also a process of tracing and detection of the scope of the problem as well as the process of problem recognition. The data that has been obtained is then processed and tested in order to identify the problem.

2. Design Phase

The design stage has several processes including the creation, development, and analysis of what is possible to do. Includes understanding of problems and identification of viable solutions.

The tasks at this stage are:

a. Model components
b. Model structure
c. Selection of selection principles (evaluation criteria)
d. Development (provision) of alternatives
e. Predicted results
f. Measurement of results
g. Scenarios

3. Choice Phase

There are two types of approaches at the election stage, namely:

a. Analytical technical uses mathematical formulation
b. Algorithm that describes the process step by step

4. Implementation Phase

This stage is the process of implementing the system design made at the stage of design and implementation of alternative actions selected at the selection stage.

Weighted Product (WP) method requires a normalization process because this method multiplies the results of the assessment of each attribute [13][14][i]. According to D. Khairina in [11] Weighted Product is one of the methods used to complete Multi Attribute Decision Making (MADM), by using multiplication technique to connect rating attribute, which needs to be done lifting with the corresponding weight attribute for each attribute rating

Here are some steps to take to troubleshoot using weighted product:

1. Normalize or improve weights.

$$w_j = \frac{w_j}{\Sigma w_j} \quad (1)$$

Normalize to produce the *value* $w_j = 1$ where $j = 1, 2,..n$ is a lot of alternatives *and* $\sum w_{j\,is}$ the total value of the weight.

2. Determine vector values by multiplying all criteria by alternative normalization or improvement of weights of positive rank (*benefit)* and negative rank for cost criteria .

$$s_i = \prod_{j-1}^{n} x_{ij} w_j \prod_{i-1}^{n} x_{ij} w_j \quad (2)$$

With $I = 1, 2,....,m$ and $j = 1, 2,....,n$.

Description:

Si : Score / value of each alternative

X_{ij} : Alternate value to i *to* attribute to j

W_j : Weight of each attribute or criterion
n : Many Criteria

In determining vector value (S) can be done by multiplying alternative normalization results with all criteria with or improvement of weights that rank positive for benefit criteria and negative rank for cost criteria. Where (S) is the prefence of criteria, (x) is the value of criteria and (n) is the number of criteria.

3. Determine the vector value, where this vector is an alternative preference used for warkingan.

$$V_i = \frac{\prod_{j=1}^{n} x_{ij}^{w_j}}{\prod_{j=1}^{n} (x_j^*)^{w_j}} \quad (3)$$

Description:
V : Alternate preferences analogized as V vectors
x : Criteria Value
w : Weighting Criteria or sub criteria
i : Alternatives
j : Criteria
n : Number of criteria

I = 1.2,.. m.
Determines the vector value (V) which is an alternative preference in performing the warkingan of each number of vector values (S) with the value taken from the sum of all vector values (S).

Determining the weight value of each alternative on each criterion to show the match rating of each alternative in each criterion is assessed by 1 to 5 namely:

Table 1. Level of Importance

Level of Importance	Weights
Very Important	5
Important	4
Simply Important	3
Not Important	2
Very Unimportant	1

According to Muhammad Bakri's presentation to [2] Cloud Computing can be identified as a model that allows us to access everywhere, network access is done jointly in accordance with the demands of configurable computing resources and can be quickly established and released with minimal service provider management and interaction efforts.

The cloud computing architecture does not focus on "how" solution design and implementation, but rather focuses on the "what" services are provided. The reference

architecture aims to provide an understanding of the ins and outs of operations in cloud computing services. It does not represent the system of a particular cloud computing architecture, as a tool for discussing, describing, and developing a cloud computing architecture that uses a general frame of reference.

Here's the purpose of the cloud computing reference architecture design:

1. To understand and describe cloud services in the context of cloud computing as a whole.
2. To provide technical references for institutions and other consumers to discuss, understand and compare cloud services.
3. To facilitate in the analysis of interprobability and probability, security, and reference implementation.

