Implementation of Weighted Product Method for Evaluating Performance of Technicians

Ardiles Sinaga
Faculty of Vocational, Institut Teknologi Del, Indonesia
Email: ardiles.sinaga@del.ac.id

Disma Maulana
Universitas Widyatama, Bandung, 40125, Indonesia
Email: maulana.disma@widyatama.ac.id

Abstract: The ISP is responsible for providing programmable cables or DSL modems. The ISP will send a technician to run the cabling and activate the service to the home or office. There are several obstacles from observations made at PT Telkom Akses Ujung Berung in evaluating the performance of Technicians. Management has difficulty evaluating the performance of the desired assessment technician. The evaluation process still uses an assessment based on subjective perceptions from the team leader, this is due to the absence of appropriate methods to be applied in the process of evaluating the performance of technicians at PT Telkom Akses Ujung Berung. One way to overcome the problem is the existence of a method for making appropriate decisions to assess or evaluate the performance of the Technician. The purpose of this research is to implement a decision support system that is implemented in an application performance evaluation technician with the Android-based Weight Product method that can solve problems by multiplying to connect the attribute rating with the corresponding weight attribute. In this method, there are 5 criteria used and 12 alternative ratings for PT. Telkom Access Ujung Berung. The results of this research are the highest results from the criteria, which are sorted from the highest to the lowest technician scores so that it can facilitate the management in evaluating the performance of technicians at PT Telkom Akses Ujung Berung.

Index Terms: Decision Support System, Technician, Weighted Product Method, Performance Evaluation Technician, PT Telkom Access Ujung Berung.

1. Introduction

Internet Service Providers (ISPs) are companies that provide individuals and organizations to access the internet through cable, internet, wireless broadband, Ethernet, etc. [1]. ISPs are organizations that provide services for accessing and using the Internet. ISPs can be arranged in various forms, such as commercial, community-owned, non-profit, or private property. Internet services typically provided by ISPs include Internet access, Internet transit, domain name registration, web hosting, Usenet services, and colocation [2].

In service provider networks, reliability, availability and management have become issues that need to be considered [3]. Quality of Service (QoS) is important in maintaining service performance to customers [4]. The ISP Admin receives, and processes complaints posted by ISP customers. Then technicians who work under a particular ISP will do field work to process and resolve complaints that have been posted by their customers [5].

PT Telkom Akses Ujung Berung is a branch of PT Telekomunikasi Indonesia Tbk that provides internet services to its customers in the Ujung Berung area, Bandung City. The product of this service, IndiHome, is a leading digital service that uses fiber optic technology that offers triple play services consisting of fiber internet (fast internet), fixed telephone (fixed telephone), and interactive TV (UseeTV). IndiHome also offers dual play services consisting of fiber internet (fast internet) and home telephone (fixed telephone). IndiHome is also equipped with various additional services (add-ons) that can be selected according to the needs and desires of customers such as telephone mania, wifi.id seamlessly, micro-antivirus trends, IndiHome display (online surveillance cameras) and many more. In the company there are several technicians who are deployed to service new installations and internet network maintenance for customers.

There are several obstacles from observations made at PT Telkom Akses Ujung Berung in assessing or evaluating the performance of Indihome Technicians. Management has difficulty evaluating the performance of technicians using a number of standards or desired assessment criteria. The evaluation process still uses an assessment based on subjective

perceptions from the team leader, this is due to the absence of appropriate methods to be applied to the performance evaluation process of Indihome technicians at PT Telkom Akses Ujung Berung. So, the decision-making process evaluates the performance of technicians, and the available alternatives are still less objective. Then the company needs an information system that can help in the process of evaluating or evaluating the performance of Indihome Technicians.

In this research, one solution to assess or evaluate the performance of Indihome Technicians by the criteria desired by management is to apply DSS. Decision Support System (DSS) is a unique information system that aims to assist management in making decisions relating to semi-structured problems [1]. A DSS provides an alternative course of action selected with specific methods to produce the best decisions, making it easier for management and team leaders to evaluate the technician's performance according to the desired criteria and determine the results of the technician's performance evaluation.

