

Application of Expert System for Determining Export Quality Pepper Seeds using Website-Based Forward Chaining Method

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Abstract: *The need for information about determining export quality pepper seeds is currently needed, this usually occurs in areas far from settlements, one of which is farmers located in rural areas far from technological developments, lack of experts or experts in the surrounding environment. increasingly triggered crop failure rates due to lack of knowledge. by building expert systems whose data is obtained from experts so that the system built has the ability to provide solutions such as an expert who is an expert in their field. This process continues until it reaches a goal or there are no rules whose premise matches the known facts. Media system maker application uses the language of PHP and MySQL as a database. Therefore the author will review how to determine quality export pepper seeds, the implementation of an expert system determines export quality pepper seeds which are expected to provide easy access for users, through the use of website-based media.*

Index Terms: *Expert Systems, Pepper Seeds, Forward Chaining, Website*

I. INTRODUCTION

A. Background

Indonesia is one of the largest producers and exporters of pepper (*Piper Nigrum L*) in the world and around $\pm 90\%$ of its production is intended for exports. However, in the period 2000-2004 the volume and contribution of Indonesian pepper

exports to the world market tended to decrease with a successive rate of 9.2% and 15.5% The quality of white pepper produced at the farm level tended to be low or even not meet the required quality importer country.

Some of the previous studies that have been carried out previously as references for this study are: Research Yetty Oktarina [1] explains that agricultural development is one of the dynamic processes to improve the agricultural sector in order to produce sufficient food to meet people's needs. For that we need to use existing resources such as human, capital, organization, technology and knowledge to utilize and simultaneously preserve natural resources to ensure welfare in the survival of farmers and nations. Research by Asrini Fazaria, Dedi Budiman Hakim, Sahara [2]. Pepper is one of the products of the plantation sub-sector included in the spice category. Pepper has a significant role in improving growth economy in Indonesia [2].

Andi Muhammad Akram Mukhlis's research, Edy Hartulistiyoso, Yohanes Aris Purwanto [3]. Pepper is one of the commodities that has high economic value. The high value of Indonesian pepper exports shows that this sector has the prospect of being developed as a foreign exchange earner from the non-oil and gas sector. The black pepper and white pepper commodity occupies the highest position in the value of Indonesian exports for the spice sector followed by nutmeg and cardamom, and cinnamon. In 2014, total exports from January to November to the commodity of white pepper reached 13,082 tons and in 2015 it increased to 18,500 tons. To respond to this, the author helps farmers and traders and buyers to determine the pepper seed determination index based on exports using the website. Because using this website is able to facilitate the maximization of pepper seeds which are really good quality.

By using the application system expert determination of pepper can describe the problem with research, this system can membantun users solve problems based on existing criteria. Comprehensive and accurate information needed by using a website is the right solution [4-7]. One of the information that utilizes expert system applications as a solution is the index of determining pepper seeds with export quality using a website. The benefit of doing this research is that it can make it easier to determine quality export pepper seeds and help traders and farmers to improve quality pepper seeds The purpose of this study is to design an application system for the export of quality pepper seeds for experts using the website.

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And by using a website, it can make it easier to make an assessment of the determination of pepper seeds as export quality.

B. Problem Formulation

Based on this background, the problem in this study is.

1. How to design an expert system application for determining pepper seeds with an export value by using website.
2. How is the use of authority in the countryside in determining export-quality pepper seeds.
3. How is the process of assessment in determining export-quality pepper seeds carried out using website.

C. Research Benefits and Objectives

The benefit of doing this research is that it can make it easier to determine quality export pepper seeds and help traders and farmers to improve quality pepper seeds

The purpose of this study is to design an expert system application for the determination of export-quality pepper seeds using website. And using website can make it easier to make an assessment of the determination of pepper seeds and understand more deeply the application of using website in determining the quality export pepper seeds.