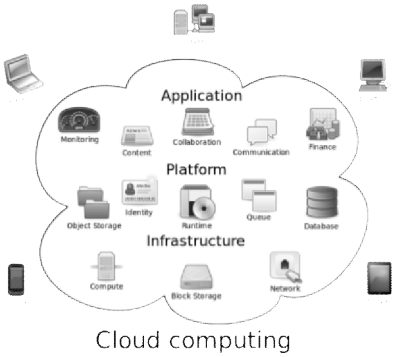

Fig1. Examples of cloud computing architecture

From what we see in the picture above, you can understand that cloud computing architecture consists of:

1. Infrastructure
   This infrastructure includes all hardware/hardware and supporting software/software, e.g. network infrastructure devices, servers, and storage media.
2. Platform
   A combination of hardware and software architecture, consisting of storage objects, user identity or information, running programs in use, data queues, and database systems used, is also inseparable from the hardware infrastructure that supports the platform.
3. Application
   Consists of a variety of applications for monitoring, content management, communication, and many more that can be used according to their respective functions and needs.

Each of the above components must support each other in order to function properly and run as needed [15].

Previous research related to Cloud Computing services can be referenced as follows:

1. Research entitled Comparison Analysis of Azure Cloud System And Google Cloud explains that the use of the operating system as a link between hardware media and

software as a controller aimed at avoiding errors in performing the operating steps of a system. The purpose of this research is to compare several points of technology, system development, integrated products as well as the quality of each service. Cloud computing may still be vaguely audible to laypeople. Therefore, the comparison done by researchers between the two services is expected to help the public in understanding what cloud computing services are and the shortcomings and advantages of each service, however, these two azure and google cloud services have many similar features and have their own advantages and disadvantages that we cannot compare in general [1].

2. Research entitled Comparison of Microsoft Onedrive Cloud Computing, Dropbox,and Google Drive explains that c loudcomputing is one of the latest web-based information technologies that provide services capable of providing resources and services. The purpose of this research is to better give an overview to the wider community about the detailed function of each service and is expected to provide convenience in supporting the industrial revolution in this new round. The era of industrial revolution 4.0 is expected all activities can be done by utilizing cloud computing technology and supporting ioT or internet of things. Cloud computing services currently face obstacles yatiu, the lack of maximum use of the services provided because the public does not understand the features that have been provided, such as shared media storage on google drives that can be used to share files in the cloud with other users who are given access, but the public still chooses to share files manually such as share via social media. Therefore, the results of this research are appropriately used to further improve the detailed understanding of the features provided by service providers are very important to support the industrial revolution 4.0 which is expected that the entire work process can be done through the cloud system[6].

II. METHODS

2.1 Research Instruments

The types of instruments used in this research are:

1. Observation
   This method is done by visiting, and observing PT. Deptech Digital directly to obtain the required data.
2. Wawancra (Interview)
   This method is done by conducting a question and answer session by asking some questions orally to the Head Of Software Developer section, to collect the required information.
3. Literature Review
   This method is done by reading and analyzing some research related to cloud computing services to understand and strengthen the points of information that has been obtained before.

2.2 Data Collection, Population, and Sample Research Methods

1. Data Collection Method
   The method used to collect data on this research is done by observation, interview and research on internet sources to obtain information services to be analyzed.

2. Population and Sample Research

In conducting population data collection and sampling in this research, conducted through direct observation and interview with the company through conference media, the population taken is a list of cloud computing services commonly used by companies as many as 10 cloud computing services. Of these populations were taken 6 samples of the most frequently used services.

2.3 Data Analysis Methods

In conducting analytical research is an important part in the methodology of scientific research, because by analyzing a data we can get meaning and meaning that is useful in solving a form of problem. The method used in this research is Weighted Product (WP) is a method of decision making that is calculated quantitatively using mathematical calculations according to weighted product formula.

III. RESULT AND DISCUSSION

3.1 Weighted Product (WP) Calculations

The Weighted Product method is one solution to the decision support system. This method evaluates several alternatives against a set of attributes / criteria, where each attribute is independent of one another. According to Yoon, the Weighted method Product uses the multiplication technique for relates the attribute rating, where the rating of each attribute must first rank with the attribute weight concerned. This process is the same as a process normalization.

In determining the services to be used in the initialization process of pt Deptech Digital Indonesia project, usually using 6 types of cloud computing service providers,which in this research we select as a sample of weighted product method calculation, which will then be processed according to the stages in the Weighted Product method. The stages of the Weight Product method are:

a. Determination of Criteria Weight

In determining the weighting of criteria on the selection of pt cloud computing services. Deptech Digital Indonesia, there are 11 (eleven) criteria that become consideration material, namely: server location, service products, operating system, downtime, backup service, service price, customer support /, security, scalability, reputation, and network speed.