From the problems that have been explained before, the research with performance appraisal data used is the participant evaluation form obtained using an assessment from the research site, PT Telkom Akses Ujung Berung. Whereas the Proposed Method uses the Weighted Product method which is one of the simplest methods with multiplication to link attribute ranks, where each attribute rank must be raised with the appropriate attribute weights. So the purpose of this research is to implement the WP method application using Android programming to facilitate the management in evaluating the performance of Indihome technicians in accordance with the criteria set at PT. Telkom Access Ujung Berung. The main limitation of this research is that the performance assessed is the Indihome technician at PT Telkom Akses Ujung Berung and the criteria used in the Weighted Product method are determined by the needs and desires of the company.

There are several research on performance evaluation using the Weighted Product method, including research on Weighted Products and their Applications for Measuring Employee Performance. The results of this system can present employee performance appraisal reports quickly and clearly so that it is more effective and efficient [6]. Then there is also research on Decision Support Systems for the recruitment of new employees using the product weighted method. The results of this research are web based DSS recruitment applications that provide information to high-ranking new recruits as a consideration for making the right decision and are expected to simplify the best decision-making process [7].

Therefore, the Weighted Product method was chosen because some research states that this method is simpler compared to other methods because there are Cost and Benefit variables, which are useful for determining the criteria that influence decisions and make it easy to rank the desired performance criteria.

2. Literature Survey

A. Decision Support System

This literature survey studies about the evaluation of Indihome technician performance. Basically, performance evaluation is an effort to evaluate employee performance. In general, it can be interpreted as an effort to carry out measurements of the performance of each company employee. This is related to the level of productivity and work effectiveness of the employee in producing certain works, according to the job description given by the company to the employee concerned. The results of these employee performance measurements will generally be used as a material consideration to continuously increase productivity and effectiveness of the company [8].

Decision Support System is a specific information system that is intended to assist management in making decisions relating to issues that are semi-structured. This system has facilities to produce various alternatives which are interactively used by users [9].

B. Weighted Product Method

The Weighted Product (WP) method is a simple method with multiplication to connect attribute ratings, where each attribute rating must be raised with the corresponding attribute weights. The above is called normalization [9]. Weighted Product method has steps as follows [10]:

1. Determination of Criteria.
2. Rating the importance of each criterion.
3. Determination of the range of values for each creation
4. Assessment of each alternative uses all criteria by determining the range the value provided indicates how great is the importance of criteria.
5. From the research data each criteria weight and Alternative values are made of a decision matrix.

There is research on comparing the Weighted Product method with Simple Additive Weighting to evaluate the cashier's performance. A support system is very useful in evaluating employee performance. Calculations on the Weighted Product method are quite effective. In this research build software using web programming for the implementation of decision support systems for cashier performance evaluation [11]. The results show that it makes it

easier for personnel who are part of the company's management to use some desired assessment criteria. Suggestions from this research henceforth are it is expected to be compared with other evaluation methods or merging between WPM and SAW. Besides, several criteria can be added for evaluating the performance of cashiers obtained from previous research [11].

In the research of decision support systems for evaluating the performance of salesclerk in Yogya Ciwalk Department Store using the Weighted Product method. This research discusses salesclerk, who is competent in serving consumers to highly determine the success of sales from a department store. The results showed that the DSS made it easy for personnel in evaluating the performance of the salesclerk in accordance with specified criteria. DSS was successfully built using Web Programming. The Weighted Product method is very appropriate for calculating the ranking of the performance of the salesclerk in the Yogya Ciwalk Department Store [12].

In the research of decision support systems performance evaluation of Lotte Mart Cashiers using Weighted Product method. This research discusses PT Lotte Mart Indonesia which, places the Cashier at the final stage of the shopping process. The results showed that the DSS made it easy for Personnel to assess Cashier's performance using several desired criteria. DSS was successfully built using Web Programming. The Weighted Product method implemented is very suitable for calculating the rank of Cashier's performance at PT Lotte Mart Indonesia [13].

There is also research on employee performance evaluation, namely the analysis and design of information systems supporting decision on the performance evaluation of civil servants with the Analytical Hierarchy Process (AHP). But in this research using the AHP method to support the decision [14].

From all the above research using web programming for the implementation of decision support systems using product weighted methods, because it is easily adapted to various changes that occur as needed. Therefore, Android programming will be used in this research in implementing the performance evaluation of technicians with weighted product methods.

