Journal of Information and Information Security (JIFORTY)
Vol. 3, No. 1, Juni 2022, 13 – 22
e-ISSN : 2722-4058
Available Online at http://ejurnal.ubharajaya.ac.id/index.php/jiforty

Decision Making Using Hierarchical Analytical Processes to Evaluate Computer Management Performance

Ajif Yunizar Pratama Yusuf [1,*], Kusdarnowo Hantoro [1], Rani Suryani [2]

[1] Informatika; Universitas Bhayangkara Jaya; Jl Perjuangan Bekasi; e-mail: ajif.yunizar@dsn.ubharajaya.ac.id, kusdarnowo@dsn.ubharajaya.ac.id
[2] Fakultas Teknik dan Informatika; Universitas Bina Sarana Informatika; Jl Kaliabang Tengah, Perwira, Kec.Bekasi Utara, Kota Bekasi, Jawa Barat; email: rani.rsy@bsi.ac.id

* Korespondensi: e-mail: ajif.yunizar@dsn.ubharajaya.ac.id

Diterima: 11 Juni 2022 ; Review: 25 Juli 2022; Disetujui: 29 Juli 2022; Diterbitkan: 29 Juli 2022

Abstract

The presence of PC computers since the 80s with its rapid and very widespread growth can be seen as a one of the most significant developments in the field of information and communication technology. This study aims to propose decision making using the Analytical Hierarchy Process approach to evaluate computer computers with respect to using the order of preference of the user. To get the most desirable features that affect the decision to choose a computer to be identified. This is realized through a survey conducted on the target group, experienced experts in the telecommunications sector and literature study. The AHP method was then used in the evaluation procedure. Analytical Hierarchy Process (AHP) was applied to determine the relative weight of the evaluation criteria applied to rank computer alternatives. The results of this case study illustrate the effectiveness of the proposed computer management performance selection.

***Keywords**: Analytical Hierarchy Process, Computer Management, DSS, Performances*

Abstrak

Kehadiran komputer PC sejak tahun 80an dengan pertumbuhannya yang cepat dan sangat luas dapat dilihat sebagai salah satu perkembangan paling signifikan di bidang teknologi informasi dan komunikasi. Penelitian ini bertujuan untuk mengusulkan pengambilan keputusan menggunakan pendekatan *Analytical Hierarchy Process* untuk mengevaluasi opsi ponsel sehubungan dengan menggunakan urutan preferensi dari pengguna. Untuk mendapatkan fitur yang paling diinginkan yang mempengaruhi keputusan memilih komputer agar dapat diidentifikasi. Hal ini diwujudkan melalui survei yang dilakukan terhadap kelompok sasaran, ahli-ahli berpengalaman di bidang telekomunikasi dan studi literatur. Metode AHP kemudian digunakan dalam prosedur evaluasi. *Analytical Hierarchy Process* (AHP) diterapkan untuk menentukan bobot relatif kriteria evaluasi diterapkan untuk menentukan peringkat alternatif komputer. Hasil studi kasus ini menggambarkan efektivitas pemilihan komputer yang diusulkan.

Kata kunci: *Analytical Hierarchy Process*, kinerja, manajemen komputer, SPK

1. Introduction

Information and communication technology has become a basic or primary human need and has a strategic function in its role in improving the quality of future generations. The demand for information technology devices, especially computers, plays an important role in

influencing the market value of electronics. This is because the availability of computers during the pandemic period for school or college needs from home will increase and will remain very limited in terms of availability.

In general, information technology includes three things, namely management information system, processing information system, decision information system. Organizational information technology functions to facilitate the acquisition and storage of data, which using various software functions can then be interpreted and transformed into meaningful information, and enables the transmission of this information to users so as to help them achieve organizational goals and objectives.

The numbers of new computers on offer from each vendor makes prospective buyers have to be selective and take a long time to make comparisons. The difficulty of getting a computer that fits the desired criteria forces prospective buyers to have to look directly at each computer to get computer-related information as comparison material. Computers are mandatory devices to make it easier to do our work; computers purchased of course vary according to different prices, needs and brands. The offer of various computer brands makes us have to be more careful with the goods we buy, for example in terms of the quality of the goods; we will directly choose goods with high quality because we assume the goods will last longer.

