International Journal of Engineering & Technology, 7 (4) (2018) 3556-3562

International Journal of Engineering & Technology

Website: www.sciencepubco.com/index.php/IJET
doi: 10.14419/ijet.v7i4.18836
Research paper

Decision support system for determining chili plant using fuzzy multiple attribute decision making

Noca Yolanda Sari [1], Miftachul Huda [2], Kamarul Shukri Mat Teh [3], Anggia Sari [1], Ramona Ramli [4], Andino Maseleno [1, 5] *

[1] Department of Information Systems, STMIK Pringsewu, Lampung, Indonesia
[2] Universiti Teknologi Malaysia, Malaysia
[3] Universiti Sultan Zainal Abidin, Malaysia
[4] Department of Software Engineering, Universiti Tenaga Nasional, Malaysia
[5]Institute of Informatics and Computing Energy, Universiti Tenaga Nasional, Malaysia
**Corresponding author E-mail: andimaseleno@gmail.com*

Abstract

Chili is a high value vegetable commodity. Because there are still many people who do not understand the type of superior chili plant. Because all this time the community determines the superior chili plants only by guessing, because of that, it was developed a Decision Support System which was used to determine the superior chili plant. Sample (alternative) of this research were 3 types of chili plant, namely cayenne curly chili, large chili. While the criteria used were plant age, plant height, leaf conditions, number of leaves and the results obtained from this study large chili plants are the highest ranked. The method used in determining the superior chili was Simple Additive Weighting (SAW), and the construction of Decision Support System (DSS) to determine superior chili plant using the Delphi 7 application program.

Keywords: *Decision Support System; Chili Plant; SAW.*

1. Introduction

1.1. Background

Chili plant is woody shrub, and the fruit is sorely spicy caused by capsaicin. Currently chili is one of the vegetable commodities that needed by people, both national and international. Every day the demand for chili is increasing along with the increasing number of people in various countries. This cultivation is a business opportunity that is still very promising, not only the local market but also the opportunity to meet the export market.

Chilli farmers in the Poncowarno village, Central Lampung, they still don't know the qualified chili and has potential to grow fast. For the people in the village, determining chili plant is usually only done by guessing. Therefore, researcher is interested in conducting research in determining the ideal chili plant, easier to cultivate and more quickly developed. In determining the chili plant must also be with the criteria and type of chili that growing fast, not arbitrary.

1.2. Problem formulation

According to background above it can be formulated problems to be discussed namely:

1. How to design decision support system in determining superior chili plant?
2. How to determine quality level of chili plant?

1.3. Problem limitation

According to background and problem formulation above, it is limited by the following:

1. To observe type and criteria of chili plant based on decision support system.
2. This decision support system is only discussed about superior chili plant that will be developed.

1.4. Research purpose

As for the objectives of this research were :

1. To design and to create decision support system in determining weighting and ranking of superior chili plant using Simple Additive Weighting (SAW).
2. To apply simple additive weighting (SAW) method as one of problem solving method in creating Delphi 7-based decision support system application.

In Decision Support System the researcher will raise a case that is looking for the best alternative in this case determining the chili plant based on the criteria that have been determined by using the Simple Additive Weighting (SAW) method. Research was carried out by looking for weight score for each attribute, then ranking process that will determine the optimal alternative, namely the ideal and qualified chili plant.

2. Literature review

2.1. System definition

The system refers to the point of view in enhancing the particular group of elements that are integrated with the intent of the same person to achieve a goal.
Definition of system revealed that the system can be defined as a unified entity of two or more components or subsystems that are integrated to achieve a goal.
From the above definition, it can be concluded that the system is a set of elements that are integrated or related to achieve a certain goal.

2.2. Decision definition

Decision is a termination of the thought process of a problem by selecting an alternative. A decision is a choice among alternatives. This definition contains 3 terms:
1) There is choice or logical choice or consideration
2) There are some alternatives must be selected as the best one.
3) There is a goal to be achieved and the decision is closer to the goal.

2.3. Decision support system

Decision Support System (DSS) is a system intended to support managerial decision-makers for semi structured issue. Scott Morton defines DSS as an interactive computer-based system, which helps decision-makers to use data and models to solve unstructured problems [64-65]. The DSS could be viewed as the tool for decision-makers to expand their capabilities, but not to replace their judgments [60]. DSS is intended for decisions that require judgment or on decisions that the algorithm cannot at all support.
As a general term, DSS is used to illustrate all computerized systems that support decision making in an organization.
The main purpose of DSS is to support and to improve decision making [61].
In accordance with the concept of DSS above, the particular distinction about DSS with Management Information System lays on the orientation of organization to have a knowledge management system to guide all its personnel in solving problems, it can have its own DSS for marketing, finance, and accounting, SCM systems for production, and some expert systems to make diagnosis and help desk improvement [62-63].
The purposes of decision support system are:
1) To help manager in making decision about semi structured problem.
2) To give support about manager consideration and not aimed to change manager function.
3) To improve the decision effectiveness taken by manager more that its efficiency improvement.
4) The speed of computer computing allows decision makers to do a lot of computing quickly at a low cost. Increased productivity builds a group of decision makers, especially experts that can be very expensive. Computerized supporters can reduce groups and allow their members to be in different locations (saving on travel costs). In addition productivity of support staff (e.g. financial and legal analysis) can be improved. Productivity is improved using optimization tools that determine the best way to run a business
5) Computer quality support can improve the quality of decision made as an example, the more accessible data the more alternatives that can be evaluated.
6) Risk analysis can be done quickly and views from experts (some of them in remote locations) can be collected quickly at a lower cost. Competitive management and enterprise resource empowerment competitive pressures make decision-making tasks difficult in the sense that competition is based not only on price but also on quality, speed, product customization, and customer support [50-53]. Organizations must be able to frequently and quickly change modes of operation, reengineer processes and structures, and empower employees with innovative decision-making technology. It can create significant empowerment by allowing people to make good decisions quickly, even if they have insufficient knowledge.
7) Overcome the cognitive limitations in processing and storage. The human brain has limited ability to process and store information