3. Research Method

At this stage there are several mechanisms for conducting research by taking primary data from the company [15] including:

1. Observation, direct observation or careful observation on PT Telkom Akses Ujung Berung. Reviewing ongoing operational documents and analyzing the Standard Operating Procedure (SOP) of the company.
2. Interviews, conducting question and answer face to face with the Technicians, Team Leader, and company management to the technician performance evaluation at the research site.
3. Literature studies and reference sources used in this research are several journals and books relating to decision support systems, Weighted Product methods, and Android programming.

The system development method uses the Waterfall model in Android programming which is divided into several phases [16] including:

1. Analysis explains the system requirements analysis regarding the functional requirements of the application that will be developed at the office using use case diagram.
2. Design, design specifications according to the needs associated with application development. In database design using Entity Relationship Diagrams (ERD) to draw tables and relationships.
3. Implementation, the programming language that will be used in making this application uses Java and XML using the Android Studio editor.
4. Testing, testing techniques performed on the application to be built using white box testing to test the flow of the application.

4. Proposed Method

A. Research Framework

The framework of the diagram is drawn in the form of a diagram that outlines the logic of the course of research. The framework of thinking is based on research questions and represents a set of several concepts and the relationships between the concepts used.

The following research framework illustrates the logic of research and the relationship between concepts to be studied.
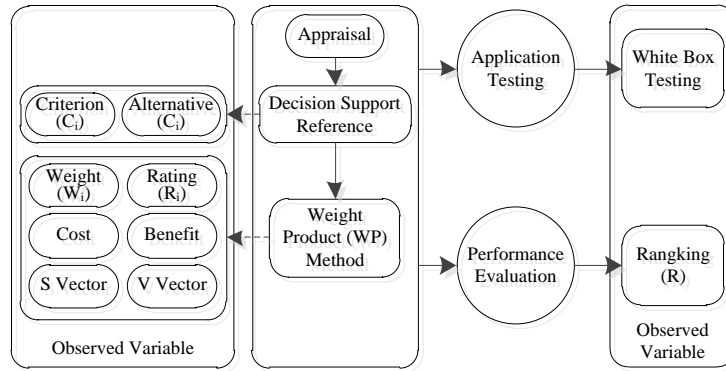
Fig.1. Research Hypothesis Framework

In Figure 1 shows the research framework with performance appraisal data used is the participant assessment form obtained using appraisal from the research site, PT Telkom Akses Ujung Berung. While the proposed method uses the Weighted Product method which is one of the simplest methods with multiplication to connect attribute ratings, where each attribute rating must be raised with the corresponding attribute weights. The above is called normalization [17].

The steps of the Weighted Product method [18] are as follows:

1. Determine the criteria that will be used as a reference for decision making (C).
2. Determine the match rating (r) of each alternative (A) on each criterion (C).
3. Correcting the weight value first by dividing the weight by the average weight i.e., the value 100 is the number of percentages of need (W).
4. The value of all attribute criteria is raised with the weight that has been fixed. For an alternative with a positive rank weight for the benefit attribute and a negative rank weight for the cost attribute.
5. All criteria attribute values are multiplied based on the number of criteria each alternative (S Vector) has.
6. The multiplication results are summed to produce a value for each alternative.
7. Find the value of the product by dividing the average value of the results of each product (V Vector).
8. Found rank order (R) value of the best results that will be a decision.
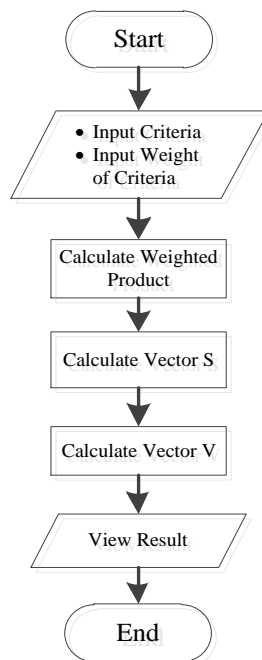

Fig.2. Flowchart Decision Support System

In Figure 2 is a Decision Support System flowchart showing the process flow from starting to enter criteria data, employee data, criterion values of each alternative. The process of calculating a weighted product has several stages, namely, normalizing the weight in advance, calculating the value of the vector S, namely by multiplying all the criteria, for each alternative with a positive rating weight, if the profit criteria category and with a negative rating weight, if the

cost criteria category and determine the vector V value will be used to rank several alternatives. The resulting alternative output decision is complete

B. Weighted Product Calculation

A manual calculation is performed on the performance evaluation of the technician using the Weighted Product method from existing data.

