DECISION SUPPORT SYSTEM FOR HYDROPONIC VEGETABLE SEED SELECTION USING EXPONENTIAL COMPARISON METHOD

Rini Nuraini

Program Studi Informatika, Fakultas Teknologi Komunikasi dan Informatika
Universitas Nasional
Jakrta Indonesia
https://www.unas.ac.id/
rini.nuraini@civitas.unas.ac.id

(*) Corresponding Author

Abstract—The issue of food security is not only the task of farmers. Therefore starting to participate in growing vegetables at home through hydroponic techniques can be a solution. Hydroponics is one solution for urban farming or farming activities in Indonesia's urban areas. In order to get an abundant harvest on limited land, it requires quality seeds. Good vegetable seeds hold the key to determining a good harvest too. So, do not carelessly buy vegetable seeds to grow vegetables hydroponically. However, the problem is, with so many vegetable seed products for hydroponics on the market, it makes someone confused about choosing the right product that suits their needs. The primary purpose of this research is to develop a decision support system for selecting hydroponic vegetable seeds with a website-based Exponential Comparison Method to facilitate decision-makers in determining the right seeds according to their needs. The Exponential Comparison method can perform a priority order of decision alternatives based on existing criteria and distinguish each alternative's value in contrast. The decision support system developed produces calculations using the valid Exponential Comparison Method because the results are by manual calculations. In addition, the black-box testing technique shows that the system has been running well.

Keywords: decision support system, exponential comparison method, vegetable seed selection, hydroponics.

Abstrak—*Isu tentang ketahanan pangan bukan hanya menjadi tugas petani, untuk itu mulai turut serta menanam sayur di rumah melalui teknkik hidroponik dapat menjadi sebuah solusi. Hidroponik merupakan salah satu solusi urban farming atau kegiatan bercocok tanam secara mandiri di wilayah perkotaan di Indonesia. Agar mendapatkan panen melimpah di lahan terbatas, maka membutuhkan benih yang berkualitas. Benih sayur yang bagus memegang kunci penentu hasil panen yang bagus pula. Jadi, tidak boleh sembarangan membeli benih sayur untuk menanam sayur secara hidroponik. Tetapi masalahnya, dengan banyaknya produk benih sayuran untuk hidroponik di pasaran mengakibatkan sesorang menjadi bingung untuk memilih produk yang tepat yang sesuai dengan kebutuhannya. Tujuan utama dari penelitian ini adalah untuk pengembangan sistem pendukung keputusan pemilihan benih sayur hidroponik dengan Metode Perbandingan Eksponensial berbasis website agar memudahkan pengambil keputusan dalam menentukan benih yang tepat dan sesuai dengan kebutuhan. Metode Perbandingan Eksponensial dapat melakukan urutan prioritas alternatif keputusan pada kriteria yang ada dan dapat membedakan nilai setiap alternatif secara kontras. Sistem Pendukung Keputusan yang dikembangkan menghasilkan perhitungan dengan Metode Perbandingan Eksponensial yang valid karena hasilnya sesuai dengan perhitungan manual. Selain itu, berdasarkan uji dengan teknik black-box testing memperlihatkan bahwa sistem yang dibangun telah berjalan dengan baik..*

Kata Kunci*: sistem pendukung keputusan, metode perbandingan eksponensial, pemilihan benih sayuran, hidroponik.*

INTRODUCTION

Food is one of the basic human needs that is always met daily. As a basic need and one of the human rights, food has a significant meaning and role in the life of a nation. For that, it is an aspiration to realize food security, where the availability of food and one's ability to access it. The Covid-19 pandemic has made people aware of preparing various efforts and breakthroughs to face various crisis threats, especially the food crisis. One of the breakthroughs to meeting food needs independently is to grow crops. However, in urban areas, there is not enough land for farming.

PILAR Nusa Mandiri: Journal of Computing and Information System
Vol. 18, No. 2 September 2022 | DOI: 10.33480/pilar.v18i2.3471

Hydroponics is one solution for urban farming or farming activities in urban areas in Indonesia because hydroponics is done with the land that is not too large and can use water for plant nutritional needs (Singgih et al., 2019). The issue of food security is not only the task of farmers. To support the Food Security Movement by the Ministry of Agriculture of the Republic of Indonesia by starting to participate in growing vegetables at home. In order to get an abundant harvest on limited land, it requires quality seeds. Good vegetable seeds hold the key to determining a good harvest too. So, you should not carelessly buy vegetable seeds to grow vegetables hydroponically. But the problem is, with so many vegetable seed products for hydroponics on the market, it makes someone confused about choosing the right product that suits their needs. So, it requires solving problems through a computerized system that can assist in determining the decision to select vegetable seeds for hydroponic plants.