The application of decision support system may consist of several subsystems namely:
1) Data management subsystem

Data management subsystem includes a database that contains relevant data for a situation and is managed by software called a database management system (DBMS / Data Base Management System).
The data management subsystem can be interconnected with the company's data warehouse, a repository for enterprise data relevant to decision making.
2) Model Management Subsystem

Is a software that includes financial models, management science statistics or other quantitative models that provide analytical capabilities and appropriate software management. Modeling languages to build custom models are also included the software is often called the base model management system (MBMS).
3) Subsystem user interface

User interface subsystem communicates with and instructs as decision support system through the subsystem, the user is the part that is considered from the system.
4) Knowledge-based Management Subsystem

The subsystem supports all other subsystems or acts directly as an independent and optional component.
Based on the definition of decision support system, it should include three major components of the DBMS, MBMS and user interface knowledge-based management subsystem are optional, but can provide many benefits because it provides intelligence for the three major components.

3. Methods

3.1. FMADM method

Fuzzy Multiple Attribute Decision Making (FMADM) is a method used to find the optimal alternative from a number of alternatives with certain criteria. The core of FMADM is to determine the weight score for each attribute, then proceed with the ranking process that will select the alternatives already given. There are 3 approaches to find attribute weight score. Those are subjective approach, objective approach and integration approach between subjective and objective. Each approach has its advantages and disadvantages [45-47]. In the subjective approach, the weight score is determined on the basis of the subjectivity of the decision-makers, so that some factors in the alternative ranking process bias are determined freely. In an objective approach, the weighted score is mathematically calculated from the decision maker.

3.1.1. FMADM algorithm

FMADM Algorithm is:
1) Provide score of each alternative (Ai) on each criterion (Cj) that has been determined, where the score is obtained based on crisp score; i = 1,2, ... m and j = 1,2, ... n.
2) Provide weight score (W) which is also obtained based on crisp score.
3) Normalize the matrix by calculating the normalized performance rating (rij) score of the alternative Ai on the attribute Cj based on the equation adjusted to the attribute type (attribute benefit / benefit = MAXIMUM or cost / cost = MINIMUM attribute). If it is a profit meaning then the crisp (Xij) score of each attribute column is divided by the crisp MAX

(MAX Xij) score of each column, while for the cost attribute, the crisp MIN (MIN Xij) score of each attribute column is divided with the crisp (Xij) score of each column.

4) Perform the ranking process by multiplying the normalized matrix (R) with the weight score (W).
5) Determine the preference score for each alternative (Vi) by summing the product of the normalized (R) matrix with the weight score (W). Greater Vi score indicates that Ai's alternative is more selected, in the journal [56-58].

3.1.2. Finishing process

This research used FMADM with SAW method. Therefore the stages are

1) Determining the criteria that will be used as a reference in decision making, namely Ci
2) Determining each compatibility alternative rating on each criterion.
3) Creating a decision matrix based on criterion (Ci), then normalizing matrix based on the equation adjusted to the attribute type (attribute gain or cost attribute) to obtain a normalized R matrix.
4) The final result is obtained from the ranking process that was the sum of normalized R matrix multiplication R the weight vector to obtain the largest score selected as the best alternative (Ai) as the solution.

3.2. SAW method (simple additive weighting)

Is one of MADM problem solving method (Multiple Attribute Decision Making). The SAW (Simple Additive Weighting) method is often also known as the weighted summing method. The basic concept of SAW method is to find the weighted sum of performance ratings on each alternative of all attributes [40][41][42]. The SAW method requires the process of normalizing of the matrix (x) decision to a comparable scale with all existing alternative ratings [43-45]. Given the following equation:

$$r_{ij} = \begin{cases} \dfrac{X_{ij}}{Max\, x_{ij}} \\ \\ \dfrac{Min\, x_{ij}}{x_{ij}} \end{cases}$$

Where r.ij is normalized performance rating of Ai, at Cj attribute , ; i=1,2,…,m dan J = 1,2,..,n. Preference score for each alternative (Vi) given as follows :

$$V_i = \sum_{J=1}^{n} w_j r_{ij}$$

A larger value of VI indicates that Ai's alternatives are preferred. the stages of SAW method are:

1) Determining the criteria to be used as a reference in the making decision, ie C,
2) Determining compatibility rating for each alternative at each criterion
3) Creating a decision matrix based on C criterion, then performing a normalized matrix based on an equation adjusted to the type of attribute (profit attribute or cost attribute)
4) The final result is obtained from the ranking process that is the sum of the matrix multiplication of R normalized with the weight vector to obtain the great value that selected as the best alternative (A) as the solution.

3.3. The advantage of simple additive weighting (saw) method

The advantage of the Simple Additive Weighting (SAW) model compared to other decision-making models lies on its ability to perform scoring more precisely because it is based on predetermined criteria and preference values, besides that SAW can also select the existing alternative because of the ranking process after determining the weight value for each attribute.