1. Criterion and Weight

Some criteria that have been determined by management and their weight are in table 1

Table 1. Criterion and Weight

No.	Criterion (C)	Weight (W)	Attribute
1	Installation	5	*Benefit*
2	Productivity	3	*Benefit*
3	Presence	4	*Benefit*
4	Daily Briefing	5	*Benefit*
5	Monthly Training	3	*Benefit*

2. Rating Alternative

The rating for each technician can be seen in table 2.

Table 2. Criterion and Weight

No.	Technician (A)	C1	C2	C3	C4	C5
1	Aji Purnomo	80	90	90	70	100
2	Ali Agung S.	100	100	90	70	100
3	Dadan Sonjaya	90	100	100	100	90
4	Firman M. Y.	90	90	90	80	100
5	Galih Permana	80	90	90	80	100
6	Irfan S.	100	100	90	100	90
7	M. Galih A	90	100	100	100	90
8	M. Marzuki	90	90	100	90	90
9	Nurdiana S. S.	80	100	90	90	100
10	Ramdhan F.	90	80	90	90	100
11	Ridwan Setia	100	100	90	70	100
12	Rizky B. A.	90	100	90	90	90

3. Normalization

Weighing the weights (W) so that $\sum W = 1$ we can get the following:

$$W_1 = \frac{5}{5+3+4+5+3} = \frac{5}{20} = 0,25$$

$$W_2 = \frac{3}{20} = 0,15$$

$$W_2 = \frac{4}{20} = 0,2$$

$$W_2 = \frac{5}{20} = 0,25$$

$$W_2 = \frac{3}{20} = 0,15$$

4. S Vector

The S vector which states the preference value from the technician can be calculated as follows:

$$S_i = \prod_{j=1}^{n} x_{ij}{}^{w}j$$

(1)

$$s1 = \left(80^{0.25}\right)\left(90^{0.15}\right)\left(90^{0.2}\right)\left(70^{0.25}\right)\left(100^{0.15}\right) = 83.37423941$$

$$s2 = \left(100^{0.25}\right)\left(100^{0.15}\right)\left(90^{0.2}\right)\left(70^{0.25}\right)\left(100^{0.15}\right) = 89.56184094$$

$$s3 = \left(90^{0.25}\right)\left(100^{0.15}\right)\left(100^{0.2}\right)\left(100^{0.25}\right)\left(90^{0.15}\right) = 95.87315155$$

$$s4 = \left(90^{0.25}\right)\left(90^{0.15}\right)\left(90^{0.2}\right)\left(80^{0.25}\right)\left(100^{0.15}\right) = 88.78058501$$

$$s5 = \left(80^{0.25}\right)\left(90^{0.15}\right)\left(90^{0.2}\right)\left(80^{0.25}\right)\left(100^{0.15}\right) = 86.20448701$$

$$s6 = \left(100^{0.25}\right)\left(100^{0.15}\right)\left(90^{0.2}\right)\left(100^{0.25}\right)\left(90^{0.15}\right) = 96.37954647$$

$$s7 = \left(90^{0.25}\right)\left(100^{0.15}\right)\left(100^{0.2}\right)\left(100^{0.25}\right)\left(90^{0.15}\right) = 95.87315155$$

$$s8 = \left(90^{0.25}\right)\left(90^{0.15}\right)\left(100^{0.2}\right)\left(90^{0.25}\right)\left(90^{0.15}\right) = 91.91661188$$

$$s9 = \left(80^{0.25}\right)\left(100^{0.15}\right)\left(90^{0.2}\right)\left(90^{0.25}\right)\left(100^{0.15}\right) = 90.19482619$$

$$s10 = \left(90^{0.25}\right)\left(80^{0.15}\right)\left(90^{0.2}\right)\left(90^{0.25}\right)\left(100^{0.15}\right) = 89.83245213$$

$$s11 = \left(100^{0.25}\right)\left(100^{0.15}\right)\left(90^{0.2}\right)\left(70^{0.25}\right)\left(100^{0.15}\right) = 89.56184094$$

$$s12 = \left(90^{0.25}\right)\left(100^{0.15}\right)\left(90^{0.2}\right)\left(90^{0.25}\right)\left(90^{0.15}\right) = 91.43366601$$