Implementing a Decision Support System (DSS) to assist in making decisions systematically is possible. DSS is a knowledge-based software that can provide the best solution in determining decisions (Giat & Bouhnik, 2021). DSS using in solving semi-structured problems to assist decision-makers in providing the best alternative solutions or suggestions (Borman et al., 2018). In addition, DSS provides information, models, and data processing that are useful in decision-making (Borman, Megawaty, et al., 2020). In making a decision, it is possible to be influenced by several factors because, in decision-making, the problems that are solved are complex and with various or multi-criteria criteria. Multi-criteria problems are overcome using the Exponential Comparison Method approach. This method uses several criteria as a priority order of decision alternatives (Borman & Fauzi, 2018). The Exponential Comparison Method is an approach that ranks the available alternatives through an exponential process (Napian & Meriza, 2020).

Previous research, which is related to the selection of seeds or plant seeds, has been widely carried out (Nurhayati, 2017), (Suranti, 2018), (Sudarwati et al., 2021). Among them is research on developing a decision support system for selecting cayenne pepper seeds by applying the Simple Additive Weighting (SAW) method (Rachman et al., 2017). The SAW method looks for a solution based on the weighted sum obtained through the performance rating of each alternative on all attributes. The weighted product method use for further research on developing a superior rice seed selection system (Susilowati & Purwanto, 2021). The WP method looks for alternatives based on the multiplication between the previous attributes and then increases the weight. Next, research related to DSS for the selection of longan seedlings uses the Analytical Hierarchy Process (AHP) approach (Yahyan & Siregar, 2019). This approach can solve multi-criteria problems by using a hierarchical structure of criteria from decision-makers to determine alternatives based on weights or priority considerations.

The difference between this research and previous research is the research conducted in solving multi-criteria problems using the Exponential Comparison Method. The Exponential Comparison method can reduce bias in the decision analysis process because the assessment results are in order of priority so that the resulting alternatives are relevant to the facts (Katemba & Neolak, 2021). This is shown from previous research, showing that applying the Exponential Comparison Method in a decision support system can solve multi-criteria problems well by producing alternatives based on priority order through an exponential process (Napian & Meriza, 2020; Sudarwati et al., 2021; Suranti, 2018). In addition, this research focuses on solving the problem of selecting vegetable crops that can be grown hydroponically. The criteria used for the selection came from an agricultural extension expert, Evrina Budiastuti, which was taken on a web page that she reviewed. The criteria used include Price, Number of Seeds, Harvest Age, Growing Power, and Purity (Budiastuti, 2022).

Based on the previous explanation, the primary purpose of this study is to develop a decision support system for selecting hydroponic vegetable seeds with a website-based Exponential Comparison Method to facilitate decision-makers in determining the right hydroponic vegetable seeds according to their needs.

MATERIALS AND METHODS

For the research to be correct, it is necessary to arrange the stages of the research. The stages in this research are a systematic approach used in solving a research problem, including the steps in conducting research (Ahmad et al., 2022). The research stages are crucial because they become an invoice for realizing research objectives through structured and well-planned research stages. The stages in this research consist of the identification of problems, system requirements analysis, problem-solving using the Exponential Comparison Method, system design, implementing a Decision Support System (DSS), and Testing System. The stages in the research application of the Exponential Comparison Method in choosing hydroponic vegetable seeds is served in Figure 1.

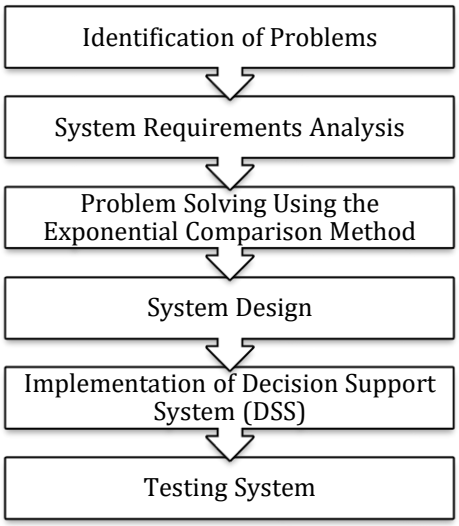


Figure 1. Research Stages

A. Identification of Problems

The initial stage is to explore the problems that solve through problem identification. Problem identification aims to find out the main problems to be solved to make it easier for developers to determine solutions to solving problems.