4. Discussion and Implementation

4.1. Needed criteria

a) Determining Criteria

In this calculation, criteria were needed to determine superior chili plant. The weight of each of these criteria will be determined. The weight consisted of five lingustic values, namely Very Bad, Bad, Fair, Good, Very Good as shown in Table 1.

Table 1: Scoring Criteria

No.	Linguistic value	Score
1	Very bad	C1
2	Bad	C2
3	Fair	C3
4	Good	C4
5	Very good	C5

Based on the criteria and suitability rating of each alternative in each criterion that had been determined, then the elaboration of the weight of each criterion that had been converted to fuzzy numbers. The criteria needed in making decision regarding the determination of superior chili plants can be seen in Table 2

Table 2: Criteria

Criteria	Description
C1	Plant age
C2	Plant height
C3	Leaf condition
C4	The number of leaves

The following is a description of each criterion that has been converted to fuzzy numbers with their weight scores. Table 3 shows plant age criteria.

Table 3: Plant age criteria

Plant age	Linguistic value	Score
0 - 7	Very bad	1
8 - 30	Bad	2
31 - 45	Good	4
46 - 60	Very good	5

Table 4 shows plant height criteria.

Table 4: Plant height criteria

Plant height	Linguistic value	Score
1 - 2	Very Bad	1
3 - 4	Bad	2
5 - 6	Good	4
7 - 9	Very Good	5

Table 5 shows leaf condition criteria.

Table 5: Leaf condition criteria

Leaf condition	Linguistic value	Score
Founded pest	Very Bad	1
Not fresh	Bad	2
Fresh green and not uniform	Good	4
Fresh green and uniform	Very Good	5

Table 6 shows the number of leaves.

Table 6: The number of leaves

The number of leaves	Linguistic value	Score
0 - 2	Very Bad	1
3 - 5	Fair	3
6 - 7	Good	4
8 - 10	Very Good	5

In this calculation it will be used 3 samples, the number of chili namely cayen, curly and large. Based on the sample data above, then the data were formed to rating the suitability of each alternative with the criteria. So that the criteria for each alternative can be seen in Table 7.

Table 7: Criteria for each alternative

Name of plant	C1	C2	C3	C4
Cayen	4	5	4	4
Curly	4	2	5	3
Large	4	5	2	5

Decision making obtained weight for each criterion as follows :
C1 = 30%; C2 = 25%; C3 = 20 %; C4 = 25%.

4.2. Calculation of weighting matrix

Decision making obtains following weight :
Vector weight : W= [0.30; 0.25; 0.20; 0.25] Create X matrix, made from compatibility table as follows :

$$X = \begin{bmatrix} 4 & 5 & 4 & 4 \\ 4 & 2 & 5 & 3 \\ 4 & 5 & 2 & 5 \end{bmatrix}$$

Firstly the matrix normalization is done how to calculate the performance rating value normalized from alternatives to attributes based on adjusted equations with the following types of attributes:

R11 = 4/max(4,4,4) = 4/4 = 1
R21 = 4/max(4,4,4) = 4/4 = 1
R31 = 4/max(4,4,4) = 4/4 = 1
R12 = 5/max(5,2,5) = 5/5 = 1
R22 = 2/max(5,2,5) = 2/5 = 0.4
R32 = 5/max(5,2,5) = 5/5 = 1
R13 = 4/max(4,5,2) = 4/5 = 0.8
R23 = 5/max(4,5,2) = 5/5 = 1
R33 = 2/max(4,5,2) = 2/5 = 0.4
R14 = 4/max(4,3,5) = 4/5 = 0.8
R24 = 3/max(4,3,5) = 3/5 = 0.6
R34 = 5/max(4,3,5) = 5/5 = 1

The second makes normalization of the R obtained from the result of normalization of the X matrix. So that the normalized matrix R is obtained as follows:

$$R = \begin{bmatrix} 1 & 1 & 0{,}4 & 0{,}8 \\ 1 & 0{,}4 & 1 & 0{,}6 \\ 1 & 1 & 0{,}8 & 1 \end{bmatrix}$$

Then the matrix W * R multiplication will be made and the sum of multiplication results for get the best alternative by doing it ranking the largest value with the equation as follows:
V1 = (0.30)(1)+(0.25)(1)+(0.20)(0.4)+(0.25)(0.8)
= 0.3+0.25+0.8+0.16 = 0.87
V2 = (0.30)(1)+(0.25)(0.4)+(0.2)(1)+(0.25)(0.6)
= 0.3+0.1+0.2+0.15= 0.75
V3 = (0.30)(1)+(0.25)(1)+(0.20)(0.8)+(0.25)(1)
= 0.3+0.25+0.16+0.25= 0.88

The biggest value is in V3. So that the plant Large Chili is the chosen alternative as the best alternative.

Table 8: Alternative ranking

No.	Alternative	Vi
1	Large chili	0.88
2	Cayene	0.87
3	Curly	0.75

4.3. Implementation

Implementation serves to display form or interfaces in the application of decision support system. With this implementation, the decision support application will be easier and the better results. Implementation results can be seen in this section and explain that this system can be opened and functioned properly. The following are the display of the program system: figure 1 shows form login, figure 2 shows chili plant data form, figure 3 shows weight form, figure 4 shows calculation form.