Knowledge and technology was used to elicit responses to a questionnaire to gather information about the company's knowledge and technology priorities. Because company resources are limited, it is very important to find a technology focus that aligns with the company's business strategy and can assist in making decisions that will give the company a competitive advantage and profitability. To gain a sustainable competitive advantage and create core competencies, knowledge and intellectual capital play a very important role. Knowledge-based management decisions are now commonly used to help determine whether goods or services can be purchased or outsourced.

The decision to buy a product or service is very important. Several things must be considered by the company to make strategic purchasing decisions to be made.. To get a computer that meets expectations, of course the buyer must have a lot of information about the personal computer being sold. Most importantly pricing decisions should be consistent with the overall buying strategy (Phengchan & Thangpreecharparnich, 2018). In this case, the price of the product and the quality of the product are expected to be as optimal as possible to make a decision to buy the product offered from the market. But sometimes we do not have information about the computer, especially if the information is very much. Therefore, a system is needed to help provide alternative choices according to the desired criteria. In management information systems, decision support is a branch of science that is located between information systems and expert systems. But not everyone is able to make decisions quickly and accurately. This ability can be obtained from the results of experience and special expertise so that they can be the best alternatives in the decision-making process. Among the computational methods that

are developing quite rapidly is the method of decision support systems (Decision Support System) (Ajalli et al., 2021).

In the decision-making plan, criteria are needed that can answer important questions about how appropriate the decision is to solve the problem at hand. In this journal, the author takes the theme of how users can determine or search for computers that are intended for campuses in accordance with learning materials related to the use of computers taught on campus.

The decision to buy a product or service is very important. Several things must be considered by the company to make strategic purchasing decisions to be made. Research on consumers who buy brand rubber mask indicates product quality. price perception and promotions influence purchasing decisions (Nurkhasanah & Santoso, 2020). Research that examines and analytically evaluates various alternatives for making purchasing decisions on the characteristics of users and products. Evaluate technology and knowledge factors and then relate them to the company's business strategy to show how technology and knowledge decisions reflect uncertainty (Takala & Tilabi, 2018). For this reason, managing uncertainty for business strategy is very important because it can replace traditional risk management. In 2021 household consumption expenditure reach a value of Rp. 6,856.5 Trillion (Badan Pusat Statistik, 2021). The amount of contribution to GDP shows that consumption household equipment is the third largest expense after food-drink and transportation-communication.

The electronics industry will benefit from increase in household consumption expenditures, especially on the needs of housing area. The electronics industry has increased in recent years (Yusuf, 2020).

It is undeniable that the rapid development of information technology has made some educational institutions implement it to be more efficient and effective. With information technology, an educational institution can carry out all its activities without being constrained by time and convoluted bureaucracy. With good utilization, information technology can optimize all jobs in educational institutions.

The decision-making process is basically choosing the best alternative. Such as structuring the problem, choosing alternatives, determining possible values for alleatory variables, setting values, time preference requirements, and specification of risks. No matter how enlarged the alternatives that can be determined as well as the details of the possible value assessment, the limitation that still surrounds is the basis for comparison in the form of a single criterion. The main tool of the Analytical Hierarchy Process (AHP) is a functional hierarchy with the main input being human perception. With a hierarchy, a problem is complex and does not solve the solution in its groups and is organized into a hierarchical form (Jadiaman Parhusip, 2019).

2. Research Methode

The research method used in this research is the *Analytical Hierarchy Process* (AHP). AHP is the method used in the decision-making process. These methods can be used to determine whether the computer to be purchased is in accordance with the required qualifications or not. This method changes the qualitative values into quantitative values so that more objective decisions are taken (Minesa et al., 2019).

The study was conducted on 300 workers in the campus environment (employees, lecturers, staff and leaders) with an age range of 22 to 40 years. The main objective of the study is to select the best alternative among several computer selection options based on the order of user preferences.To limit the research space, alternative prices of the devices are selected in predetermined intervals.