5. *V Vector*

The V vector value that will be used for ranking can be calculated as follows:

$$Vi = \frac{\prod\limits_{j=1}^{n} x_{ij}^{\,w_j}}{\prod\limits_{j=1}^{n} (x_j)^{\,w_j}} \qquad (2)$$

Simple as this

$$Vi = \frac{S1}{S1 + S2 + S3} \qquad (3)$$

Explanation
S = alternative preference, analogous to vector S.
V = alternative preferences are analogous to vector V.
X = criteria value.
W = criteria weights.
i = alternative.
j = criteria.
n = number of criteria.
* = number of criteria that have been graded on vector S.

$$V1 = \frac{S_1}{S_1 + S_2 + S_3 + S_4 + S_5 + S_6 + S_7 + S_8 + S_9 + S_{10} + S_{11} + S_{12}}$$

$$= \frac{83,37423941}{1088.986399} = 0.076561323$$

$$V2 = \frac{89,56184094}{1088.986399} = 0.082243305$$

$$V3 = \frac{95,87315155}{1088.986399} = 0.088038888$$

$$V4 = \frac{88,78058501}{1088.986399} = 0.081525890$$

$$V5 = \frac{86,20448701}{1088.986399} = 0.079160297$$

$$V6 = \frac{96,37954647}{1088.986399} = 0.088503903$$

$$V7 = \frac{95,87315155}{1088.986399} = 0.088038888$$

$$V8 = \frac{91,91661188}{1088.986399} = 0.084405656$$

$$V9 = \frac{90,19482619}{1088.986399} = 0.082824566$$

$$V10 = \frac{89,83245213}{1088.986399} = 0.082243305$$

$$V11 = \frac{89,56184094}{1088.986399} = 0.082243305$$

$$V12 = \frac{91,43366601}{1088.986399} = 0.083962174$$

6.   Ranking Result

The results of the calculation of vector V can be ranked as follows in Table 3 there is a value of vector V in each alternative where the value of the vector V is the final value that will be used in ranking. Furthermore, to get the results of the technician with the best value by comparing the vector values in each alternative where the results of high alternative value are the best alternative technician.

Table 3. Ranking [19]

No.	Technicians	V_i	Ranking
1	Aji Purnomo	0.076561323	12
2	Ali Agung S.	0.082243305	9
3	Dadan Sonjaya	0.088038888	2
4	Firman Maulana Y.	0.081525890	10
5	Galih Permana	0.079160297	3
6	Irfan Sholihudin	0.088503903	1
7	M. Galih A.	0.088038888	11
8	M. Marzuki	0.084405656	4
9	Nurdiana Sopian S.	0.082824566	6
10	Ramdhan Fathonih	0.082491804	7
11	Ridwan Setia	0.082243305	8
12	Rizky Bagja Aulia	0.083962174	5

The data obtained from observation, observing the performance evaluation process of technicians who are currently running at PT. Telkom Ujung Berung Access to get data that can be used as research material.

From the results of the ranking in table 3 it can be seen that Irfan Sholihudin was ranked first with Vi 0.088503903, while Aji Purnomo Vi 0.076561323 was in the last position.

5. Result Analysis and Discussion

A. Analysis

Detailed requirements specifications of the application using the Weighted Product method. Describe the use case diagram in the application to be built related to the main business.
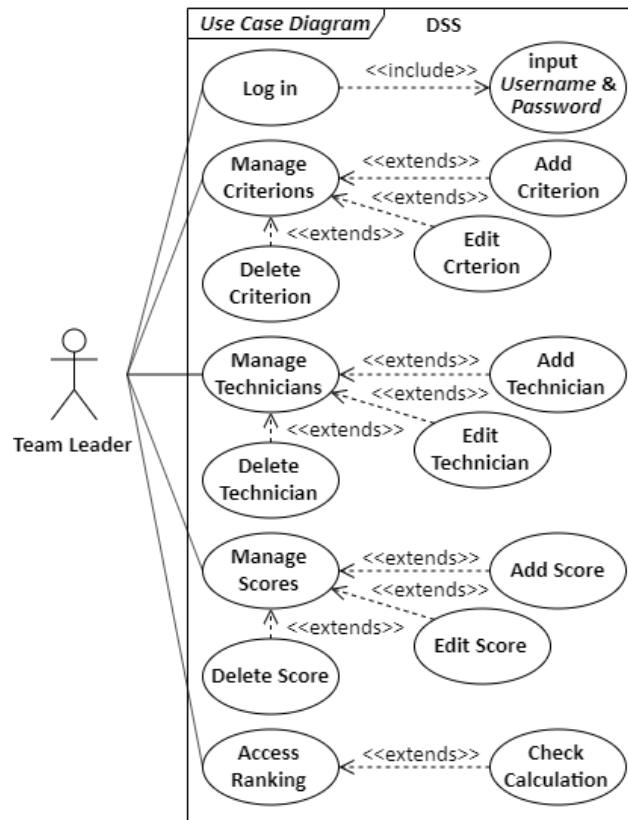
Fig.3. Use Case Diagram of Application