The field study requires quality seeds for an abundant harvest in limited land or hydroponics. Good vegetable seeds hold the key to determining a good harvest too. So, it would help if you did not carelessly buy vegetable seeds to grow vegetables hydroponically. However, the problem is that with so many vegetable seed products for hydroponics on the market, people are confused about choosing the right product that suits their needs. For that, we need a decision support system that can assist in selecting the right vegetable seeds through the Exponential Comparison Method.

B. System Requirements Analysis

The next step is to analyze the system requirements. In requirements analysis, statements about the required features in the system, usually called functional requirements, are compiled. Functional requirements analysis is an analysis that produces statements about system services (Napianto et al., 2021). So, at this stage, it will produce a statement about the features the user needs to solve user problems.

Based on the identification of the problem, the functional requirements are as follows:

1) The system has features to manage criteria data.
2) The system has features to manage alternative data.
3) The system has features to manage weight data.
4) The system has features to manage the value of each alternative.
5) The system can perform calculations using the Exponential Comparison Method.
6) The system can display alternative ranking results from the calculation of the Exponential Comparison Method.

C. Problem Solving Using the Exponential Comparison Method

The main goal in decision-making is to choose the best solution from the existing solutions in a structured and systematic manner (Borman et al., 2018). DSS is also software that can provide the best alternative to determine a decision (Borman & Apriansyah, 2018). It requires models or methods and mathematical and statistical calculations to produce DSS that can assist decision-making. The Exponential Comparison Approach is one of several existing modelling in the decision support system used to determine the priority order of decision alternatives using multiple criteria (Borman & Fauzi, 2018). By calculating the difference in value between the criteria and the exponential, the criteria will show the difference depending on the decision maker (Hertyana, 2019). Additionally, the Exponential Comparison Method is one of several approaches to making decisions that calculate the opinion of one or more people on a particular scale (Warseno et al., 2021). This approach is usually applied to assist decision-makers in using well-defined modelling designs at the processing stage (Cristian et al., 2019).

The Exponential Comparison Method will get alternative values that can distinguish the value of each alternative in contrast. Implementing the Exponential Comparison Method will go through several stages. These stages include:

1) Collect alternatives to be selected.
2) Establish criteria or a relative comparison of the decision criteria needed in evaluating. The criteria compile using a specific conversion scale adjusted to what the decision-maker wants.
3) Determine the weight of the criteria or the level of importance of each criterion. Weights will show the level of importance of a criterion.
4) Determine the value of each alternative on each criterion in the form of scoring for each alternative.
5) Equation (1) use to calculate the tv's value. It is finding each alternative's Total Value (TV) and ranking the results of these values. The larger the TV, the higher the order of priority. It means that the highest TV is the best alternative.

$$Total\ Value\ (TV_i) = \sum_{j=1}^{m} (RK_{ij})^{TKK_j} \quad \text{..... (1)}$$

Where TV_i is the total value of the i-th alternative. While n is the number of alternatives and m is the

PILAR Nusa Mandiri: Journal of Computing and Information System
Vol. 18, No. 2 September 2022 | DOI: 10.33480/pilar.v18i2.3471

number of criteria. *RKij* is the level of the relative importance of the *j*-th criterion in each *i*-th alternative. *TKKj* is the level of importance of the *j*-th decision criteria (*TKKj* is greater than 0).

D. System Design

The next step is to design the system. System design is a stage for modelling that can represent the circumstances and facts of the problems that occur (Yunita et al., 2018). The design to model the system in this study uses a use case diagram. The diagram will describe the relationship between the actor and the system that shows the functions contained in the system (Borman, Priandika, et al., 2020).

The use case diagram design of the decision support system for selecting hydroponic vegetable seeds show in Figure 2 below.

