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Implementation Weighting Method for Selection Online Buying and Selling Platforms in the Digital Era

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ABSTRACT IN ENGLISH

With the development of the technology-based era, communication patterns can be carried out through application intermediaries. With an application intermediary, the communicator does not need to meet face-to-face. The influence of the development of information technology has penetrated the economic sector. A buying and selling transaction is one of the everyday activities carried out in the financial field. Application-based buying and selling transactions make it easier for market players, including sellers and buyers. Internet technology adds to the convenience and capacity of buying and selling transactions because people in different locations carry out these activities. Along with the various advantages of buying and selling platforms, it has impacted the emergence of different online buying and selling platforms with multiple features. From this presentation, it is necessary to develop research in the form of application design to determine or choose the ideal online buying and selling platform for online shopping activists, especially Generation Z. The weighting method used in this research is the Simple Additive Weighting method. The output of the online buying and selling platform with the highest value is Shopee, which is 23.73. The next platform is Tokopedia which is 23.33. So the Decision Support System using the Simple Additive Weighting method is suitable for choosing an ideal buying and selling platform.

Keywords:
Buying and Selling; Decision Support System; Economic; Marketplace; Simple Additive Weighting

1. INTRODUCTION

Humans are social creatures who live side by side. Human interaction from ancient times was carried out by meeting directly or face to face [1]. As social beings, communication is an essential element in human life. The primary function of communication is to inform something. With the development of the technology-based era, communication patterns can be carried out through application intermediaries. With an application intermediary, the communicator does not need to meet face-to-face. The influence of the development of information technology has penetrated the economic sector. A buying and selling transaction is one of the everyday activities carried out in the financial field [2].

Buying and selling transactions were initially carried out in the market, so they had to be face-to-face. Application-based buying and selling transactions make it easier for market players, including sellers and buyers. Internet technology adds to the convenience and carrying capacity of buying and selling transaction activities because these activities are carried out by people, not in the exact location. For sellers, having an online buying and selling platform will save costs and energy for marketing. For buyers, having an online buying and selling platform will save energy because they don't need to go to the market.

Along with the various advantages of buying and selling platforms, it has impacted the emergence of different online buying and selling platforms with multiple features. The number of emerging media is caused by developers competing with each other to benefit from a large number of users. Users who dominate Generation Z undoubtedly have to be selective in choosing an online buying and selling platform with various features and qualities. Several online buying and selling platforms can be said to be prone to fraud against buyers or users. This has been widely reported in the news regarding the various scams on online buying and selling platforms. Generation Z is a generation that was born with technology but still needs to improve in choosing an online buying and selling platform that is suitable and safe to use.

Figure 1 - Digital Platform User Statistics in Indonesia (Source: data.tempo.co (2020))

Based on Figure 1, the highest number of users is projected to occur in 2024, reaching 189.6 million, or 2 out of 3 of the total population of Indonesia. This increase is also supported by a study published by Binus University in 2019, which found that 60.5% of the Indonesian population prefers to shop online rather than offline.

From this explanation, it is necessary to develop research in the form of application design to determine or choose the ideal online buying and selling platform for online shopping activists, especially Generation Z. The selection process uses a computational method based on Multi-Criteria Decision Making. The technique is Simple Additive Weighting by utilizing the weight value on each criterion. The Simple Additive Weighting method is often and effectively used in various cases or selection problems.

A previous study conducted by Yuda Irawan emphasized the of providing salary bonuses to employees to boost their morale. Variables used as criteria include Supervisory Assessment (PA), Length of Service, Absenteeism, and Written Warnings (SP). The method employed is Simple Additive Weighting (SAW). This method aids company administrators in swiftly and effectively determining and recommending employee bonus decisions. Thus, the bonus amount received by employees using the SAW method is the base salary multiplied by the percentage of the ranking value [3]. Another study was conducted by Rizal Furqan Ramadhan on decision recommendations for selecting outstanding students using the Simple Additive Weighting method. The application output consists of the top 3 students based on weighted calculations. Utilizing the Simple Additive Weighting method in assessing student achievements, is expected to yield valid outcomes [4].