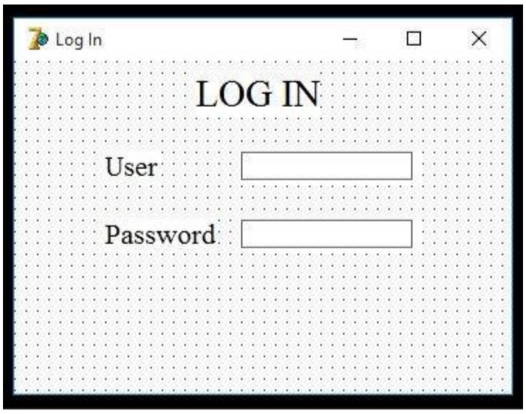

Fig. 1: Form Login

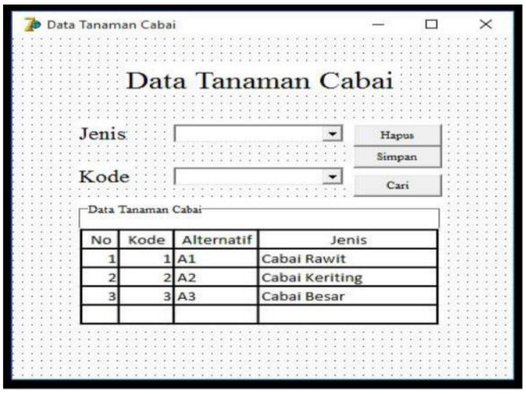

Fig. 2: Chili plant data form

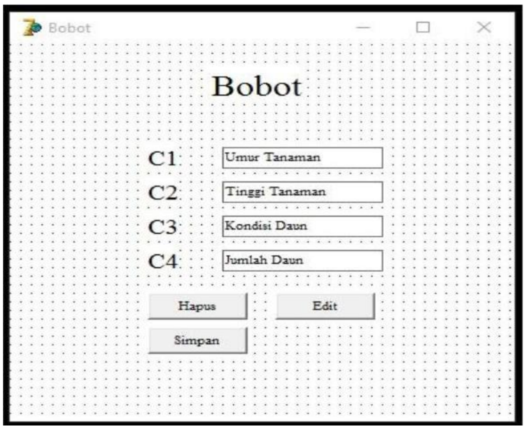

Fig. 3: Weight form

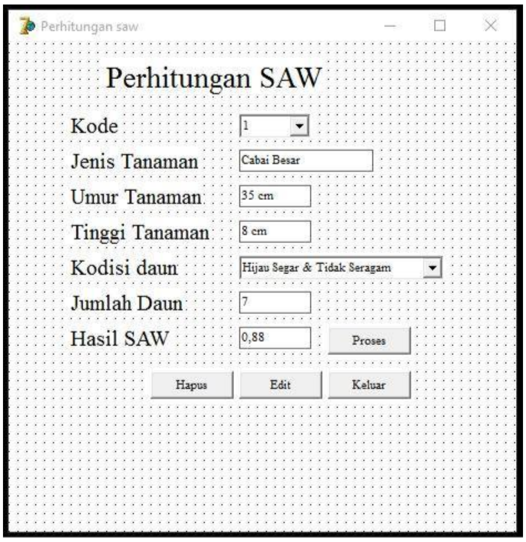

Fig. 4: Calculation form

5. Conclusion

By existence of this decision support system of superior chili plant, it is expected: 1) System can obtain decision alternative in using Simple Additive Weighting (SAW) method calculation that can be reference of farmer in determining superior chili plant. 2) System can obtain information about superior chili plant. 3) The results of decision support system design of superior chili plant determination that the largest score was third alternative (A3), namely large chili plant with a final score of 0.88.
The suggestion that author can point out from the results of this study is the system can be further improved in terms of quality in order to produce a new system that can include the determination of superior chili plant with more effective methods, so as to get the best alternative choice for farmers.

References

[1] Adela, H., Jasmi, K.A., Basiron, B., Huda, M., Maseleno, A. (2018). Selection of dancer member using simple additive weighting. International Journal of Engineering & Technology. 7(3). 1096-1107. https://doi.org/10.14419/ijet.v7i3.11983.

[2] Aminin, S., Huda, M., Ninsiana, W., and Dacholfany, M.I. (2018). Sustaining civic-based moral values: Insights from language learning and literature. International Journal of Civil Engineering and Technology. 9(4), 157-174.

[3] Amin, M.M., Nugratama, M.A.A., Maseleno, A., Huda, M., Jasmi, K.A., (2018). Design of cigarette disposal blower and automatic freshner using mq-5 sensor based on atmega 8535 microcontroller. International Journal of Engineering & Technology. 7(3). 1108-1113 https://doi.org/10.14419/ijet.v7i3.11917.

[4] Anshari, M., Almunawar, M. N., Shahrill, M., Wicaksono, D. K., & Huda, M. (2017). Smartphones usage in the classrooms: Learning aid or interference. Education and Information Technologies, 22(6), 3063-3079. https://doi.org/10.1007/s10639-017-9572-7.

[5] Atmotiyoso, P. and Huda, M. (2018). Investigating Factors Influencing Work Performance on Mathematics Teaching: A Case Study. International Journal of Instruction. 11(3), 391-402 https://doi.org/10.12973/iji.2018.11327a.

