

DECISION SUPPORT SYSTEM FOR PURCHASING OF MIRRORLESS CAMERA USING WEIGHTED PRODUCT METHOD

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Abstract— *A mirrorless camera is a camera that does not have a mirror or a pentaprism with the size and workpiece of a compact camera, but has an equivalent capability to a DSLR camera. There are several mirrorless camera manufacturers widely known in the market, among others: Canon, Sony, Fujifilm, Nikon, Olympus and Panasonic with the advantages of each manufacturer's specifications highlighted in order to enhance the attractiveness of consumers. With many types of mirrorless cameras in the market, many consumers are still confused in choosing which mirrorless camera is right and suited to their needs. Therefore, it takes a decision support system for the selection of mirrorless cameras using the weighted product method that can generate decisions about mirrorless cameras that comply with the selection of consumer criteria. The criteria used in this study are price, sensor size, megapixel, maximum ISO and LCD. The results of this study show that the alternative mirrorless camera which has the highest value is the Olympus PEN E-PL9 camera with a value of 0.148.*

Keywords: *Mirrorless Camera, Weighted Product, Decision Support System.*

Abstrak — Kamera *mirrorless* merupakan kamera yang tidak memiliki cermin atau pentaprisma dengan ukuran dan cara kerja seperti kamera saku, namun memiliki kemampuan yang setara dengan kamera DSLR. Ada beberapa produsen kamera *mirrorless* yang cukup dikenal secara luas di pasaran antara lain: Canon, Sony, Fujifilm, Nikon, Olympus dan Panasonic dengan keunggulan masing-masing spesifikasi yang ditonjolkan oleh produsen agar dapat meningkatkan daya tarik konsumen. Dengan banyaknya jenis kamera *mirrorless* dipasaran, banyak konsumen yang masih bingung dalam memilih kamera *mirrorless* mana yang tepat dan sesuai dengan kebutuhannya.

Untuk itu, dibutuhkan suatu sistem pendukung keputusan untuk pemilihan kamera *mirrorless* menggunakan metode *weighted product* yang dapat menghasilkan keputusan tentang kamera *mirrorless* yang sesuai dengan pemilihan kriteria konsumen. Kriteria-kriteria yang digunakan dalam penelitian ini adalah harga, ukuran sensor, megapiksel, maksimum ISO dan LCD. Hasil dari penelitian ini menunjukkan bahwa alternatif kamera *mirrorless* yang memiliki nilai tertinggi adalah kamera Olympus PEN E-PL9 dengan nilai 0,148.

Kata Kunci: *Kamera Mirrorless, Weighted Product, Sistem Pendukung Keputusan*

INTRODUCTION

A mirrorless camera is a camera that does not have a mirror and an optical viewfinder with an image quality equivalent to that of *Digital Single Lens Reflex* (DSLR) camera (Hermawan 2016). Currently, camera sales are quite fast in the market, especially mirrorless camera and DSLR camera (Fajar 2019).

There have been many consumers who prefer Mirrorless camera over than DSLR camera (Susmikawati and Sunarti 2017). The rapid number of mirrorless camera products on the market has made some consumers confused about choosing the right camera and according to their needs. (Fajar 2019). In general, consumers buy mirrorless cameras with high specifications, but their use is only a recreational hobby. In fact, by using it as a recreational hobby, consumers can choose a mirrorless camera with medium specifications. (Gani, Kridalaksana, and Arifin 2019). This confusion is one of the problems in choosing a mirrorless camera (Gani et al. 2019). Consumers need to pay attention to this problem so that they don't make the wrong purchase of a

camera that will later harm themselves. (Putra et al. 2018)

Based on the explanation above, this research creates a decision support system for purchasing a mirrorless camera using a weighted product.

The purpose of this study is to apply the weighted product method, with the creation of a decision support system that is expected to help consumers who want to buy a mirrorless camera according to their needs.