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Research was also conducted by Krzysztof Piasecki and colleagues on the collaboration between the Simple Additive Weighting method and the Fuzzy method in decision recommendation. With the SAW method in place, the ranking process remains inevitable, resulting in effective outcomes [5]. From the presentation of several previous studies, it is necessary to redevelop the application of the Simple Additive Weighting method for new problems and close to generations close to technology. Therefore the researcher took the topic according to the research title, one of which was because the research object was Generation Z.

2. METHOD

This study uses several stages of research. The steps are essential to carry out the research process properly and coherently. The research stages will be presented in the form of a chart or diagram to make it easier for the reader to understand the research conducted by the researcher.

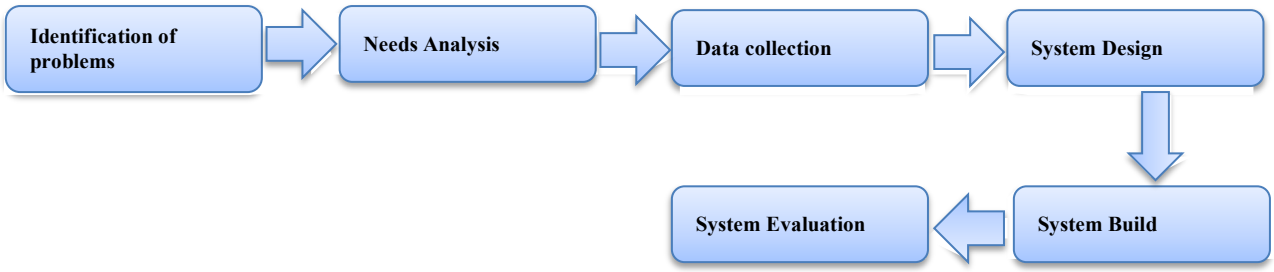

Figure 2 - Research Methods

As shown in Figure 2. The research starts with the problem identification process. The problem studied is the number of online buying and selling platforms circulating in the field. These platforms have different features and characteristics, so it is necessary to conduct a selection process to produce recommendations for the ideal venue. In addition, fraud often occurs from several online buying and selling platforms, which are detrimental to sellers and buyers. So this research must be carried out so that online shopping activists feel safer and more comfortable in making online transactions.

The second stage is needs analysis, namely analyzing all needs that support the research process. This needs analysis includes determining the data source to be processed because data is the main component in research. At the data analysis stage, a database design facilitates data processing before reprocessing using the simple additive weighting method. The third stage is data collection. The data used is an online buying and selling platform that many people often use. Then the respondents assessed that some buying and selling media were dominated by Generation Z. Generation Z was considered closer and more familiar with and mastered technology than the previous generation.

The next stage is system design. The research system design implements the Waterfall method as part of the Software Development Life Cycle (SDLC) technique. Stages in the waterfall method include requirements analysis, design, implementation, evaluation, and maintenance as depicted in Figure 3. Moreover, system design also involves determining the programming language used, both for interface design and for designing system input and output processes, ensuring programmers face no obstacles during system development.

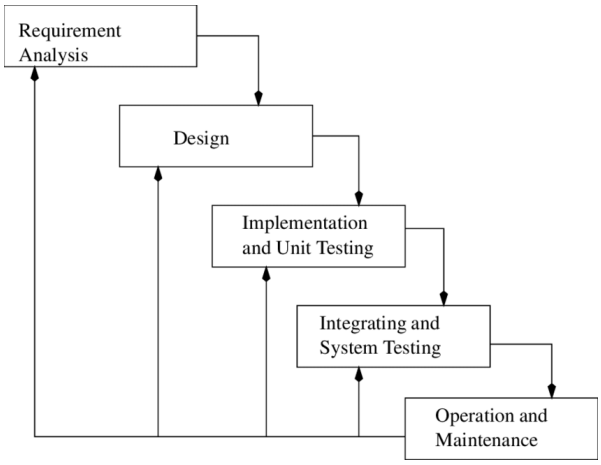

Figure 3 - Stages of the Waterfall Method

The stage of making the system is a technical stage of the research. This stage applies a programming language to create the design and then, in processing the data, uses the database as the storage medium. After the two components are involved, the last step is to apply the simple additive weighting method to the system. The final stage of the research is evaluation; the evaluation stage determines whether the system's output is appropriate or not with the conditions in the field. Digital economic experts from both academics and computer practitioners carried out this evaluation.