Weight assessment indicators on each criteria are taken using quality scales that can be seen in Table 2.

Table 2. Quality Level Scale

Value	Quality Level Scale (Benefit)
1	Not very good
2	Not Good
3	Pretty Good

4	Good
5	Excellent

Table 3. Quality Level Scale

Value	Quality Scale (Cost)
1	Excellent
2	Good
3	Pretty Good
4	Not Good
5	Not Very Good

b. Determination of Alternative Data (Services) Along with Criteria

List of cloud computing services (alternatives) used for this research, the details of which will be listed in the following table:

Table 4. Cloud Computing Data Services

Alternative Service	Server Location	Service Product	Operation System	Down time	Backup Service	Service Prices	Customer Support	Security	Scalability	Reputation	Network Speed
AWS	Very good	Very good	Very good	Very good	Very good	Pretty good	Good	Very Good	Very Good	Very Good	Very Good
Microsoft Azure	Very Good	Very Good	Very Good	Very Good	Very Good	Pretty good	Pretty good	Very Good	Very Good	Very Good	Very Good
Digital Ocean	Very Good	Good	Good	Very Good	Very Good	Very Good	Good	Very Good	Very Good	Pretty good	Very Good
Telkom	Pretty good	Pretty good	Good	Pretty good	Good	Not Good	Not Good	Good	Pretty good	Good	Good
Google Cloud	Very Good	Very Good	Very Good	Very Good	Very Good	Very Good	Very Good	Very Good	Very Good	Very Good	Very Good
ID Cloud Host	Pretty good	Pretty good	Pretty good	Pretty good	Pretty good	Pretty good	Pretty good	Pretty good	Good	Pretty good	Good

c. Conversion of Alternative Values (Services)

Determination of the match rating of each service with each criterion.

Table 5. Service Data Value Conversion

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11
A1	*5*	*5*	*5*	*5*	*5*	*3*	*4*	*5*	*5*	*5*	*5*
A2	*5*	*5*	*5*	*5*	*5*	*3*	*3*	*5*	*5*	*5*	*5*
A3	*5*	*4*	*4*	*5*	*5*	*1*	*4*	*5*	*5*	*3*	*5*
A4	*3*	*3*	*4*	*3*	*4*	*4*	*2*	*4*	*3*	*4*	*4*
A5	*5*	*5*	*5*	*5*	*5*	*1*	*5*	*5*	*5*	*5*	*5*
A6	*3*	*3*	*3*	*3*	*3*	*3*	*3*	*3*	*4*	*3*	*4*

Description:
A1 : *Amazon Web Services* (AWS)
A2 : *Microsoft Azure*
A3 : *DigitalOcean*
A4 : Telkom
A5 : *Google Cloud*
A6 : *IDCloudHost*
C1: Server Location (Benefit), This criterion is used to consider the server location based on the needs of the project and the nature of the data to be stored
C2: Service Products (Benefit), This criterion is used to assess the different types of services that can be used to support the performance and performance of the application.
C3: Operating System (Benefit), This criterion is used to consider the required operating system applications, and the operating system used on the server.
C4: Downtime (Benefit), This criterion is used for historical downtime indicators or times when the service cannot be used.
C5: Backup Service (Benefit), This criterion is to assess whether the cloud computing service supports backup services or not, especially in favor of snapshots.
C6: Service Price (Cost), This criterion is used to determine the price of the service, depending on needs and conditions.
C7: Customer Support/Warranty (Benefit), This criterion is an assessment of support services from service providers in case of constraints along with the channels offered.
C8: Security (Benefit), This criterion is an assessment of the security aspects used by cloud computing service providers to support corporate data security.
C9: Scalability (Benefit), These criteria assess how cloud computing service providers support in improving specifications, to improve the performance of the services we use.
C10: Reputation (Benefit), Reputation assessment criteria or service rating from a cloud computing service provider.
C11: Network Speed (Benefit), Network speed criteria offered by service providers.

d. Level of Interest

Weight determination for criteria is determined based on the value of the interest level scale where the value of the level of interest starts from 1 to 5. Interest level scale data can be seen in table 6.