In Figure 3 is a use case diagram for the evaluation of technicians using the Weighted Product method. Use case diagrams illustrate the actors, use cases, and dependencies of a project in order to explain the concept of the relationship with its boundaries. The functions contained in the decision support system are:

1.   Team Leader can log in.
2.   Team Leader manages some criterions.
3.   Team Leader manages his subordinates.
4.   Team Leader can manage scores.
5.   Team Leader can access ranking.

B. Design

Static structure diagrams that illustrate the structure of supplier selection applications can be seen using class diagrams.

In Figure 4 shows a class diagram of the construction supplier selection application consisting of technician, criteria, scores, and team leaders classes. Each class consists of properties (attributes), behavior (operations), and the same relationship between objects.

In this class diagram is used to represent classes, class components, and the relationship between each class. In addition, class diagrams describe the types of objects in the system and the various static relationships that exist among them. Class diagrams also show the properties and operations of a class and the constraints that are contained in the object's relationships.
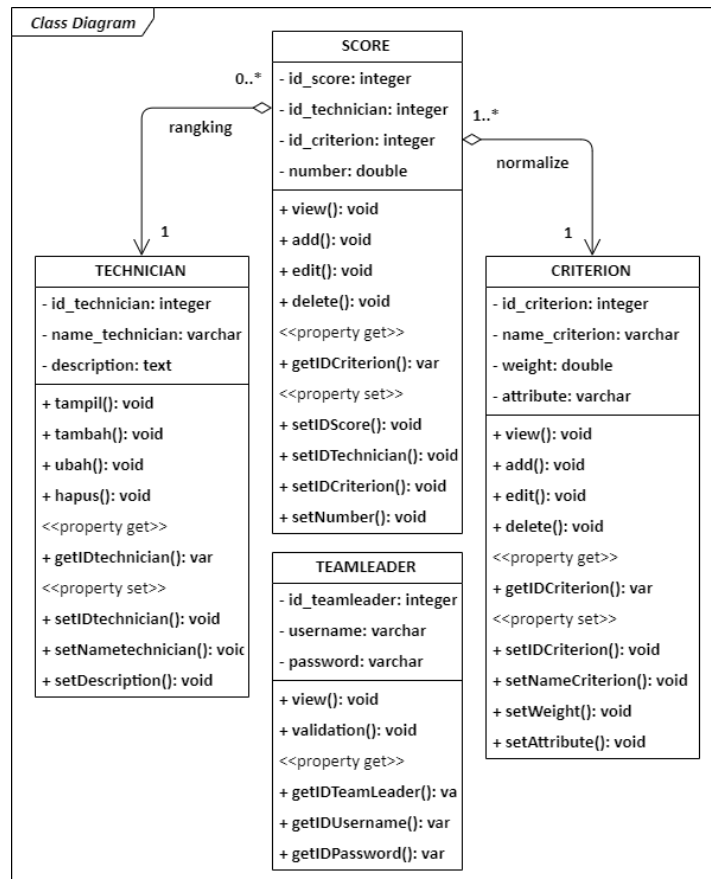
Fig.4. Class Diagram of Application

C. Implementation

This research using Android for implementation, Android is an operating system for smartphones and tablets. Users can interact with their device and run applications available on that device or device [20]. Android Studio used as a software for Android developers in creating and developing Android applications [21].