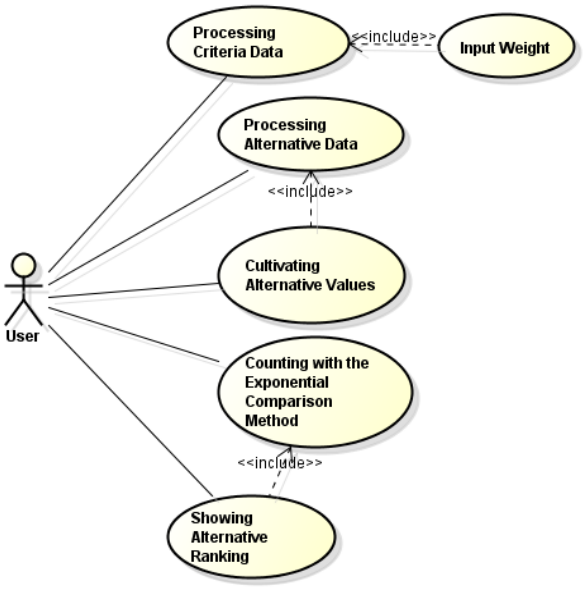


Figure 2. Use Case Diagram of DSS for Selection of Hydroponic Vegetable Seeds

Based on Figure 2, users have functionalities including processing criteria data, processing alternative data, cultivating alternative value, counting with the Exponential Comparison Method, and showing alternative ranking. In the use case of processing criteria data, users can enter, modify and delete criteria data. However, in the use case, managing criteria data requires weight input, which includes the use case input weight data. Users can enter, change and delete alternative data for use cases processing alternative data. Furthermore, for the use case of managing alternative values, the user can enter, modify and enter values for each alternative. However, the user cannot process the use case managing alternative values if alternative data has not been entered. Then, this use case includes the use case of managing alternative data. The subsequent use case is the process of calculating the Exponential Comparison Method. In this use case, the user can see the calculation process using the Exponential Comparison Method. After that, users can see the ranking results generated by the system.

E. Implementation of a Decision Support System (DSS)

This stage is coding the system by converting the design into an application or system using a programming language recognized by the computer (Ahmad et al., 2021). The decision support system is built based on the website, so for coding using the PHP programming language and Adobe Dreamweaver text editor as well as for the database using MySQL.

F. Testing System

The next stage is the testing stage. This stage aims to ensure that the system built functions correctly and is free from errors (Ahmad et al., 2020). The testing technique applied is the black-box testing method. Black-box testing is a technique that tests system features and services to determine whether they are running correctly according to their functionality (Andarwati et al., 2020). Then the output at this stage is the result of black-box testing, which contains a list of test features and results.

RESULTS AND DISCUSSION

Several steps take to implement a decision support system employing the exponential comparison method for picking hydroponic vegetable seeds. The following are the steps to solve it.

1) Collect alternatives to be selected.

This step creates a decision support system for selecting hydroponic vegetable seeds, and the first step is to collect alternatives to be selected. There are many products and brands of hydroponic vegetable seeds, and the following are some of the products used as alternatives, including Benih Pedia - Scallion, Infarm- Kangkung Seeds, Ninufarm - Japanese Spinach, Cap Panah Merah - Pakchoy F1 and Potme Farm - Kale Dwarf Curly.

2) Establish criteria or a relative comparison of the decision criteria needed in evaluating.

This step is to evaluate alternatives and criteria that are needed. The criteria serve as a consideration in making the selection of alternatives. The decision maker sets the criteria according to the needs and what has been determined. The criteria used for the selection came from an agricultural extension expert, Evrina Budiastuti, which was taken on a web page that she reviewed. The criteria used include Price, Number

of Seeds, Harvest Age, Growing Power, and Purity (Budiastuti, 2022).

The decision criteria for evaluating alternatives are arranged in a specific conversion scale to facilitate the alternative selection process. Furthermore, the criteria are arranged in the form of a conversion scale, as shown in Table 1 below. The conversion value used uses a scale of 1 to 5, where the value is 1 = Very Not Good, 2 = Not Good, 3 = Enough, 4 = Good and 5 = Very Good.

Table 1. Criteria for Selection of Hydroponic Vegetable Seeds

Criteria	Range	Value
Price	< 5,000	5
	>= 5,000 and < 10,000	4
	>= 10,000 and < 15,000	3
	>= 15,000 and < 20,000	2
	>= 20,000	1
Number of Seeds	< 100 seeds	1
	>= 100 and < 200 seeds	2
	>= 200 and < 300 seeds	3
	>= 300 and < 400 seeds	4
	>= 400 seeds	5
Harvest Age	< 25 days	1
	>= 25 days and < 50 days	2
	>= 50 days dan < 75 days	3
	>= 75 days dan < 100 days	4
	>= 100	5
Growing Power	< 20%	1
	>= 20% and < 40%	2
	>= 40% and < 60%	3
	>= 60% and < 85%	4
	>= 85%	5
Purity	< 30%	1
	>= 30% and < 60%	2
	>= 60% and < 80%	3
	>= 80% and < 95%	4
	>= 95%	5

3) Determine the weight of the criteria or the level of importance of each criterion.