Table 6. Importance Scale

Value	Importance Scale
1	Highly Ins important
2	Not Important (TP)
3	Simply Important (CP)
4	Important (P)
5	Very Important (SP)

Here is a list of initial weight values (W) of each criteria that have been determined by the PT. Deptech Digital Indonesia based on the value of interest level scale that can be seen in table 7.

Table 7. Weighting Criteria

Criteria Code	Weight Value
C1	4
C2	4
C3	5
C4	5
C5	3
C6	2
C7	3
C8	5
C9	5
C10	4
C11	5

e. Weight Improvement Criteria

After the weight value for each criterion has been determined. Furthermore, weight improvement will be carried out from the predetermined initial weight value. The calculation process to get the results can be seen in the calculation as follows:

1. The result of calculation on the weight of server *location* criteria with a weight value of 4 is 0.9.

$$W_1 = \frac{4}{4+4+5+5+3+2+3+5+5+4+5} = 0.9$$

2. The result of calculation on the weight of service product criteria with a weight value of 4 is 0.9.

$$W_2 = \frac{4}{4+4+5+5+3+2+3+5+5+4+5} = 0.9$$

3. The result of calculation on the weight of operating system criteria with a weight value of 5 is 0.11.

$$W_3 = \frac{5}{4+4+5+5+3+2+3+5+5+4+5} = 0.11$$

4. The result of calculation on the weight of *downtime* criteria with a weight value of 5 is 0.11.

$$W_4 = \frac{5}{4+4+5+5+3+2+3+5+5+4+5} = 0.11$$

5. The result of calculation on the weight of backup *service* criteria with a weight value of 3 is 0.7.

$$W_5 = \frac{3}{4+4+5+5+3+2+3+5+5+4+5} = 0.7$$

6. The result of calculation on the weight of service price criteria with a weight value of 2 is 0.4.

$$W_6 = \frac{2}{4+4+5+5+3+2+3+5+5+4+5} = 0.4$$

7. The result of calculation on the weight of customer *support* / warranty criteria with a weight value of 3 is 0.7.

$$W_7 = \frac{3}{4+4+5+5+3+2+3+5+5+4+5} = 0.7$$

8. The result of calculation on the weight of security criteria with a weight value of 5 is 0.11.

$$W_8 = \frac{5}{4+4+5+5+3+2+3+5+5+4+5} = 0.11$$

9. The result of calculation on *scalability criteria weight* with a weight value of 5 is 0.11.

$$W_9 = \frac{5}{4+4+5+5+3+2+3+5+5+4+5} = 0.11$$

10. The result of calculation on the weight of reputation criteria with a weight value of 4 is 0.9.

$$W_{10} = \frac{4}{4+4+5+5+3+2+3+5+5+4+5} = 0.9$$

11. The result of calculation on the weight of network speed criteria with a weight value of 5 is 0.11.

$$W_{11} = \frac{5}{4+4+5+5+3+2+3+5+5+4+5} = 0.11$$

After the process of calculating the improvement of the initial weight value on each criterion, here is a summary of the calculation results that can be seen in Table 8

Table 8. Criteria Weight Improvement Results

Criteria Code	Weight Value
C1	0,09
C2	0,09
C3	0,11
C4	0,11
C5	0,07
C6	0,04
C7	0,07
C8	0,11
C9	0,11
C10	0,09
C11	0,11

b. Vector Value Calculation (S)

After the improvement of the initial weight value, the next process will be continued to the calculation of vector value (S) where each of the initial weight of the criteria will be raised with the weight of the improvement result for each alternative, where the calculation is as follows:

1. The result of vector value calculation (S) for alternative 1 (A1) is 4.3676.

$$S_1 = (5^{0.09}) * (5^{0.09}) * (5^{0.11}) * (5^{0.11}) * (5^{0.07}) * (3^{-0.04}) * (4^{0.07}) * (5^{0.11}) * (5^{0.11}) * (5^{0.09}) * (5^{0.11}) = 4.3676$$

2. The calculation result of vector value (S) for alternative 2 (A2) is 4.2846.

$$S_2 = (5^{0.09}) * (5^{0.09}) * (5^{0.11}) * (5^{0.11}) * (5^{0.07}) * (3^{-0.04}) * (3^{0.07}) * (5^{0.11}) * (5^{0.11}) * (5^{0.09}) * (5^{0.11}) = 4.2846$$