3. RESULTS AND DISCUSSION

3.1. Decision Support System

A Decision Support System is a system that produces output from data processing in a dynamic database [2]. Data processing is carried out in a DBMS (Database Management System) quickly and accurately because it is based on information technology [6]. The Decision Support System can produce outputs as decision recommendations for managers or leaders in an institution or organization [7]. Decision recommendations come from mathematical calculations or are known as methods [8]. The methods used vary so that they adjust to the problems studied.

In the Decision Support System, there are several components. The components in question include [9]:

- **Data Management**: Data management in question is the role of the database for dynamic data storage.
- **Subsystem Management Model**: The management model in question uses the DBMS (Database Management System) or the application to store data.
- **Subsystem interface**: With the interface, the user can communicate with the system. So that users can use the system properly
- **Knowledge Technology**: The Knowledge Technology in question is Artificial Intelligence. With the existence of artificial intelligence, various computational methods can be used in a system so that the system can replace human performance.

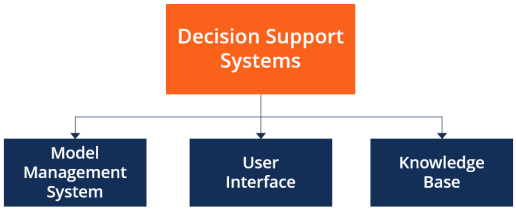

Figure 4 - Decision Support System chart

Based on Figure 4, in the decision support system, several components are interconnected with one another. In addition to the database, it contains large amounts of data processing and is supported by knowledge translated into programming languages. The ability in question can be in the form of artificial intelligence or other fields of computational science.

In previous studies, most research based on Decision Support Systems used the Multi-Criteria Decision Making technique to process data. The Multi-Criteria Decision Making technique has blended into one with the Decision Support System. The two concepts, both DSS and MCDM, have been proven to have many benefits. One object that directly benefits from these two concepts is leadership. Applying these two concepts will undoubtedly help leaders who are too busy with their activities and work then translate them into applications.

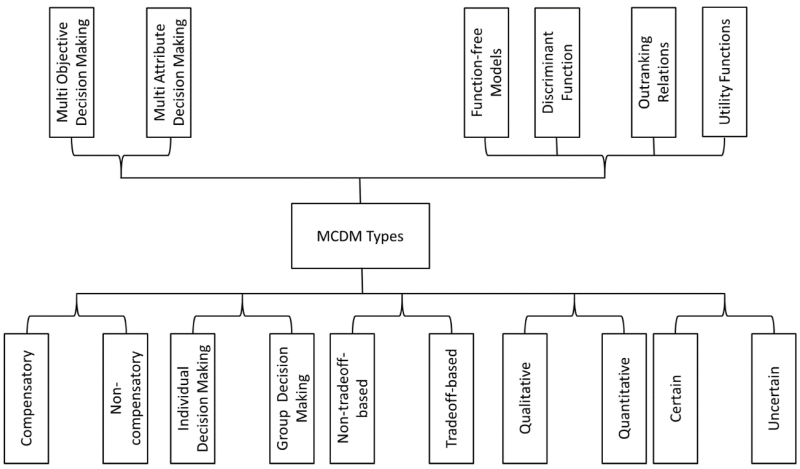

Figure 5 - Multi-Criteria Decision-Making Chart

Based on Figure 5, the Multi-Criteria Decision Making concept has many mutually influential and related parts. The idea of Multi-Criteria Decision Making has several types but has almost the same functions and characteristics. For example, in the Multi-Attribute Decision-Making section, the criteria used in this concept will be sorted based on attributes so that the criteria values and the attribute value components are used.

Attributes on each criterion have different types. The difference between each attribute is according to its characteristics, so the value is also other. Each class consists of several different methods. The methods have additional features and mathematical stages based on expert research. From this explanation, many problems often use the concept of Multi-Criteria decision-making with the output results following the actual conditions.