The significance of the criteria is sometimes called the weight of the criteria. The decision maker will determine the weight of each criterion to determine the level of importance of each criterion. Each criterion is rated on a scale of importance between 1 to 5, where the score is 1 = Very Not Important, 2 = Not Important, 3 = Fairly Important, 4 = Important, and 5 = Very Important. Table 2 of the level of importance that the decision-maker has determined.

Table 2. Criteria Weight

Criteria	Level of Interest	Weight Value
Price	Important	4
Number of Seeds	Not Important	2
Harvest Age	Important	4
Growing Power	Fairly Important	3
Purity	Not Important	2

4) Determine the value of each alternative on each criterion in the form of scoring for each alternative.

Furthermore, each alternative will be given a value for each criterion based on data from the alternative. Table 3 below is the value of each alternative for each criterion.

Table 3. Alternative Values

Alternative	Criteria	Value	Conversion
Benih Pedia - Scallion	Price	8,000	4
	Number of Seeds	100	2
	Harvest Age	60 days	2
	Growing Power	80%	4
	Purity	95%	5
Infarm-Kangkung Seeds	Price	11,000	3
	Number of Seeds	350	4
	Harvest Age	30 days	4
	Growing Power	80%	4
	Purity	90%	4
Ninufarm - Japanese Spinach	Price	6,000	4
	Number of Seeds	40	1
	Harvest Age	35 days	4
	Growing Power	80%	4
	Purity	90%	4
Cap Panah Merah - Pakchoy F1	Price	13,000	3
	Number of Seeds	1000	5
	Harvest Age	50 days	3
	Growing Power	85%	5
	Purity	90%	4
Potme Farm - Kale Dwarf Curly	Price	17,000	2
	Number of Seeds	100	2
	Harvest Age	60 days	3
	Growing Power	85%	5
	Purity	95%	5

5) We are finding each alternative's Total Value (TV) and ranking the results of these values.

PILAR Nusa Mandiri: Journal of Computing and Information System
Vol. 18, No. 2 September 2022 | DOI: 10.33480/pilar.v18i2.3471

The next step is calculating the Total Value (TV) using equation (1). The following is calculating the Total Value (TV) for each alternative.

$$TV_1 = 4^4 + 2^2 + 2^4 + 4^3 + 5^2 = 365$$
$$TV_2 = 3^4 + 4^2 + 4^4 + 4^3 + 4^2 = 433$$
$$TV_3 = 4^4 + 1^2 + 4^4 + 4^3 + 4^2 = 593$$
$$TV_4 = 3^4 + 5^2 + 3^4 + 5^3 + 4^2 = 328$$
$$TV_5 = 2^4 + 2^2 + 3^4 + 5^3 + 5^2 = 251$$

Based on these results, the highest Total Value (TV) was obtained, namely TN4 or the alternative Ninufarm - Japanese Spinach. The highest Total Value (TV) is the best alternative. Furthermore, based on the results of TV, a ranking table is arranged as in Table 4 below.

Table 4. Alternative Ranking Results

Alternative	Total Value (TV)	Rank
Ninufarm - Japanese Spinach	593	1
Infarm- Kangkung Seeds	433	2
Benih Pedia - Scallion	365	3
Cap Panah Merah - Pakchoy F1	328	4
Potme Farm - Kale Dwarf Curly	251	5

Then, the Exponential Comparison Method is implemented into a decision support system using the PHP programming language with Adobe Dreamweaver text editor and database using MySQL. The dashboard interface or the main menu of the DSS for selecting hydroponic vegetable seeds is shown in Figure 3 below.

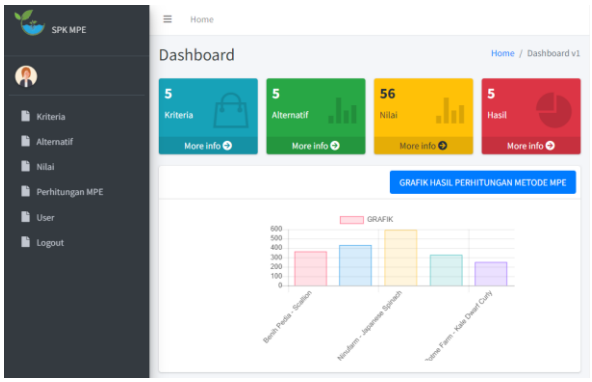


Figure 3. DSS Dashboard Interface for Hydroponic Vegetable Seed Selection

In the dashboard interface in Figure 3, some features exist in the DSS for selecting hydroponic vegetable seeds. These features include Alternative Data, Criteria Data, Vendor Assessment, and Calculation of the Exponential Comparison Method. The Dashboard feature is the main menu of the system, which displays information about the number of alternatives, a list of criteria, alternative values, decision results and a graph of the results of calculations using the Exponential Comparison Method. The user can add, change, and delete criteria data in this feature. Then the user can manage the criteria data on the Criteria Data menu, as shown in Figure 4.