3. The result of vector value calculation (S) for alternative 3 (A3) is 4.1912.

$$S_3 = (5^{0.09}) * (4^{0.09}) * (4^{0.11}) * (5^{0.11}) * (5^{0.07}) * (1^{-0.04}) * (4^{0.07}) * (5^{0.11}) * (5^{0.11}) * (3^{0.09}) * (5^{0.11}) = 4.1912$$

4. The calculation result of vector value (S) for alternative 4 (A4) is 3.0095.

$$S_4 = (3^{0.09}) * (3^{0.09}) * (4^{0.11}) * (3^{0.11}) * (4^{0.07}) * (4^{-0.04}) * (2^{0.07}) * (4^{0.11}) * (3^{0.11}) * (4^{0.09}) * (4^{0.11}) = 3.0095$$

5. The calculation result of vector value (S) for alternative 5 (A5) is 4.6548.

$$S_5 = (5^{0.09}) * (5^{0.09}) * (5^{0.11}) * (5^{0.11}) * (5^{0.07}) * (1^{-0.04}) * (5^{0.07}) * (5^{0.11}) * (5^{0.11}) * (5^{0.09}) * (5^{0.11}) = 4.6548$$

6. The result of vector value calculation (S) for alternative 6 (A6) is 2.9005.

$$S_6 = (3^{0.09}) * (3^{0.09}) * (3^{0.11}) * (3^{0.11}) * (3^{0.07}) * (3^{-0.04}) * (3^{0.07}) * (3^{0.11}) * (4^{0.11}) * (3^{0.09}) * (4^{0.11}) = 2.9005$$

After the calculation of vector value (S) is done the following is the result of the preference of vector value (S) of each alternative along with the total amount that can be seen in Table 9.

Table 9. Vector Calculation Result (S)

Alternative Preferences	Vector Value
S1	4.3676
S2	4.2846
S3	4.1912
S4	3.0095
S5	4.6548
S6	2.9005
Total	23.4083

a. Vector Value Calculation (V)

At this stage, the calculation that has been done to get vector value (S) will be re-processed to perform data that has the highest result based on vector value calculation (V). The results of the calculation are obtained by the following calculation process:

1. The calculation result of vector value (V) in alternative 1 (A1) is 0.1866

$$V_1 = \frac{4.3676}{23.4083} = 0.1866$$

2. The calculation result of vector value (V) in alternative 2 (A2) is 0.1830

$$V_1 = \frac{4.2846}{23.4083} = 0.1830$$

3. The calculation result of vector value (V) in alternative 3 (A3) is 0.1790

$$V_1 = \frac{4.1912}{23.4083} = 0.1790$$

4. The calculation result of vector value (V) in alternative 4 (A4) is 0.1286

$$V_1 = \frac{3.0095}{23.4083} = 0.1286$$

5. The calculation result of vector value (V) in alternative 5 (A5) is 0.1989

$$V_1 = \frac{4.6548}{23.4083} = 0.1989$$

6. The calculation result of vector value (V) in alternative 6 (A6) is 0.1239

$$V_1 = \frac{2.9005}{23.4083} = 0.1239$$

After calculating the vector value (V) for each alternative, here's a summary of the results that can be seen in Table 10.

Table 10. Vector Calculation Result (V)

Alternative Preferences	Vector Value
V1	0.1866
V2	0.1830
V3	0.1790
V4	0.1286
V5	0.1989
V6	0.1239

b. The Ranking Process

After passing a series of calculation processes that have been done at several stages above, it is found the results of the ranking that can be seen in table 11 below:

Table 11. Ranking results

Alternative	Vector Value (V)	Ranking
A1	0.1866	2
A2	0.1830	3
A3	0.1790	4
A4	0.1286	5
A5	0.1989	1
A6	0.1239	6

IV. CONCLUSION

With the results of this research is expected to help companies in conducting selection of cloud computing services. Weighting the criteria will accelerate the selection process by conducting a thorough comparison according to the criteria set out in each alternative, this will certainly cut the comparative time performed directly against each service. With this research, companies can develop it by adding additional criteria or alternatives. The calculation results using the WP method give preference to the top 3 services: Google Cloud (A5), Amazon Web Services (A1) and Microsoft Azure (A2). This proves that research with the WP method can be applied to various services that will be used in the future according to predetermined criteria. Based on these results, the system can recommend cloud computing services according to the needs and a good level of accuracy.