The first step of this study is to explore the most desirable features that influence computer selection. For this reason, a list of reasonable criteria has been compiled and an in-depth literature study has been compiled. The survey was conducted on several groups and based on user experience (Gülfem & Büyüközkan, 2007; Sudaryanto & Karningsih, 2016).

Table 1. Questionaire

No	Factors that determine the decision	Scale				
		1	2	3	4	5
1	The brand of computers					
2	Technical support					
3	Display(Dy)					
4	Price (Pz)					
5	Microprocessor (Mp)					
6	Memory (RAM)					
7	Harddisk capacity(HD)					
8	Keyboard(Ky)					
9	Mouse(Mo)					

Source: Research Results (2022)

Table 2. Numerical Assesment

Scale	Meaning
1	Not important at all
2	Not very important
3	Important
4	Quiet important
5	Very important

Source: Research Results (2022)

This study, several design variables that are considered important by customers can be summarized, namely reliability, compatibility, luxury, simplicity, color, texture, material, after-sales service satisfaction.

Respondents were asked to rate “not very important at all”, “not very important”, “quiet important”, “important” and “very important” which are verbal representations of a numerical scale from 1 to 5.

Respondents' responses that have been obtained are then arranged to take the average value of each questionnaire. In the process and analysis phase, the next weighting of the criteria will be calculated, which is explained in detail in the next section.

AHP Methodology

AHP is very suitable and flexible to be used to make decisions that help a decision maker to make qualitative and quantitative decisions based on all the aspects it has [3]. Another advantage of AHP is that it can provide a clear and rational picture to the decision maker about the resulting decision. Types of AHP: 1. Single-criteria ; Choose one alternative with one criterion. Decision making involves one or more alternatives with one criterion, 2. Multi-criteria; Decision making that involves one/more alternatives with more than one criteria Select one alternative with multiple criteria (Setiawan et al., 2010).

The steps in solving this problem are a) Determine the types of computer selection criteria; b) Develop criteria in the pairwise comparison matrix; c) perform pairwise comparisons d) Calculating the normalization matrix; e) Calculate the weight of each criterion (Falatehan, 2021). Determine the types of computer selection criteria, as for the criteria needed in the selection (Table 1 & Table 2).

In table 1, questions are given about the brand of Computer, Technical Support, Display, Price, Microprocessor, Memory, Harddisk Capacity, Keyboard, and Mouse. With table 2 which gives for each value a value of 1 which means not important at all, value of 2 ; not very important, value 3; important, value 4 ; quiet important, and value 5 ; very important.

Next is to do pairwise comparisons, by entering the values that have been set by AHP. If a criterion is compared with itself, it is given a value of 1. In the comparison matrix, alternatives a[i,j] can be interpreted as the degree of preference of the i-th criterion over the j-th criterion. In order to determine the weight of the criteria more reliably when using pairwise comparisons rather than obtaining them directly, because it is easier to make comparisons between two attributes than to determine the weights to make a whole.

The decision matrix calculates the assessment of each alternative related to the decision criteria. If the decision-making problem consists of *n* criteria and *m* alternatives; decision matrix of the form:

$$D = \begin{bmatrix} d_{11} & d_{12} & \dots & d_{1n} \\ d_{21} & d_{22} & \dots & d_{2n} \\ d_{31} & d_{32} & \dots & d_{3n} \\ d_{41} & d_{42} & \dots & d_{4n} \\ \dots & \dots & \dots & \dots \\ d_{m1} & d_{m2} & \dots & d_{mn} \end{bmatrix}$$

The next step involves pairwise comparisons of the constructed elements. The goal is to find the relative priority associated with each element at the next higher level. The pairwise comparison matrix, which is based on the Saaty's 1–9 scale, has the form:

$$A = \begin{bmatrix} a_{11} & a_{12} & \dots & a_{1n} \\ a_{21} & a_{22} & \dots & a_{2n} \\ a_{31} & a_{32} & \dots & a_{3n} \\ a_{41} & a_{42} & \dots & a_{42} \\ \dots & \dots & \dots & \dots \\ a_{m1} & a_{m2} & \dots & a_{mn} \end{bmatrix}$$

$$W = \begin{bmatrix} w_1/_{w1} & w_1/w_2 & \dots & w_1/w_n \\ w_2/w_1 & w_2/w_2 & \dots & w_2/w_n \\ w_3/w_1 & w_3/w_2 & \dots & w_3/w_n \\ w_4/w1 & w_4/w_2 & \dots & w_4/w_n \\ \dots & \dots & \dots & \dots \\ w_m/w_1 & w_m/w_2 & \dots & w_m/w_n \end{bmatrix}$$