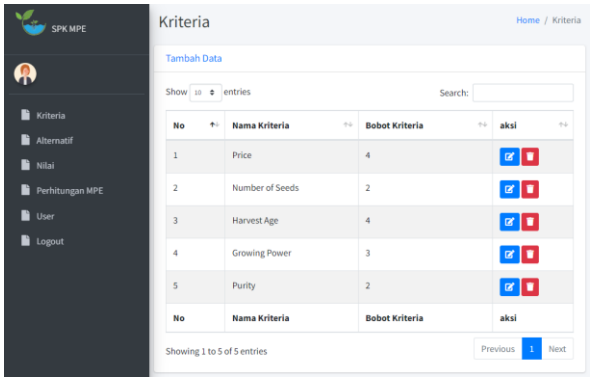
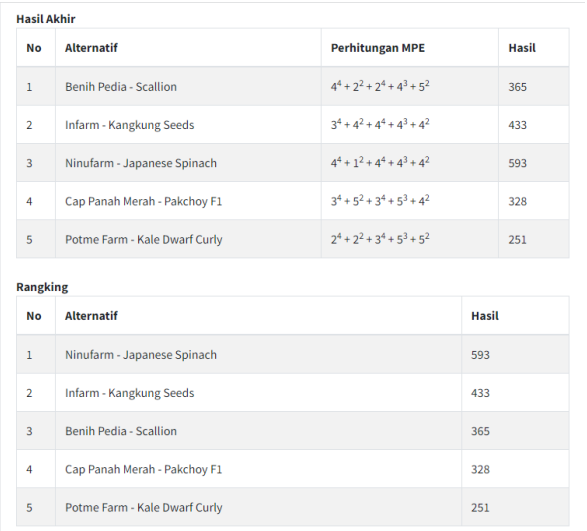


Figure 4. Criteria Data Feature Interface

Furthermore, users can manage alternative data on the Alternative Data menu. Through this feature, users can add, edit and delete alternatives. After the alternative is filled in, the user can assign a value to the alternative through the Value feature. The user will provide a value for each alternative based on the criteria specified in this feature. After the user assigns a value to each alternative, the user can see the calculation process generated by the Exponential Comparison Method on the system through the Calculation Process menu. This menu will display the calculation process and alternative rankings. They show the characteristics of the Exponential Comparison Method's calculation process, shown in Figure 5.



Hasil Akhir

No	Alternatif	Perhitungan MPE	Hasil
1	Benih Pedia - Scallion	$4^4 + 2^2 + 2^4 + 4^3 + 5^2$	365
2	Infarm - Kangkung Seeds	$3^4 + 4^2 + 4^4 + 4^3 + 4^2$	433
3	Ninufarm - Japanese Spinach	$4^4 + 1^2 + 4^4 + 4^3 + 4^2$	593
4	Cap Panah Merah - Pakchoy F1	$3^4 + 5^2 + 3^4 + 5^3 + 4^2$	328
5	Potme Farm - Kale Dwarf Curly	$2^4 + 2^2 + 3^4 + 5^3 + 5^2$	251

Rangking

No	Alternatif	Hasil
1	Ninufarm - Japanese Spinach	593
2	Infarm - Kangkung Seeds	433
3	Benih Pedia - Scallion	365
4	Cap Panah Merah - Pakchoy F1	328
5	Potme Farm - Kale Dwarf Curly	251

Figure 5. Exponential Comparison Method Calculation Process Interface

The calculations on the system show the same results as calculations using manual calculations.

Thus, the calculation of the Exponential Comparison Method generated by the system is declared valid. Next will be testing the system. This stage is to ensure that the system is error-free. Tests carried out are through black-box testing based on system functions. The test results show in Table 5.