[6] Elisabet Yunaeti Anggraeni, Miftachul Huda, Andino Maseleno, Jimaain Safar, Kamarul Azmi Jasmi , Ahmad Kilani Mohamed, Aminudin Hehsan, Bushrah Basiron, Siti Suhaila Ihwani, Wan Hassan Wan Embong, Ahmad Marzuki Mohamad, Sulaiman Shakib Mohd Noor, Almira Nabila Fauzi, Dona Ari Wijaya, and M. Masrur. (2018). Poverty level grouping using SAW method. International Journal of Engineering and Technology. 7(2.27), 218-224

[7] Long, J. K., Murphy, S. P., Weiss, R. E., Nyerere, S., Bwibo, N. O., & Neumann, C. G. (2012). Meat and milk intakes and toddler growth: a comparison feeding intervention of animal-source foods in rural Kenya. *Public health nutrition*, *15*(6), 1100-1107. https://doi.org/10.1017/S1368980011002746.

[8] Wright, C. M., Parkinson, K. N., Shipton, D., & Drewett, R. F. (2007). How do toddler-eating problems relate to their eating behavior, food preferences, and growth? *Pediatrics*, *120*(4), e1069-e1075. https://doi.org/10.1542/peds.2006-2961.

[9] Huda, M., Anshari, M., Almunawar, M. N., Shahrill, M., Tan, A., Jaidin, J. H., & Masri, M. (2016a). Innovative Teaching in Higher Education: The Big Data Approach. The Turkish Online Journal of Educational Technology, 15(Special issue), 1210-1216.

[10] Huda, M., Yusuf, J. B., Jasmi, K. A., & Nasir, G. A. (2016b). Understanding Comprehensive Learning Requirements in the Light of al-Zarnūjī's Ta'līm al-Muta'allim. Sage Open, 6(4), 1-14. https://doi.org/10.1177/2158244016670197.

[11] Huda, M., Yusuf, J. B., Jasmi, K. A., & Zakaria, G. N. (2016c). Al-Zarnūjī's Concept of Knowledge ('ilm). SAGE Open, 6(3), 1-13. https://doi.org/10.1177/2158244016666885.

[12] Huda, M., Jasmi, K. A., Mohamed, A. K., Wan Embong, W. H., & and Safar, J. (2016d). Philosophical Investigation of Al-Zarnuji's Ta'lim al-Muta'allim: Strengthening Ethical Engagement into Teaching and Learning. Social Science, 11(22), 5516-551.

[13] Huda, M., Sabani, N., Shahrill, M., Jasmi, K. A., Basiron, B., & Mustari, M. I. (2017a). Empowering Learning Culture as Student Identity Construction in Higher Education. In A. Shahriar, & G. Syed (Eds.), Student Culture and Identity in Higher Education (pp. 160-179). Hershey, PA: IGI Global. https://doi.org/10.4018/978-1-5225-2551-6.ch010.

[14] Huda, M., Jasmi, K. A., Hehsan, A., Shahrill, M., Mustari, M. I., Basiron, B., & Gassama, S. K. (2017b). Empowering Children with Adaptive Technology Skills: Careful Engagement in the Digital Information Age. International Electronic Journal of Elementary Education, 9(3), 693-708.

[15] Huda, M., Shahrill, M., Maseleno, A., Jasmi, K. A., Mustari, I., & and Basiron, B. (2017c). Exploring Adaptive Teaching Competencies in Big Data Era. International Journal of Emerging Technologies in Learning, 12(3), 68-83. https://doi.org/10.3991/ijet.v12i03.6434.

[16] Huda, M., Jasmi, K. A., Basiran, B., Mustari, M. I. B., & Sabani, A. N. (2017d). Traditional Wisdom on Sustainable Learning: An Insightful View from Al-Zarnuji's Ta 'lim al-Muta 'allim. SAGE Open, 7(1), 1-8. https://doi.org/10.1177/2158244017697160.

[17] Huda, M., Jasmi, K. A., Embong, W. H., Safar, J., Mohamad, A. M., Mohamed, A. K., Muhamad, N. H., Alas, Y., & Rahman, S. K. (2017e). Nurturing Compassion-Based Empathy: Innovative Approach in Higher Education. In M. Badea, & M. Suditu (Eds.), Violence Prevention and Safety Promotion in Higher Education Settings (pp. 154-173). Hershey, PA: IGI Global. https://doi.org/10.4018/978-1-5225-2960-6.ch009.

[18] Huda, M., Jasmi, K. A., Alas, Y., Qodriah, S. L., Dacholfany, M. I., & Jamsari, E. A. (2017f). Empowering Civic Responsibility: Insights from Service Learning. In S. Burton (Ed.), Engaged Scholarship and Civic Responsibility in Higher Education (pp. 144-165). Hershey, PA: IGI Global. https://doi.org/10.4018/978-1-5225-3649-9.ch007.

[19] Huda, M., Jasmi, K. A., Mustari, M. I., Basiron, B., Mohamed, A. K., Embong, W., & Safar, J. (2017g). Innovative E-Therapy Service in Higher Education: Mobile Application Design. International Journal of Interactive Mobile Technologies, 11(4), 83-94. https://doi.org/10.3991/ijim.v11i4.6734.

[20] Huda, M., Jasmi, K. A., Mustari, M. I., & Basiron, B. (2017h). Understanding Divine Pedagogy in Teacher Education: Insights from Al-zarnuji's Ta'lim Al-Muta'Allim. The Social Sciences, 12(4), 674-679.

[21] Huda, M., Jasmi, K. A., Mustari, M. I. B., & Basiron, A. B. (2017i). Understanding of Wara' (Godliness) as a Feature of Character and Religious Education. The Social Sciences, 12(6), 1106-1111.