3.2. Simple Additive Weighting Method

The Simple Additive Weighting method is part of the Fuzzy Multi-Attribute Decision Making process, which requires the calculation process of normalizing the decision matrix (x) to a scale that can be compared with all existing alternative ratings before calculating the preference value [10] [11].

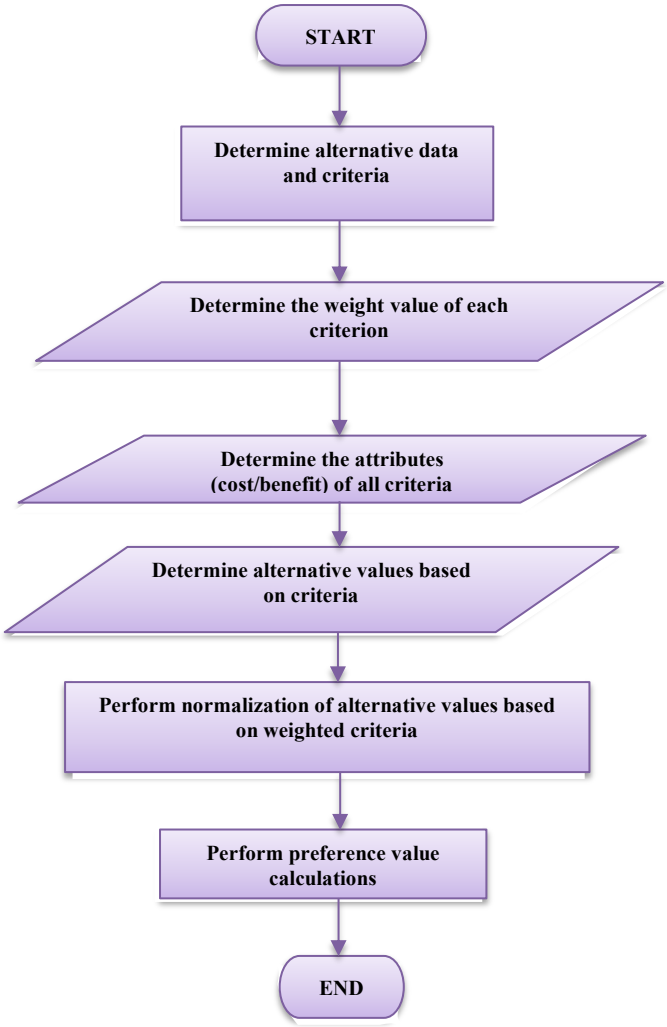

Figure 6 - Flowchart of the Simple Additive Weighting Method

Based on Figure 6, the Simple Additive Weighting Method starts from alternative data, then there are criteria based on these alternative data, and each measure has a different weight according to the expert decision[12][13]. Alternative data used in the research are several online buying and selling platforms that are often used by people in Indonesia. This platform provides various interesting features and goods for consumers who actively carry out digital transactions to purchase. Some of these platforms have advantages and disadvantages so differences in the quality of each platform will be visible in the system based on the results of mathematical calculations using the Simple Additive Weighting method. The Simple Additive Weighting method begins with collecting alternative data first. This alternative data comes from 63 respondents by assessing each trading platform presented. Of the 63 people, it is dominated by Generation Z, with

professionals as students or already working. The age range of the respondents is 19 to 22 years old because they are considered productive in using technology devices. Respondents from this age range are considered objective in providing assessments based on sufficient experience in terms of using different online buying and selling platforms both in terms of facial appearance and features used. Researchers did not involve the baby boomer generation because this generation still has very little understanding of using online buying and selling platforms so it is quite risky to provide value.

Expert considerations will give each of the predetermined criteria weight. The experts in question are experts in the digital economy, both academics and practitioners in the field of information technology. The attribute type must also determine all criteria, costs, or benefits. Determination of this weight is carried out for the following calculation process, namely normalization. Expert judgment and mathematical normalization techniques go hand in hand. Expert judgment serves to adjust the weight values to real conditions in the field. The normalization technique also cannot be left alone because this technique is part of the Simple Additive Weighting method.