V. ACKNOWLEDGMENTS

The authors are grateful to PT. Deptech Digital Indonesia who has supported this research. We also thank all parties who have contributed both directly and indirectly to the perfection of this research.

REFERENCES

[1] A. R. Hakim, "Analisis Perbandingan Sistem Cloud Azure dan Google Cloud," ***InfoTekJar J. Nas. Inform. dan Teknol. Jar***., **vol. 1,** no. 1, pp. 38–41, 2016.

[2] M. Bakri, "Arsitektuknologi Komputasi Awan Untuk Sistem Informasi Layanan Kesehatan Daerah," ***J. Komput. dan Inform***., **vol. 15,** no. 1, pp. 201–208, 2020**.**

[3] A. Chan, M. Maharani, and P. W. Tresna, "Perbandingan Pengalaman Pengguna pada Aplikasi Mobile Go-Jek dan Grab (Studi pada Konsumen Pt Go-Jek dan Pt Grab Indonesia di Dki Jakarta)," ***AdBispreneur J. Pemikir. dan Penelit. Adm. Bisnis dan Kewirausahaan***, **vol. 2,** no. 2, 2017.

[4] M. S. Rumetna, "Pemanfaatan Cloud Computing Pada Dunia Bisnis: Studi Literatur," ***J. Teknol. Inf. dan Ilmu Komput.*, vol. 5,** no. 3, 2018**.**

[5] Y. C. Giap *et al.*, *Cloud Computing: Teori dan Implementasi*. **Yayasan Kita Menulis**, 2020.

[6] I. Agus, F. Destiawati, and H. Dhika, "Perbandingan Cloud Computing Microsoft Onedrive, Dropbox, dan Google Drive," ***Fakt. Exacta*, vol. 12**, no. 1, pp. 20–27, 2019.

[7] M. D. PRASETYO, "Perancangan Sistem Komparasi Penyedia Layanan Komputasi Awan Berdasarkan Persentase Kecocokan Fitur." **Universitas Gadjah Mada**, 2019.

[8] S. Surahmat and A. Tenggono, "Analisis Perbandingan Kinerja Layanan Infrastructure As A Service Cloud Computing Pada Proxmox dan Xenserver," ***MATRIK J. Manajemen, Tek. Inform. dan Rekayasa Komput.*, vol. 19**, no. 1, pp. 9–16, 2019.

[9] H. Supriyono and C. P. Sari, "Developing decision support systems using the weighted product method for house selection," in ***AIP Conference Proceedings*, 2018, vol. 1977**, no. 1, p. 20049.

[10] B. Andika, H. Winata, and R. I. Ginting, "Sistem Pendukung Keputusan Menentukan Duta Sekolah untuk Lomba Kompetensi Siswa Menggunakan Metode Elimination Et Choix Traduisant la Realite (Electre)," ***J. SAINTIKOM (Jurnal Sains Manaj. Inform. dan Komputer)*, vol. 18**, no. 1, pp. 47–54, 2019.

[11] D. M. Khairina, D. Ivando, and S. Maharani, "Implementasi Metode Weighted Product Untuk Aplikasi Pemilihan Smartphone Android," ***J. Infotel*, vol. 8**, no. 1, pp. 16–23, 2016.

[12] R. Widyasari, H. Cipta, and I. Husein, "Integrated AHP and Fuzzy-Promethee On Best Selection Process," ***ZERO J. Sains, Mat. dan Terap.*, vol. 2**, no. 1, 2019.

[13] I. Taufik, A. Saleh, C. Slamet, D. S. Maylawati, M. A. Ramdhani, and B. A. Muhammad, "Decision support system design for determining brown sugar quality with weighted product method," in ***Journal of Physics: Conference Series*, 2019, vol. 1280**, no. 2, p. 22019.

[14] R. Alfita, "Perancangan sistem pendukung keputusan penentuan prioritas produk unggulan daerah menggunakan metode Weighted Product (WP)," in ***Jombang,[Prosiding Seminar Competitive Advantage I] Lembaga Pengembangan & Penelitian Unipdu***,

2011.
[15] S. Bahri, “Analisa Kebutuhan Cloud Computing Dalam Mendukung Bisnis Perusahaan,” ***J. INFORMATICS, Sci. Technol.*****, vol. 9,** no. 2, 2019.