[22] Huda, M., Siregar, M., Ramlan, Rahman, S.K.A., Mat Teh, K.S., Said, H., Jamsari, E.A., Yacub, J., Dacholfany, M.I., & Ninsiana, W. (2017j). From Live Interaction to Virtual Interaction: An Exposure on the Moral Engagement in the Digital Era. Journal of Theoretical and Applied Information Technology, 95(19), 4964-4972.

[23] Huda, M., Maseleno, A., Jasmi, K. A., Mustari, I., & Basiron, B. (2017k). Strengthening Interaction from Direct to Virtual Basis: Insights from Ethical and Professional Empowerment. International Journal of Applied Engineering Research, 12(17), 6901-6909.

[24] Huda, M., Haron, Z., Ripin, M. N., Hehsan, A., & Yaacob, A. B. C. (2017l). Exploring Innovative Learning Environment (ILE): Big Data Era. International Journal of Applied Engineering Research, 12(17), 6678-6685.

[25] Huda, M. (2018). Empowering Application Strategy in the Technology Adoption: Insights from Professional and Ethical Engagement. Journal of Science and Technology Policy Management. https://doi.org/10.1108/JSTPM-09-2017-0044.

[26] Huda. M. & Sabani, N. (2018). Empowering Muslim Children's Spirituality in Malay Archipelago: Integration between National Philosophical Foundations and Tawakkul (Trust in God). International Journal of Children's Spirituality, 23(1), 81-94. https://doi.org/10.1080/1364436X.2018.1431613.

[27] Huda, M., & Teh, K. S. M. (2018). Empowering Professional and Ethical Competence on Reflective Teaching Practice in Digital Era. In Dikilitas, K., Mede, E., Atay D. (Eds). Mentorship Strategies in Teacher Education (pp. 136-152). Hershey, PA: IGI Global. https://doi.org/10.4018/978-1-5225-4050-2.ch007.

[28] Huda, M., Teh, K.S.M., Nor, N.H.M., and nor, M.B.M. (2018a). Transmitting Leadership Based Civic Responsibility: Insights from Service Learning. International Journal of Ethics and Systems, 34(1), 20-31. https://doi.org/10.1108/IJOES-05-2017-0079.

[29] Huda, M., Maseleno, A., Muhamad, N.H.N., Jasmi, K.A., Ahmad, A., Mustari, M.I., Basiron, B. (2018b). Big Data Emerging Technology: Insights into Innovative Environment for Online Learning Resources. International Journal of Emerging Technologies in Learning 13(1), 23-36. https://doi.org/10.3991/ijet.v13i01.6990.

[30] Huda, M., Maseleno, A., Teh, K.S.M., Don, A.G., Basiron, B., Jasmi, K.A., Mustari, M.I., Nasir, B.M., and Ahmad, R. (2018c). Understanding Modern Learning Environment (MLE) in Big Data Era. International Journal of Emerging Technologies in Learning. 13(5), 71-85. https://doi.org/10.3991/ijet.v13i05.8042.

[31] Huda, M., Almunawar, M. N., Hananto, A. L., Rismayadi, B., Jasmi, K. A., Basiron, B., & Mustari, M. I. (2018d). Strengthening Quality Initiative for Organization Stability: Insights from Trust in Cyberspace-Based Information Quality. In Cases on Quality Initiatives for Organizational Longevity (pp. 140-169 Hershey, PA: IGI Global. https://doi.org/10.4018/978-1-5225-5288-8.ch006.

[32] Huda, M., Qodriah, S.L., Rismayadi, B., Hananto, A., Kardiyati, E.N., Ruskam, A., and Nasir, B.M. (2019a). Towards Cooperative with Competitive Alliance: Insights into Performance Value in Social Entrepreneurship in Creating Business Value and Competitive Advantage with Social Entrepreneurship. (pp.294). Hershey, PA: IGI Global. https://doi.org/10.4018/978-1-5225-5687-9.ch014.

[33] Huda, M., Hehsan, A., Basuki, S., Rismayadi, B., Jasmi, K. A., Basiron, B., & Mustari, M. I. (2019b). Empowering Technology Use to Promote Virtual Violence Prevention in Higher Education Context. In Intimacy and Developing Personal Relationships in the Virtual World (pp. 272-291). Hershey, PA: IGI Global. https://doi.org/10.4018/978-1-5225-4047-2.ch015.

[34] Huda, M., Ulfatmi, Luthfi, M.J., Jasmi, K.A., Basiron, B., Mustari, M.I., Safar, A., Embong, H.W.H., Mohamad, A.M., and Mohamed, A.K. (2019c). Adaptive online learning technology: Trends in big data era in Diverse Learning Opportunities Through Technology-Based Curriculum Design. (pp.163-195), Hershey, PA: IGI Global. https://doi.org/10.4018/978-1-5225-5519-3.ch008.

[35] Maseleno, A., & Hasan, M. M. (2013). The Dempster-Shafer theory algorithm and its application to insect diseases detection. *International Journal of Advanced Science and Technology*, *50*(1), 111-119.

[36] Maseleno, A., & Hardaker, G. (2016). Malaria detection using mathematical theory of evidence. *Songklanakarin Journal of Science & Technology*, *38*(3), 257-263.