The implementation steps that display the application interface built as follows:

1. *Login Form*

The display applications for login forms can be seen in the Figure 5.
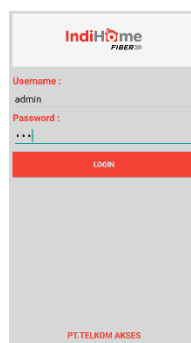
Fig.5. Login Form

In Figure 5 there is an input column for the username and password to be filled in by the Team Leader before going into data processing or managing some data of evaluation.

2. *Criterions Form*

The display of login form on the application can be seen in the Figure 6.

Fig.6. Criterion Form

In Figure 6 shows the data criteria that can be managed by the Team Leader in accordance with management's policy.

3. *Technicians Form*

The display of the technicians form can be seen in Figure 7.

Fig.7. Technicians Form

In Figure 7 contains the data of the technicians who are subordinate to the Team Leader.

4. *Scores Form*

The display of the scores form for technicians can be seen in Figure 8.

Fig.8. Scores Form

In Figure 8 contains the score data to provide an evaluation of the technicians. All scores are filled in by the Team Leader in accordance with their evaluation in the field work.

5.   Ranking Form

The display of the technicians ranking form can be seen in Figure 9.

Fig.9. Ranking Form

In Figure 9 shows the results of the technician performance evaluation. In the calculation form, a ranking table is displayed containing the names of technicians, values, and their sequence.

D. Testing

Applications built with Android were tested using white box testing, the testing method is generally used to test the flow of the application [15]. Cyclomatic complexity or software matrices that provide quantitative measurements of logical complexity for technician performance evaluation applications can be illustrated in the flow graph in Figure 10.
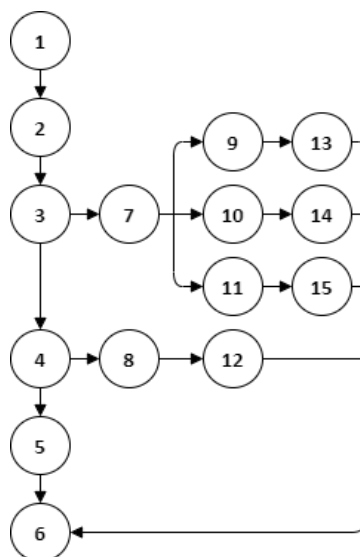
Fig.10. Flow Graph of Application

In Figure 10 the cyclomatic complexity of the flow graph can be obtained by the following calculation:

V(G) = 18 - 15 + 2 = 5
V(G) < 10 that means fulfilling the cyclomatic complexity requirements.

6. Conclusion

Based on the results of the research that was made, it was explained that the Team Leader received assistance in assessing the performance of Indihome technicians who met the requirements for the extension of the work contract. Weighted Product method can calculate the right assessment in the process of evaluating the performance of technicians and makes it easier for company management to use several desired assessment criteria. After calculating the 12 alternatives with different criteria, values found the best technician for the operational needs of PT. Telkom access, namely Irfan Sholihudin, was ranked first with Vi 0.088503903, while Aji Purnomo Vi 0.076561323 was in the last position. And then, the technician's performance evaluation application was successfully built using Android programming at PT Telkom Akses Ujung Bering. By applying it can make it easier for companies to assess the performance of technicians in accordance with the desired criteria so that future results spur employee performance and make the company grow rapidly.

Suggestions from this research henceforth are expected to be compared with other evaluation methods. In addition, several criteria can be added for evaluating the performance of technicians obtained from previous scientific research.