Related research

No	Topic/Title	Author	Results/Conclusion
1	Decision Support System for High School Scholarship Recipients Using Fuzzy Multiple Attribute Decision Making Model Weighted Product	T. Hidayatulloh, S. Suhada, E. Nursyifa, and L. Yusuf	In this case, SMAN 1 Cicurug Sukabumi organizes scholarships for outstanding students to continue their studies at SMAN 1 Cicurug Sukabumi. The criteria used in determining the scholarship are the average value of report cards, the average value of diplomas, number of dependents of parents, parents' income and areas of expertise with the weight of each criteria. With the results obtained from the 5 alternatives used are those that have the highest value in the ranking, namely the 2nd alternative (Hidayatulloh et al. 2018).
2	Design and Application of Weighted Product Method in Decision Support System for Purchase of Laptop	Nur Sumarsih	The purpose of this study is to assist consumers in choosing a laptop based on predetermined criteria. The criteria used include: price, RAM capacity, type of processor, hard drive capacity, and VGA (Sumarsih 2019).
3	Implementation of the Weighted Product Method in the Decision Support System for Choosing the Best Electronic Money Service	M. Wasti, S. Hartini, and Rinawati,	This research was conducted to assist users in choosing the best electronic money. Because electronic money is easier to use than conventional money. The criteria used in this study were comfort, safety, promotion, speed and convenience. The alternatives used are OVO, Go-Pay and Dana. Based on the results obtained in the calculation using the weighted product, the first alternative recommendation for electronic money is that OVO has a final V vector value of 0.394. (Wasti, Hartini, and Rinawati 2019).

MATERIALS AND METHOD

Purchasing

Purchasing is an effort to procure goods or services that are used in the company for the purpose of being managed by themselves, for the benefit of production or resale (Indrajani 2015).

According to (Indrajani 2015) the function of purchasing is responsible for determining the selected contribution in the procurement of goods, and issuing purchase orders to selected contributors and to obtain information about the price of goods.

Decision Support System

Decisions are the result of the process of choosing the best option from several available alternatives. In order to get the best choice, we will try to devote all the thoughts and activities

necessary to the decision-making process (Diana 2018).

According to (Kusrini 2017) the stages of decision making are as follows:

- a. Identify the problem
- b. Choose a problem solving model
- c. Collect the data needed to implement the decision model
- d. Implementing the model
- e. Evaluating the positive side of the chosen alternative
- f. Implement the chosen solution

Decision support systems are used to support management in carrying out analytical work in conditions that are less structured and with unclear criteria (Kusrini 2017).

In (Simangunsong and Sinaga 2019) A decision support system is a system that has been designed and can be implemented to support

decisions that have been agreed upon in the selection of an object.

From the explanation above, it can be concluded that a decision support system is a system that can assist and provide decision results in processing data or information for its users.

Characteristics and Capabilities of Decision Support System

A decision support system has several characteristics. According to (Sari 2018) characteristics of decision support systems, among others:

1. Support all organizational activities,
2. Support interactive decisions,
3. It is constant and can be used repeatedly,
4. Data and models are the main components,
5. Using external and internal data,
6. Some of the models used are quantitative models.

Weighted Product

The decision-making technique of several alternatives available in Multi Attribute Decision Making (MADM) is the definition of Weighted Product. The method evaluates several alternatives against a set of criteria or attributes, where each attribute is independent of one another (MZ 2018).

According to (Nofriansyah and Defit 2017) The weighted product method is a method that uses multiplication in connecting attribute ratings, then each attribute rating is raised to the power of the available attribute weights.

The basic concept of normalization of the Weighted Product (WP) method is to find S_i by raising the criterion value on an alternative with a weighted value for each criterion owned. After that the value of S_i will be used to find the value of V_i by dividing the value of S_i by $\sum S_i$, so that it will produce a value for each alternative (Maruloh et al. 2020).

The steps in completing the Weighted Product (WP) method according to (Diana 2018) are as follows:

- a. Identify the criteria that will be used as a reference in decision making.
- b. Each criterion is determined by initial weight and normalizes or corrects the weights to produce a value of $w_j = 1$ where $1, 2, \dots, n$ is the number of alternatives and $\sum w_j$ is the total number of weighted values.

$$W_j = \frac{w_j}{\sum w_j} \dots\dots\dots (1)$$

- c. Determine the vector value (S)

$$S_i = \prod_{j=1}^n X_{ij} w_j \dots\dots\dots (2)$$

- d. Determine the vector value (V)

$$V_j = \frac{\prod_{j=1}^n X_{ij} w_j}{\prod_{j=1}^n (X_{ij}^*) w_j} \dots\dots\dots (3)$$

Vector V is an alternative preference that will be used for ranking by dividing each number of vector values S by the number of all vectors S

Likert Scale

The Likert scale is a psychometric scale that is commonly used for questionnaires and is the most widely used scale in research in the form of surveys (Nofriansyah and Defit 2017). In this scale, the rating ranges from 1 to 5 with several scale formats, namely:

Table 1. Positive Statement Likert Scale

Very important	5
Important	4
Quite important	3
Unimportant	2
Very unimportant	1

Source: Defit & Nofriansyah (2017)

Research Stages

Below are the stages in the research as follows:

1. Problem Identification
 The first step in this research is to identify the problem that will be used as the subject of the research discussion, namely determining what are the criteria that influence consumers in choosing a mirrorless camera and how to apply the weighted product method to a decision support system in choosing a mirrorless camera.
2. Literature Study
 The next step is a literature study by studying and understanding theories related to the object of research derived from books, journals and previous research studies and will then be used as a theoretical study in the preparation of this thesis report.
3. Data Collection
 At this stage the authors collect data in the form of information about the selection of mirrorless cameras by means of observations and interviews with sellers and prospective buyers of mirrorless cameras as objects of research.
4. Data Analysis
 Analysis of the mirrorless camera selection data from this study used the weighted product method which was carried out by collecting data from a questionnaire about the selection of a mirrorless camera and the results of the analysis to obtain information that must be concluded.
5. Results of Data Analysis
 After the data analysis phase of the purchase of a mirrorless camera using the weighted product

method, an analysis result is produced which is the result of a research process carried out.

6. Conclusions and Suggestions

This stage is the last stage of the description of the research process by concluding the results of the research on decision support systems in purchasing mirrorless cameras and providing suggestions for developing further research to be even better in purchasing mirrorless cameras using the weighted product method.

Research Instruments

According to (Zai, Mesran, and Buulolo 2017) the human instrument or referred to as a qualitative researcher, is used to determine the focus of research, select informants as data sources, collect data, assess data quality, interpret data and draw conclusions from their research.

The research instrument used for this study which serves as a data collection tool is a questionnaire. The research instrument is used to measure the value of the criteria being analyzed, thus the number of instruments to be used for research will depend on the number of criteria to be studied.

In this study the criteria used are:

1. Price, basically the price is the most important benchmark for most potential buyers.
2. Sensor size, this relates to the ability to capture light and determine whether or not the photos taken are good. Therefore the size of the camera sensor is the most important part in considering the purchase of a camera.
3. Megapixels, is the main thing in a camera and is an important consideration in choosing a camera, because the size of the megapixels on the camera affects the quality of the resolution in the photos taken.
4. International Organization for Standardization (ISO) maximum, used in low light conditions. The higher the International Organization for Standardization (ISO) is used, the more sensitive the sensor will be so that the images or photos captured by the camera are brighter.
5. Liquid Crystal Display (LCD), serves to display the results of photo shots with several system settings on the camera. Liquid Crystal Display (LCD) is also important. Because the small or wide Liquid Crystal Display (LCD) makes consumers interested in choosing a camera

As for the alternative product choices from mirrorless camera shops, they are as follows: Fujifilm X-T20, Fujifilm A-X5, Canon EOS M100, Nikon Z50, Sony A6400, Olympus Pen E-PL9, Panasonic Lumix GF10, and Panasonic Lumix GF9.

In observing the respondents, the measurement scale used is the Likert scale, which

will get answers in the form of strongly agree, agree, neutral, disagree, and strongly disagree.

Table 2. Positive Statement Likert Scale

Very important	5
Important	4
Quite important	3
Unimportant	2
Very unimportant	1

Source: Defit & Nofriansyah (2017)

Table 3. Negative Statement Likert Scale

Very important	1
Important	2
Quite important	3
Unimportant	4
Very unimportant	5

Source: Defit & Nofriansyah (2017)

Research Methods

The author obtains data by conducting direct research in a systematic and standard procedure so as to obtain good and correct data with the following data collection techniques:

- a. Observation Method (Observation)
Observations were made directly to prospective mirrorless camera buyers and gave a questionnaire about the decision to choose a mirrorless camera to be studied so that they got the materials needed. According to (Sugiyono 2019) a questionnaire is a list of questions or statements made based on indicators of research variables given to respondents.
- b. Interview Method (Interview)
The author obtains data and examines the truth of the information and data by conducting questions and answers directly with the camera seller as the object of research.
- c. Library Method (Literature)
Literature study is looking for various reference books sourced from journals, articles, literature books and the internet later to support the completeness of the formulation and comparison materials related to the problems to be discussed.