[37] Kurniasih, D., Jasmi, K.A., Basiron, B., Huda, M., Maseleno, A. (2018). The uses of fuzzy logic method for finding agriculture and livestock value of potential village. International Journal of Engineering & Technology. 7(3). 1091-1095. https://doi.org/10.14419/ijet.v7i3.11984.

[38] Amin, M. M., Maseleno, A., Shankar, K., Perumal, E., Vidhyavathi, R. M., & Lakshmanaprabu, S. K. (2018). Active Database System Approach and Rule Based in the Development of Academic Information System. *International Journal of Engineering & Technology*, *7*(2.26), 95-101.

[39] Listiani, Dewi. (2014). Pemilihan Susu Formula untuk Memenuhi Asupan Gizi pada Balita dengan Metode SAW. Surabaya: Institut Teknologi Sepuluh Nopember.

[40] Maseleno, A., Pardimin, Huda, M., Ramlan, Hehsan, A., Yusof, Y.M., Haron, Z., Ripin, M.N., nor, N.H.M., and Junaidi, J. (2018a). Mathematical Theory of Evidence to Subject Expertise Diagnostic. ICIC Express Letters, 12 (4), 369 DOI: 10.24507/icicel.12.04.369

[41] Maseleno, A., Huda, M., Jasmi, K.A., Basiron, B., Mustari, I., Don, A.G., and Ahmad, R. (2018b). Hau-Kashyap approach for student's level of expertise. Egyptian Informatics Journal, https://doi.org/10.1016/j.eij.2018.04.001.

[42] Maseleno, A., Sabani, N., Huda, M., Ahmad, R., Jasmi, K.A., Basiron, B. (2018c). Demystifying Learning Analytics in Personalised Learning. International Journal of Engineering & Technology. 7(3). 1124-1129. https://doi.org/10.14419/ijet.v7i3.9789.

[43] Maseleno, A., Huda, M., Siregar, M., Ahmad, R., Hehsan, A., Haron, Z., Ripin, M.N., Ihwani, S.S., and Jasmi, K.A. (2017). Combining the Previous Measure of Evidence to Educational Entrance Examination. Journal of Artificial Intelligence 10(3), 85-90. https://doi.org/10.3923/jai.2017.85.90.

[44] Moksin, A. I., Shahrill, M., Anshari, M., Huda, M., & Tengah, K. A. (2018b). The Learning of Integration in Calculus Using the Autograph Technology. Advanced Science Letters, 24(1), 550-552. https://doi.org/10.1166/asl.2018.12067.

[45] Amin, M. M., Sutrisman, A., Stiawan, D., & Maseleno, A. (2018). Design Restful Web Service of National Population Database for Supporting E-Health Interoperability Service. *Journal of Theoretical & Applied Information Technology*, *96*(15).

[46] Nur Aminudin, Miftachul Huda, Siti Suhaila Ihwani, Sulaiman Shakib Mohd Noor, Bushrah Basiron, Kamarul Azmi Jasmi, Jimaain Safar, Ahmad Kilani Mohamed, Wan Hassan Wan Embong, Ahmad Marzuki Mohamad, Andino Maseleno, M. Masrur, Trisnawati, and Dwi Rohmadi. (2018). the family hope program using AHP method. International Journal of Engineering and Technology. Seven (2.27), 188-193.

[47] Nur Aminudin, Miftachul Huda, Ahmad Kilani, Wan Hassan Wan Embong, Ahmad Marzuki Mohamed, Bushrah Basiron, Siti Suhaila Ihwani, Sulaiman Shakib Mohd Noor, Kamarul Azmi Jasmi, Jimaain Safar, Natalie L. Ivanova, Andino Maseleno, Agus Triono, and Nungsiati. (2018). Higher education selection using simple additive weighting. International Journal of Engineering and Technology. 7(2.27), 211 -217.

[48] Othman, R., Shahrill, M., Mundia, L., Tan, A., & Huda, M. (2016). Investigating the Relationship between the Student's Ability and Learning Preferences: Evidence from Year 7 Mathematics Students. The New Educational Review, 44(2), 125-138.

[49] Pardimin, Apriadi, Widhiya Ninsiana, M Ihsan Dacholfany, Karnawi Kamar, Kamarul Shukri Mat Teh, Miftachul Huda, April Lia Hananto, Muhammad Muslihudin, K. Shankar, and Andino Maseleno. (2018). Developing Multimedia Application Model for Basic Mathematics Learning. Journal of Advanced Research in Dynamical and Control Systems. (In press).

[50] Putra, D.A.D., Jasmi, K.A., Basiron, B., Huda, M., Maseleno, A., Shankar, K., Aminudin, N. (2018). Tactical Steps for E-Government Development. International Journal of Pure and Applied Mathematics.119 (15). 2251-2258.

[51] Rosli, M.R.B., Salamon, H.B., and Huda, M. (2018). Distribution Management of Zakat Fund: Recommended Proposal for Asnaf Riqab in Malaysia. International Journal of Civil Engineering and Technology 9(3), pp. 56–64.

[52] Ristiani, Pardimin, Kamarul Shukri Mat Teh, Ahmad Fauzi, April Lia Hananto, Miftachul Huda, Muhamad Muslihudin, K. Shankar, and Andino Maseleno. (2018). Decision Support System Model for Selection of Best Formula Milk for Toddlers Using Fuzzy Multiple Attribute Decision Making. Journal of Advanced Research in Dynamical and Control Systems, Issue: 02 Special Issue, 2075-2088.