Table 5. Test Results Using Black-Box Testing

No	Test Case	Functionality	Result
1	Dashboard	Displays the main menu, dashboard, and DSS hydroponic vegetable seed selection features.	Valid
2	Criteria Data	The system can manage criteria such as adding, changing and deleting data.	Valid
3	Alternative Data	The system can manage alternatives such as adding, modifying, and deleting alternative data.	Valid
4	Alternative Value	The system can manage alternative values such as adding, changing, and deleting alternative value data.	Valid
5	Calculation Process	The system displays the calculation process of the Exponential Comparison Method approach	Valid
6	Ranking Results	The system displays the ranking results for each alternative	Valid

The test results in Table 5 show that all the test features have been running well, with all test cases with the status of Valid. The decision support system for selecting hydroponic vegetable seeds has been running well.

CONCLUSION

This study implements the Exponential Comparison Method on DSS selection of vegetable seeds for hydroponics. The Exponential Comparison method can perform a priority order of decision alternatives based on existing criteria and distinguish each alternative's value in contrast. In addition, the system can generate calculations with a valid Exponential Comparison Method because the results are by manual calculations. The system developed is based on a website with facilities such as data management criteria, weights, alternatives, alternative assessments, the Exponential Comparison Method calculation process, and each alternative's ranking results. Based on the black-box testing technique, it shows that the system built has been running well.

REFERENCE

Ahmad, I., Borman, R. I., Fakhrurozi, J., & Caksana, G. G. (2020). Software Development Dengan Extreme Programming (XP) Pada Aplikasi Deteksi Kemiripan Judul Skripsi Berbasis Android. *Jurnal Invotek Polbeng - Seri Informatika*, *5*(2), 297–307.

Ahmad, I., Rahmanto, Y., Pratama, D., & Borman, R. I. (2021). Development of augmented reality application for introducing tangible cultural heritages at the lampung museum using the multimedia development life cycle. *ILKOM Jurnal Ilmiah*, *13*(2), 187–194.

Ahmad, I., Suwarni, E., Borman, R. I., Asmawati, A., Rossi, F., & Jusman, Y. (2022). Implementation of RESTful API Web Services Architecture in Takeaway Application Development. *International Conference on Electronic and Electrical Engineering and Intelligent System (ICE3IS)*, 132–137.

Andarwati, M., Amrullah, F., Thamrin, E., & Muslikh, A. R. (2020). An Analysis of Point of Sales (POS) Information Systems in SMEswith The Black Box Testing and PIECES Method An Analysis of Point of Sales (POS) Information Systems in SMEswith The Black Box Testing and PIECES Method. *IOSR Journal of Business and Management (IOSR-JBM*, *22*(9), 20–25. https://doi.org/10.9790/487X-2209052025

Borman, R. I., & Apriansyah. (2018). Penerapan Media Pembelajaran Interaktif Berbasis Multimedia Pada Mata Kuliah Sistem Pendukung Keputusan. *Semnas RISTEK*, 1–6. https://doi.org/10.31227/osf.io/mwvf3

Borman, R. I., & Fauzi, H. (2018). Penerapan Metode Perbandingan Eksponensial (MPE) Dalam Sistem Pendukung Keputusan Penerimaan Beasiswa Siswa Berprestasi Pada SMK XYZ. *CESS: Journal of Computer Engineering, System and Science*, *3*(1), 17–22.

Borman, R. I., Mayangsari, M., & Muslihudin, M. (2018). Sistem Pendukung Keputusan Menentukan Lokasi Perumahan Di Pringsewu Selatan Menggunakan Fuzzy Multiple Attribute Decision Making. *JTKSI (Jurnal Teknologi Komputer Dan Sistem Informasi)*,

01(01), 5–9. https://doi.org/10.56327/jtksi.v1i1.874

Borman, R. I., Megawaty, D. A., & Attohiroh, A. (2020). Implementasi Metode TOPSIS Pada Sistem Pendukung Keputusan Pemilihan Biji Kopi Robusta Yang Bernilai Mutu Ekspor (Studi Kasus: PT. Indo Cafco Fajar Bulan Lampung). *Fountain of Informatics Journal*, *5*(1), 14–20. https://doi.org/10.21111/fij.v5i1.3828

Borman, R. I., Priandika, A. T., & Edison, A. R. (2020). Implementasi Metode Pengembangan Sistem Extreme Programming (XP) pada Aplikasi Investasi Peternakan. *JUSTIN (Jurnal Sistem Dan Teknologi Informasi)*, *8*(3), 272–277. https://doi.org/10.26418/justin.v8i3.40273

Budiastuti, E. (2022). *10 Benih Sayur Terbaik - Ditinjau oleh Penyuluh Pertanian*. Mybest. https://my-best.id/139061

Cristian, C., Dewayani, E., & Rusdi, Z. (2019). Sistem Pendukung Keputusan Memilih Perusahaan Investasi Menggunakan Metode Perbandingan Eksponensial. *Jurnal Ilmu Komputer Dan Sistem Informasi*, *7*(2), 211–215.