Population and Research Sample

An object or subject that has certain quantities and characteristics determined by researchers to study and then draw conclusions is a population (Zai et al. 2017). According to (Zai et al. 2017) population is not just people, but objects and other things. And not just the amount that is in the object or subject but includes all the characteristics possessed by the object or subject.

In this study, the population taken is consumers or potential buyers of mirrorless cameras. Sampling in this study using a technique or method

of random sampling. The sample is selected from the population elements at random, where every member of the population has the same rights to be sampled..

In this study, samples were taken as many as 30 respondents, namely prospective buyers of mirrorless cameras, in order to represent the population as a whole.

Data Analysis Method

In this study, we will use Weighted Product (WP) analysis where in determining a decision by means of multiplication to link the attribute rating, where the rating of each attribute is raised first by the weight of the attribute in question.

According to (Frieyadi and Fariati 2019) argues that the Weighted Product (WP) method is a quantitative decision-making method.

From these criteria then fix the weights first. The weight of the criteria used as a test is obtained from the results of the questionnaire where the respondent chooses the level of importance according to the appropriate needs in selecting a mirrorless camera, then normalization of the weight or weight improvement is carried out by determining the vector S, namely the value of each alternative, this calculation is carried out where the data to be analyzed is carried out. multiplied by the previous one must be raised to the power of the weight of each criterion. After each vector S gets a value, the next step is to determine the value of the vector V used for alternative ranking. After the calculation using the V vector is complete, the next step is to enter all the calculation results into the table according to the highest value of the V vector value, then the calculation results will show the ranking of the V vector values from the largest to the smallest, so that the best alternative

recommendation for choosing a mirrorless camera is obtained based on the highest value vector V.

RESULTS AND DISCUSSION

Research Data

At this stage the authors collect the mirrorless camera selection data needed to perform calculations using the weighted product method. The following are criteria that are used as a reference in choosing a mirrorless camera using the weighted product method:

Table 4. Criteria

Criteria	Symbol
Price	C1
Sensor Size	C2
Megapiksel	C3
Maksimum ISO	C4
LCD	C5

From the table, a level of importance for criteria is determined based on the weight value for each criterion with a weight value of 1 to 5, this weighting refers to the Likert scale, namely:

Tabel 5. Value Weight

Statement	Weight
Very important	5
Important	4
Quite important	3
Unimportant	2
Very unimportant	1

Weighted Product Step Determining Alternative

Table 6. Mirrorless Camera Data

No	Mirrorless Camera	Specification					Code
		Price	Sensor Size	MP	ISO	LCD	
1	Fujifilm X-T20	Rp. 10.350.000	APS-C	24	51200	3.00"	A1
2	Fujifilm X-A5	Rp. 7.550.000	APS-C	24	12800	3.00"	A2
3	Canon EOS M100	Rp. 5.500.000	APS-C	24	25600	3.00"	A3
4	Nikon Z50	Rp. 15.500.000	APC-C	20	51200	3.02"	A4
5	Sony A6400	Rp. 13.900.000	APC-C	24	102400	3.00"	A5
6	Olympus Pen E-PL9	Rp. 10.500.000	Four Thirds	16	25600	3.00"	A6
7	Panasonic Lumix GF10	Rp. 6.900.000	Four Thirds	16	25600	3.00"	A7
8	Panasonic Lumix GF9	Rp. 4.500.000	Four Thirds	16	25600	3.00"	A8

Table 4 is the first step in determining the alternative to be used in the calculation. In this study, 8 samples of mirrorless camera data will be used.

A. Determining Improvement Criteria Weight

Determine the weight of preference or determine the level of importance based on the level of importance of each criterion. The following is the weight value given by the respondents, namely:

Table 7. Respondent Input

Criteria	Value
Price	3
Sensor Size	3
Megapiksel	3
Maksimum ISO	2
LCD	2

Next, the weights will be corrected first with an initial weight of $W = (3, 3, 3, 2, 2)$, where W is the weight of each criterion that the respondent gives. The following is the calculation for the improvement of the criteria as follows:

- 1) Price Criteria. $W_1 = 0,230$
- 2) Sensor Size Criteria. $W_2 = 0,230$
- 3) Megapiksel Criteria. $W_3 = 0,230$
- 4) Maksimum ISO Criteria. $W_4 = 0,154$
- 5) LCD Criteria. $W_5 = 0,154$

The following are the results of the calculation of the improvement in the criteria weights:

Table 8. Criteria Weight Improvement

Criteria	Value	Weight
Price	3	0,230
Sensor Size	3	0,230
Megapiksel	3	0,230
Maksimum ISO	2	0,154
LCD	2	0,154

B. Determining the Weight of Each Alternative

The next step is to give weighting criteria for each mirrorless camera data contained in table 7 Mirrorless Camera Data. The following is the weight of the criteria for each mirrorless camera, namely:

Table 9. Criteria Weight of Each Mirrorless Camera

Criteria	Alternatif							
	A1	A2	A3	A4	A5	A6	A7	A8
C1	2	3	4	1	1	2	3	4
C2	3	3	3	3	3	4	4	4
C3	3	3	3	3	3	5	5	5
C4	2	4	3	2	1	3	3	3
C5	4	4	4	3	4	4	4	4

C. Calculating Vector S

After getting the results of the calculation of the improvement value of the criterion weights, then the next step is to calculate the vector S where this calculation will be multiplied but before it is raised with the weight of each criterion. With the weight as a positive power for the favorable criteria and negative weight for the cost criteria. The following is the calculation of the vector S , namely:

- 1) Alternative Mirrorless Camera A1
 $S_1 = 1,947$
- 2) Alternative Mirrorless Camera A2
 $S_2 = 1,972$
- 3) Alternative Mirrorless Camera A3
 $S_3 = 1,765$
- 4) Alternative Mirrorless Camera A4
 $S_4 = 2,183$
- 5) Alternative Mirrorless Camera A5
 $S_5 = 2,050$
- 6) Alternative Mirrorless Camera A6
 $S_6 = 2,491$
- 7) Alternative Mirrorless Camera A7
 $S_7 = 2,269$
- 8) Alternative Mirrorless Camera A8
 $S_8 = 2,122$

The following are the results of the calculation of the vector S , namely:

Table 10. Vector S Calculation

Alternative	Value
A1	1,947
A2	1,972
A3	1,765
A4	2,183
A5	2,050
A6	2,491
A7	2,269
A8	2,122

D. Determine the Vector V

After getting the vector S value, the next step is to determine the alternative ranking of mirrorless cameras by dividing the vector V value used for ranking for each alternative by the total value of all S vector alternative values. The following is the vector V calculation, namely:

- 1) $V_1 = 0,116$
- 2) $V_2 = 0,117$
- 3) $V_3 = 0,105$
- 4) $V_4 = 0,130$
- 5) $V_5 = 0,122$
- 6) $V_6 = 0,148$
- 7) $V_7 = 0,135$
- 8) $V_8 = 0,126$

E. Final Value Obtained

After the calculation using vector V is complete, the next step is to enter all the calculation results into the table according to the highest value of vector V , then the highest value will be obtained as the recommended value, namely:

Table 11. Result Value

Alternative	Value	Ranking
A6	0,148	1
A7	0,135	2
A4	0,130	3
A8	0,126	4
A5	0,122	5
A2	0,117	6
A1	0,116	7
A3	0,105	8

So the results of the calculation of choosing a mirrorless camera using the weighted product method state that the first rank is the A6 alternative with a value of 0.148, namely the Olympus PEN E-PL9 mirrorless camera. The second is the A7 alternative with a value of 0.135, namely the Panasonic Lumix GF10 mirrorless camera. The third is the A4 alternative with a value of 0.130, namely the Nikon Z50 mirrorless camera. The fourth is the A8 alternative with a value of 0.126, namely the Panasonic Lumix GF9 mirrorless camera. The fifth is the A5 alternative with a value of 0.122, namely the Sony A6400 mirrorless camera. The sixth is the A2 alternative with a value of 0.117, namely the Fujifilm X-A5 mirrorless camera. The seventh is the A1 alternative with a value of 0.116, namely the Fujifilm X-T20 mirrorless camera. And the last eighth ranking is the A3 alternative with a value of 0.105, namely the Canon EOS M100 camera.

CONCLUSION

From the results of the research discussion on the decision support system for choosing a laptop using the weighted product method, the authors can conclude that in using the weighted product method, criteria are needed to be considered, the criteria that have been determined are price, sensor size, megapixel, maximum ISO and LCD. Meanwhile, to build a mirrorless camera purchase decision support system using the weighted product method, the first step is to determine the criteria and alternatives for mirrorless cameras to be compared, then the data will be calculated using the weighted product method.

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