In the comparison matrix A, the aij element can be interpreted as the degree of preference of the i-th criterion over the j-th criterion. Here the determination of criterion weights is more reliable to use as a pairwise comparison than to obtain it directly, because it is easier to make comparisons between two weighting attributes than to compare them as a whole.

To get priority order, all priority vector calculations, comparison matrices must be normalized first. Therefore, each column must be divided by the number of entries from the corresponding column. In that way, a normalized matrix is obtained where the number of elements of each column vector is 1.

3. Result and Discussion

To get the results of pairwise comparisons, enter a predefined value. If a criterion is compared with itself, it is given a value of 1. The initial input is to determine the value of the criteria as shown in the table.

Table 3. Value of Criteria

Criteria	Pz	Dy	Mp	RAM	HD	Ky	Mo
Pz	1	5	3	5	3	9	9
Dy	0.2	1	3	3	3	5	5
Mp	0.333	0.333	1	5	1	9	9
RAM	0.2	0.333	0.2	1	3	3	3
HD	0.333	0.333	1	0.333	1	9	9
Ky	0.111	0.2	0.111	0.333	0.111	1	1
Mo	0.111	0.2	0.111	0.333	0.111	1	1
Total	2.288	7.399	8.422	14.999	11.222	37	37

Source: Research Results (2022)

The number of each column in the table above can be calculated by the normalization matrix by dividing each element in the column by the appropriate number per column, to calculate the normalization matrix in column 1 and row 1, the results can be seen in table 4.

Table 4 Normalization Matrix

Criteria	Pz	Dy	Mp	RAM	HD	Ky	Mo
Pz	0,402	0,647	0,348	0,250	0,245	0,214	0,214
Dy	0,080	0,129	0,348	0,150	0,245	0,119	0,119
Mp	0,134	0,043	0,116	0,250	0,082	0,214	0,214
RAM	0,402	0,647	0,348	0,250	0,245	0,214	0,214
HD	0,080	0,129	0,348	0,150	0,245	0,119	0,119
Ky	0,134	0,043	0,116	0,250	0,082	0,214	0,214
Mo	0,080	0,043	0,023	0,250	0,082	0,119	0,119

Source: Research Results (2022)

After the normalization matrix is obtained in table 3, the next step is to add up each row in the matrix. Can the results of these calculations get priority criteria such as the table 5.

Table 5. Priority

Criteria	Priority
Price	2,320
Display	1,263
Processor	1,053
RAM	2.320
Harddisk	1.190
Keyboard	1.053
Mouse	1.053

Source: Research Results (2022)

After obtaining the number in each row, then the weight of each criterion is calculated by dividing each number of rows by the number of elements or the number of criteria (n = 7).

Table 6. Weight of Criteria

Criteria	Weight (n=7)
Price	0.331
Display	0.180
Processor	0.150
RAM	0.331
Harddisk	0.170
Keyboard	0.150
Mouse	0.102

Source: Research Results (2022)

After getting the weight value of each criterion, then perform calculations with computer selection. To compare this computer, it takes at least 3 computers that will be the choice of consumers. For example, computer A, computer B, and computer C. Furthermore, computer A, computer B, and computer C are evaluated to get an evaluation weight value for each criterion, as shown in the table 7.

Table 7. Evaluation Weight

Factor	Computer A	Computer B	Computer C
Pz	5	6	5
Dy	5	6	4
Mp	3	3	3
RAM	6	5	6
HD	7	5	5
Ky	7	5	6
Mo	7	5	6

Source: Research Results (2022)

After obtaining the results of each computer from the above calculations. Total Value of Computer Evaluation A = 5.714, Total Value of Computer Evaluation B = 5.000, Total Value of Computer Evaluation C = 5.000. The alternative with the highest value is the best solution based on the selected criteria; therefore the best solution falls on Computer A with a total of 5,714.