Giat, Y., & Bouhnik, D. (2021). A Decision Support System and Warehouse Operations Design for Pricing Products and Minimizing Product Returns in a Food Plant. *Interdisciplinary Journal of Information, Knowledge, and Management*, *16*, 39–54.

Hertyana, H. (2019). Sistem Pendukung Keputusan Seleksi Pemilihan Perguruan Tinggi Menggunakan Metode Topsis. *Jurnal Pilar Nusa Mandiri*, *15*(1), 97–102. https://doi.org/10.33480/pilar.v15i1.223

Katemba, P., & Neolak, N. N. (2021). Penerapan Metode Perbandingan Exponensial (MPE) Penentuan Penerimaan Beras Sejahtra (RASTRA) di Desa Tobu. *Jurnal Ilmiah Elektronika Dan Komputer*, *14*(2), 339–349.

Napian, S. D. R., & Meriza, A. (2020). Implementation of Exponential Comparison Method in Performance Evaluation of Temporary Employees in District Court of Prabumulih. *Advances in Intelligent Systems Research*, *172*, 527–531.

Napianto, R., Rahmanto, Y., Borman, R. I., Lestari, O., & Nugroho, N. (2021). Dhempster-Shafer Implementation in Overcoming Uncertainty in the Inference Engine for Diagnosing Oral Cavity Cancer. *CSRID (Computer Science Research and Its Development Journal)*, *13*(1), 45. https://doi.org/10.22303/csrid.13.1.2021.46-54

Nurhayati, S. (2017). Web-based application on employee performance assessment using exponential comparison method. *IORA*, 0–6. https://doi.org/10.1088/1742-6596/755/1/011001

Rachman, W. H., Widians, J. A., & Masnawati, M. (2017). Sistem Pendukung Keputusan Pemilihan Bibit Cabai Rawit Menggunakankan Metode Simple Additive Weighting (SAW) Berbasis Web. *Prosiding Seminar Ilmu Komputer Dan Teknologi Informasi*, *2*(1), 175–181.

Singgih, M., Prabawati, K., & Abdulloh, D. (2019). Bercocok Tamam Mudah Dengan Sistem Hidroponik NFT. *Jurnal Abdikarya : Jurnal Karya Pengabdian Dosen Dan Mahasiswa*, *03*(1), 21–24.

Sudarwati, W., Hardjomidjojo, H., Machfud, M., & Setyaningsih, D. (2021). Exponential Comparison Method and TFN For Selection of Regional Superior Products Based on Processed Seaweed. *International Journal of Advanced Research (IJAR)*, *10*(06), 929–944. https://doi.org/10.21474/IJAR01/14972

Suranti, D. (2018). Application of Exponential Comparison Method and Simple Additive Weighting Method in Assessment of Agricultural Extension Performance. *Scientific Journal of Informatics*, *5*(2), 128–137.

Susilowati, A. G., & Purwanto, P. (2021). Sistem Pendukung Keputusan Pemilihan Bibit Padi Unggul Menggunakan Metode Weighted Product. *Prosiding Webinar Nasional Penelitian Dan Pengabdian Masyarakat*, 555–564.

Warseno, A., Retno, Y., Utami, W., & Kkw, A. (2021). Sistem Pendukung Keputusan Penentuan Pemberian Pinjaman Dengan Metode Perbandingan Eksponensial Pada Koperasi XYZ. *Jurnal Ilmiah Sinus (JIS)*, *19*(1), 49–62.

Yahyan, W., & Siregar, M. I. A. (2019). Sistem Pendukung Keputusan Pemilihan Bibit Benih Padi Unggul Berbasis Web Menggunakan Metode AHP (Analytical Hierarchy Process). *Menara Ilmu*, *XIII*(11), 110–123.

Yunita, Y., Qomariah, S., & Masdar, M. (2018). Penerapan Metode Perbandingan Eksponensial Pada Sistem Pendukung Keputusan Pemberian Kredit Pada Bank XYZ. *Jurnal Borneo Saintek*, *1*(2), 44–57.