The value of each of these alternatives will later be processed by normalization. This normalization process also adjusts to the attributes of each criterion [14]. The normalization calculation formula is as in Equation 1.

$$r_{ij} = \begin{cases} \dfrac{x_{ij}}{\underset{i}{Max}\ x_{ij}} & If\ j\ is\ the\ attribute\ benefit \\ \dfrac{\underset{i}{Min}\ x_{ij}}{x_{ij}} & If\ j\ is\ the\ attribute\ cost \end{cases} \quad (1)$$

Based on equation 1, the symbol r is the normalized value resulting from calculating the multiplication and division of the x value. The x value is an alternative value or alternative data. Each alternative has a normalized value based on the type of attribute [15] [16]. After going through the normalization process, the final process is calculating preference values. For the formula according to Equation 2.

$$V_i = \sum_{j=1}^{n} w_j \quad r_{ij} \quad (2)$$

Based on equation 2, the symbol V is the preference value. The preference value is the result of the Simple Additive Weighting method. The symbol W is each criterion's weight value, which amounts to 5 criteria. The five criteria have different weight values. The symbol R is the normalized value. Calculating the preference value is the sum of the multiplication results of each criterion weight with the normalized value. The stages in the Simple Additive Weighting method can stream human performance processes computationally. In addition, this method can also help various parties, especially agencies or institutions, decide on a consideration.

3.3. System Design

Before the researcher applied the Simple Additive Weighting method, a system design was carried out with the aim that the flow and function of the system would run well. The system design is in Figure 7.

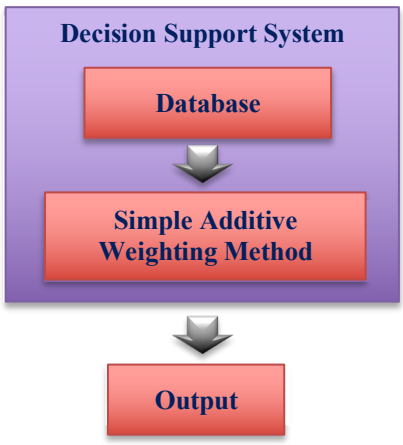

Figure 7 - System Design

Based on Figure 7, there is data storage in the Decision Support System before processing using the Simple Additive Weighting method. The database stores alternative data and the criteria data used in the Decision Support System. It is

in this database that the concept of an information system is applied. With a database, an information system can process input data. In this database, table relations function to avoid duplicate data or data redundancy.

Using a programming language, stored data can be processed using the Simple Additive Weighting method. All alternative data and criteria data have been stored in the database and can be processed using mathematical techniques according to the method. The final result of the Simple Additive Weighting method's calculation process is the system's output. The last function, or the last stage of the Simple Additive Weighting method, will be ranked through the system so that the manager can determine the output according to the stated value.

3.4. Results and Discussion

This study uses several alternative data and criteria. The two components complement each other. Alternative data is an online buying and selling platform often used by online shopping activists, namely Generation Z. Alternative data is by Table 1.

Table 1 - Alternative Data

No	Alternative
1	Shopee
2	Bukalapak
3	Tokopedia
4	Lazada
5	Blibli

Based on Table 1, the alternative data is an online buying and selling platform often used by Generation Z or online shopping activists, both sellers and buyers. Next the stages to determine the criteria used in this study. The essential criteria component supports the research process because the computational method is part of the Multi-Attribute Decision Making technique. The main element of the design is the criteria that serve as assessment material for respondents.

Table 2 - Criteria Data

No	Criteria	Attribute
1	User Interface	Benefit
2	Types of products	Benefit
3	Price	Cost
4	Shipping And Packaging	Benefit
5	Payment Techniques	Benefit
6	Service Response	Benefit
7	Transaction Security	Benefit

Based on Table 2, the criteria are determined with seven criteria. These criteria are assessment materials integrated with the Decision Support System and then filled in by the respondents. All of these criteria have different attributes according to the type of interest. The benefit attribute is a criterion whose value is high; the benefits are high for the respondents. While the cost criterion has increased weight, the benefits are low for the respondents.