References

[1]   M. Swarnalatha and J. Komala, "Enhancement of Autonomous System for Inter Provider Service Using Multi-Protocol Label Switching," *i-Manager's J. Wirel. Commun. Networks*, vol. 6, no. 2, p. 21, 2017.
[2]   L. Hoxha, "A PRACTICAL APPROACH FOR PROVIDING QOS OF THE INTERNET IN ALBANIA," *J. Eur. Acad. Res.*, 2017.
[3]   Z. Song, P. W. C. Prasad, A. Alsadoon, L. Pham, and A. Elchouemi, "Upgrading Internet service provider (ISP) network in multiprotocol label switching (MPLS) and border gateway protocol (BGP) environment," in *2016 International Conference on Advances in Electrical, Electronic and Systems Engineering (ICAEES)*, 2016, pp. 237–241.
[4]   E. Budiman, D. Moeis, and R. Soekarta, "Broadband quality of service experience measuring mobile networks from consumer perceived," in *2017 3rd International Conference on Science in Information Technology (ICSITech)*, 2017, pp. 423–428.
[5]   A. Umamageswari, "STARK–Simultaneous Tracking And Ranking Using Word Cloud."
[6]   N. Aminudin, E. Sundari, K. Shankar, P. Deepalakshmi, R. I. Fauzi, and A. Maseleno, "Weighted Product and Its Application to Measure Employee Performance," *Int. J. Eng. Technol.*, vol. 7, no. 2.26, pp. 102–108, 2018.
[7]   D. M. Khairina, M. R. Asrian, and H. R. Hatta, "Decision support system for new employee recruitment using weighted product method," in *2016 3rd International Conference on Information Technology, Computer, and Electrical Engineering (ICITACEE)*, 2016, pp. 297–301.
[8]   I. M. Budihardjo, *Panduan Praktis Penilaian Kinerja Karyawan*. RAIH ASA SUKSES, 2015.
[9]   D. Nofriansyah and S. Defit, *Multi Criteria Decision Making (MCDM) pada Sistem Pendukung Keputusan*. Deepublish, 2017.
[10]   F. Sari, *Metode Dalam Pengambilan Keputusan*. Deepublish, 2018.
[11]   I. Hariyanti and W. Wiguna, "Perbandingan Metode Weighted Product dengan Simple Additive Weighting untuk Evaluasi Kinerja Kasir," *J. RESPONSIF Ris. Sains Inform.*, vol. 1, no. 1, pp. 33–45, 2019.

[12] P. Mauliana, W. Wiguna, and D. Widyaman, "Sistem Pendukung Keputusan Evaluasi Kinerja Pramuniaga Toserba Yogya Ciwalk Menggunakan Metode Weighted Product," *Infotronik J. Teknol. Inf. dan Elektron.*, vol. 3, no. 2, pp. 85–94, 2018.

[13] M. Mirawati, A. B. Hikmah, and W. Wiguna, "Sistem Penunjang Keputusan Penilaian Kinerja Kasir Lotte Mart Menggunakan Metode Weighted Product," *IJCIT (Indonesian J. Comput. Inf. Technol.*, vol. 3, no. 2, 2018.

[14] A. Sinaga and M. Murnawan, "ANALISIS DAN PERANCANGAN SISTEM INFORMASI PENDUKUNG KEPUTUSAN PENILAIAN PRESTASI KERJA PNS DENGAN ANALITYCAL HIERARCHY PROCESS," *Pros. Semnastek*, 2018.

[15] W. Wiguna and T. Alawiyah, "Sistem Reservasi Paket Wisata Pelayaran Menggunakan Mobile Commerce di Kota Bandung," *J. VOI (Voice Informatics)*, vol. 8, no. 2, 2019.

[16] W. Wiguna, P. Mauliana, and A. Y. Permana, "Pengembangan E-Helpdesk Support System Berbasis Web di PT Akur Pratama," *J. RESPONSIF Ris. Sains Inform.*, vol. 2, no. 1, pp. 19–29, 2020.

[17] D. Nofriansyah, S. Kom, and M. Kom, *Konsep Data Mining Vs Sistem Pendukung Keputusan*. Deepublish, 2015.

[18] Y. Hasan, "THE LIABILITY OF INTERNET SERVICE PROVIDERS IN PALESTINE."

[19] PT. TA Ujung Berung, "Tecnisions Performance Data in PT. Telkom Akses Ujung Berung," Bandung, 2020.

[20] A. Satyaputra, *Beginning Android Programming with ADT Bundle*. Elex Media Komputindo, 2014.

[21] M. kom. Aziz, Abdul, D. A. budi. M. K. Utami, K. Umam, and I. nur Dzaki, *Bermain Android itu Mudah : Studi Kasus Pembuatan eM-Tilang*. Yogyakarta: CV BUDI UTAMA, 2018.

Authors' Profiles

Ardiles Sinaga is currently serving as a Lecturer on the Faculty of Vocational at Del Institute of Technology, Indonesia. In 2013, he is completed his S2-Magister in Telkom University on Informatics.

Disma Maulana Born in Garut, September 3, 1992, he lives in Bandung, West Java. He was a Diploma of Computer Engineering at Telkom University Bandung in 2013, and then he still studied at Widyatama University Informatics Engineering 2020. He is currently active at PT. Telkom Access in the maintenance division in the Ujung Berung Area.