4. Conclusion

In this paper, we propose AHP for a decision-making tool, in which a criterion is modelled in stages. Knowledge-oriented AHP is used to get the required local features. Experiments on two real data show that this model produces better results. The criteria used consist of 7 criteria, namely Price, Display, Processor, RAM, Harddisk, Keyboard, and Mouse. With a decision support system using the Analytical Hierarchy Process (AHP) method and calculations using Matlab programming.

Bibliography

Ajalli, M., Saberifard, N., & Zinati, B. (2021). Evaluation and Ranking the Resilient Suppliers with the Combination of Decision Making Techniques. *Management and Production Engineering Review*, *12*(3), 129–140. https://doi.org/10.24425/mper.2021.137685

Badan Pusat Statistik. (2021). Catalog : 1101001. *Statistik Indonesia 2021*, *1101001*, 790. https://www.bps.go.id/publication/2020/04/29/e9011b3155d45d70823c141f/statistik-indonesia-2020.html

Falatehan, A. F. (2021). *Analytical Hierarchy Process (AHP)*. 17–24. https://doi.org/10.1007/978-3-030-64765-0_3

Gülfem, I., & Büyüközkan, G. (2007). Using a Multi-Criteria Decision Making Approach to Evaluate Mobile Phone Alternatives. *Computer Standards & Interface*, *29*, 265–274. https://doi.org/10.1016/j.csi.2006.05.002

Jadiaman Parhusip. (2019). Penerapan Metode Analytical Hierarchy Process (AHP) Pada Desain Sistem Pendukung Keputusan Pemilihan Calon Penerima Bantuan Pangan Non Tunai (BPNT) di Kota Palangka Raya. *Jurnal Teknologi Informasi Jurnal Keilmuan Dan Aplikasi Bidang Teknik Informatika*, *13*(2), 18–29. https://doi.org/10.47111/jti.v13i2.251

Minesa, P., Siregar, H., & Manuwoto, M. (2019). Aplikasi Analytical Hierarchy Process (AHP) Dalam Penentuan Skala Prioritas Penyelenggaraan Jalan di Kecamatan Cibinong Kabupaten Bogor. *Jurnal Manajemen Pembangunan Daerah*, *6*(2). https://doi.org/10.29244/jurnal_mpd.v6i2.25099

Nurkhasanah, L., & Santoso, A. (2020). Determinants of Masks Purchasing Decisions. *Jurnal Studi Manajemen Dan Bisnis*, *7*(1). https://doi.org/10.21107/jsmb.v7i1.7048

Phengchan, P., & Thangpreecharparnich, P. (2018). Advantages of Knowledge Management and Supply Chain Integration: A Case Study of Thai Palm Oil Production. *Management and Production Engineering Review*, *9*(4), 150–160. https://doi.org/10.24425/119555.

Setiawan, A., Handojo, A., & Budi, E. (2010). Perancangan Sistem Pengambilan Keputusan dalam Penentuan Supplier Menggunakan Analytical Hierarchy Process (AHP) Pada Perusahaan Jasa Konstruksi. *Scientific Repository Petra Christian University*, *1*.

Sudaryanto, R., & Karningsih, P. D. (2016). Integrasi TOWS , AHP dan SAW dalam Perumusan Strategi (Studi Kasus PT.“ XYZ"). *Jurnal Studi Manajemen dan Bisnis*, *3*(2), 195–209.

Takala, J., & Tilabi, S. (2018). Towards Developing a Decision Making Tool for Technology and Knowledge Priorities. *Management and Production Engineering Review*, *9*(3), 33–40. https://doi.org/10.24425/119532

Yusuf, A. (2020). Pemilihan Laptop Menggunakan Metoda Analytical Hierarchy Process (AHP). *Jurnal STEI Ekonomi*, *XX*(xx), 1–15.