[53] Satria Abadi, Kamarul Shukri Mat Teh, Badlihisham Mohd Nasir, Miftachul Huda, Natalie L. Ivanova, Thia Indra Sari, Andino Maseleno, Fiqih Satria, and Muhamad Muslihudin. (2018). Application model of k-means clustering insights into promotion strategy of vocational high school. International Journal of Engineering and Technology. 7 (2.27), 182-187.

[54] Sugiyarti, E., Jasmi, K.A., Basiron, B., Huda, M., Shankar, K., Maseleno, A. (2018). Decision support system of scholarship grantee selection using data mining. International Journal of Pure and Applied Mathematics.119 (15), 2239-2249.

[55] Sundari, E., Jasmi, K.A., Basiron, B., Huda, M., and Maseleno, A. (2018). Web-Based Decision Making System for Assessment of Employee Revenue using Weighted Product. International Journal of Engineering and Technology.

[56] Susilowati, T., Jasmi, K.A., Basiron, B., Huda, M., Shankar, K., Maseleno, A., Julia, A., Sucipto. (2018). Determination of Scholarship Recipients Using Simple Additive Weighting Method. International Journal of Pure and Applied Mathematics.119 (15), 2231-2238.

[57] Tri Susilowati, M. Ihsan Dacholfany, Sudirman Aminin, Afiful Ikhwan, Badlihisham Mohd. Nasir, Miftachul Huda, Adi Prasetyo, Andino Maseleno, Fiqih Satria, Sri Hartati, and Wulandari. (2018). getting parents involved in child's school: using attendance application system based on SMS gateway. International Journal of Engineering and Technology.7 (2.27), 167-174.

[58] Tri Susilowati, Kamarul Shukri Mat Teh, Badlihisham Mohd Nasir, Abdul Ghafar Don, Miftachul Huda, Talia Hensafitri, Andino Maseleno, Oktafianto, and Dedi Irawan. (2018). Learning application of Lampung language based on multimedia software. International Journal of Engineering and Technology.7 (2.27), 175-181.

[59] Wulandari, Sudirman Aminin, M. Ihsan Dacholfany, Abdul Mujib, Miftachul Huda, Badlihisham Mohd Nasir, Andino Maseleno, Eni Sundari, Fauzi1, and M. Masrur. (2018). Design of library application system. International Journal of Engineering and Technology. 7(2.27), 199-204.

[60] Satria Abadi, Miftachul Huda, Kamarul Azmi Jasmi, Sulaiman Shakib Mohd Noor, Jimaain Safar, Ahmad Kilani Mohamed, Wan Hassan Wan Embong, Ahmad Marzuki Mohamad, Aminudin Hehsan, Bushrah Basiron, Siti Suhaila Ihwani, Andino Maseleno, Muhamad Muslihudin, Fiqih Satria, Dedi Irawan, and Sri Hartati. (2018). Determination of the best quail eggs using simple additive weighting. International Journal of Engineering and Technology.7 (2.27), 225-230.

[61] Satria Abadi, Miftachul Huda, Aminudin Hehsan, Ahmad Marzuki Mohamad, Bushrah Basiron, Siti Suhaila Ihwani, Kamarul Azmi Jasmi, Jimaain Safar, Ahmad Kilani Mohamed, Wan Hassan Wan Embong, Sulaiman Shakib Mohd Noor, Boris Brahmono, Andino Maseleno, Almira Nabila Fauzi, Nur Aminudin, and Miswan Gumanti. (2018). Design of online transaction model on traditional industry in order to increase turnover and benefits. International Journal of Engineering and Technology.7 (2.27), 231-237.

[62] Satria Abadi, Miftachul Huda, Bushrah Basiron, Siti Suhaila Ihwani, Kamarul Azmi Jasmi, Aminudin Hehsan, Jimaain Safar, Ahmad Kilani Mohamed, Wan Hassan Wan Embong, Ahmad Marzuki Mohamad, Sulaiman Shakib Mohd Noor, Dona Novita, Andino Maseleno, Rita Irviani, Muhammad Idris, and Muhamad Muslihudin. (2018). Implementation of fuzzy analytical hierarchy process on notebook selection. International Journal of Engineering and Technology.7 (2.27), 238-243.

[63] Zamzami Septiropa, Mohd. Hanim Osman, Ahmad Baharuddin Abd. Rahman, Mohd. Azreen Mohd Ariffin, Miftachul Huda, and Andino Maseleno. (2018). Profile of cold-formed steel for compression member design a basic combination performance. (2018). International Journal of Engineering and Technology. 7(2.27), 284-290

[64] Nur Aminudin, Fauzi, Miftachul Huda, Aminudin Hehsan, Mohd. Nasir Ripin, Zulkifli Haron, Juhazren Junaidi, Rita Irviani, Muhamad Muslihudin, Syahromi Hidayat, Andino Maseleno, Miswan Gumanti, and Almira Nabila Fauzi. (2018). Application program learning based on android for students experiences. International Journal of Engineering and Technology. Seven (2.27), 194-198.

[65] Satria Abadi, Kamarul Shukri Mat Teh, Miftachul Huda, Aminudin Hehsan, Mohd. Nasir Ripin, Zulkifli Haron, Nasrul Hisyam nor Muhamad, Riki Rianto, Andino Maseleno, Riki Renaldo, and Ahmad Syarifudin. (2018). Design of student score application for assessing the most outstanding student at vocational high school. International Journal of Engineering and Technology.7 (2.27), 172-177.