Table 3 - Weight Value

No	Criteria	Weight Value
1	User Interface	0,25
2	Types of products	0,1
3	Price	0,35
4	Shipping And Packaging	0,05
5	Payment Techniques	0,1
6	Service Response	0,1
7	Transaction Security	0,05

Based on Table 3, the weight value for each criterion is displayed. The weight value adjusts from the level of importance in each bar. The weight value will be grouped into the numerator and denominator. If the criterion has a benefit attribute, the weight value is used as a divisor, and vice versa for bars with a cost attribute.

Table 4 - Normalization Results

No	Alternative	Criteria						
		C1	C2	C3	C4	C5	C6	C7
1	Shopee	16,00	42,00	0,09	76,00	41,00	37,00	78,00
2	Bukalapak	14,40	35,00	0,10	70,00	36,00	35,00	72,00
3	Tokopedia	16,40	39,00	0,09	78,00	39,00	37,00	76,00
4	Lazada	15,20	36,00	0,10	70,00	36,00	36,00	72,00
5	Blibli	14,40	34,00	0,10	70,00	36,00	35,00	70,00

Based on Table 4, the alternative data values and weight values are calculated by dividing the results. The weight value included in the benefit criteria group will be the divisor. In contrast, the weight value included in the cost criteria will be the quantifier—normalization calculation according to equations 3 and 4.

$$A1C1 = \frac{4}{0,25} = 16 \quad (3)$$

$$A1C2 = \frac{4,2}{0,1} = 42 \quad (4)$$

Based on equations 3 and 4, it is a manual calculation of normalizing the value of r from alternative 1 data with criteria 1 and 2. Each weight value will be calculated by involving the respondent's value in each option. And still, pay attention to the attributes of each criterion.

Table 5- Preference Value Calculation Results

No	Alternative	Preference Value	Rank
1	Shopee	23,732237	1
2	Bukalapak	21,336029	4
3	Tokopedia	23,333108	2
4	Lazada	21,734028	3
5	Blibli	21,136029	5

Based on Table 5, the normalized value of R will be calculated to produce a preference value. The preference value results from multiplying the weight value and the normalization result. Manual calculation according to equations 5 and 6.

$$V4 = (0,25x15,2) + (0,1x36) + (0,35x0,1) + (0,05x70) + (0,1x36) + (0,1x36) + (0,05x72) = 21,73 \quad (5)$$

$$V5 = (0,25x14,4) + (0,1x34) + (0,35x0,1) + (0,05x70) + (0,1x36) + (0,1x35) + (0,05x70) = 21,13 \quad (6)$$

The results in Table 5 are the output of the Decision Support System to produce an ideal online buying and selling platform used by online shopping activists as sellers and buyers. The Shop platform has the highest score from the Decision Support System using the Simple Additive Weighting method, with a value of 23.7. The ranking below is the Tokopedia platform, with a value of 23.33.

The online buying and selling platforms in this research are a sample of all platforms frequently used by Indonesian people. With the development of time and time, you can find many online buying and selling platforms that are still relatively new with various features. However, several things make this platform minimally popular. The lack of interest or consumers who visit the platform is due to one of the reasons for the appearance of the application which is less attractive and difficult for users to understand according to Table 2. From this explanation, this research can still be developed further by increasing the number of research objects, namely the number of online buying and selling platforms, and by adding more complex criteria data.

4. CONCLUSION

Based on the research findings, using weighting methods based on the Decision Support System can produce an output in the form of an ideal sequence of online buying and selling platforms that can be used by online shopping enthusiasts, both sellers and buyers. Generation Z, as the largest user group, receives decision recommendations in the form of an ideal online buying and selling platform to use. The Simple Additive Weighting method applies techniques that do not complicate researchers or developers in designing and creating the Decision Support System. The highest-rated online buying and selling platform output is Shopee at 23.73, followed by Tokopedia at 23.33. The high values of these two platforms do not imply that other platforms have low quality, such as Lazada, Bukalapak, and Blibli. The majority of the platforms are of good quality; however, the calculated values in the system differ based on the criteria set in the research

process. The good quality of each platform based on preference values shows minimal differences among them. Therefore, it can be concluded that a weighting method based on the Decision Support System using the Simple Additive Weighting method is suitable for selecting ideal buying and selling platforms and can be recommended for further research. Thus, this study needs to be re-evaluated by applying different cases or issues to maximize its utility.

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