II THEORETICAL BASIS

A. Expert system

The basic concept of an expert system contains several elements, including expertise, transfer of expertise, inference, rules and ability to explain [8-10]. Expertise is one of the masters of knowledge in certain fields that are obtained both formally and informally [11-15]. An expert is someone who has certain knowledge and is able to explain a response and has the desire to learn to update knowledge in his field [16-20]. The transfer of expertise is to divert expertise from an expert and then divert it to someone who is not an expert or a lay person in need [21-25]. While inference, is a series of processes to produce information from facts that are known or assumed [26-30]. The ability to explain, is one of the features that must be owned by an expert system after a program is available in the computer. Expert system is a system designed to be able to mimic the expertise of someone expert in answering questions and solving a problem. The expert system will provide a fraction of a problem obtained from dialogue with users. With the help of an expert system a non-expert / expert can answer questions, solve problems and make decisions that are usually carried out by an expert. An expert system is a computer program designed to model the problem solving capabilities of an expert.

B. Forward Chaining

Forward Chaining is a fact to get a conclusion from that fact. This reasoning is based on existing facts (data driven), this method is the opposite of the Backward Chaining method, where this method is executed by gathering existing facts to draw conclusions. In other words, the process starts from the facts (facts that exist) through the interface fact process (reasoning facts) towards a goal (a goal). This method is also

called using the IF – THEN rule where the premise (IF) goes to the conclusion (THEN) or can be written as follows:

THEN (conclusion)

There are two opinions regarding the implementation of this method. First, by bringing all the data obtained to the expert system. Second, by bringing only the important parts of the data obtained to the expert system. The first way is better to use if the expert system is connected with an automatic process and the recipient of all data from the database. The second way saves time and money by reducing data and retrieving data that is deemed necessary. For example, as in the case of the two methods above, based on this method steps are taken:

R1 : IF A and C, THEN B

R2 : IF D and C, THEN F

R3 : IF B and E, THEN F

R4 : IF B, THEN C

R5 : IF F, THEN G

These two types of strategies will lead to a conclusion.

However, efficiency depends on the condition of the problem at hand, if a problem has fewer premises than the conclusion, then the strategy will be offered Backward Chaining.

C. PHP

PHP is a server-side scripting language that integrates with HTML to create dynamic web pages [31-35]. The purpose of server-side scripting is the syntax and the commands given will be fully executed on the server but included in the HTML document [36-40]. Making this web is a combination of php itself as a programming language and HTML as a web page [41-46].

D. Website

In terminology, a website is a collection of web pages, which are usually summarized in a domain or subdomain, which is located on the World Wide Web (WWW) on the Internet [47-51]. A web page is a document written in HTML (Hyper Text Markup Language) format, which is almost always accessible via HTTP, a protocol that conveys information from a website server to be displayed to users through a web browser [52-55]. All publications from these websites can form a very large information network [56-60].

E. Pepper Characteristics

1. Petaling 1: (SK Number. 275 / Kpts / KB.230 / 4/1988, April 21, 1988)

Age begins to flower: ± 10 months

Fruit shape: round, Fruit color: young green, red orange cooking

Start flowering until ripe fruit: ± 9 months,

Average fruit bunch: ± 60 items,

Perfect fruit percentage: $\pm 64.8\%$,

Average yield: 4.48 tons / ha (± 2.8 kg / tree) dry white pepper, Resilience: A little resistant to jaundice, rather sensitive to rot stem base.

Can be planted in infertile soils, on fertile soils in old age the growth will be better. The use of dead climbing poles and mulch is more suitable. Figure 1 shows Petaling 1.



Fig. 1. Petaling 1

2. Petaling 2 : (Sk number. 275 / Kpts / KB.230 / 4/1988, April 21, 1988)

Age begins to flower: 11 months
 Fruit shape: big round
 Fruit color: young green fruit, orange red ripe fruit
 Start flowering until ripe fruit: \pm 8 months,
 Average fruits: \pm 80 items
 Perfect fruit percentage: \pm 66.1%
 Average yield: 4.80 tons / ha (\pm 3.0 kg / tree) of dry white pepper
 Disease Resistance: A little resistant to jaundice, rather sensitive to stem rot.
 It is recommended to plant in soil that is free from stem rot and jaundice and moderate to high fertility. Dead enforcement poles are more suitable. Figure 2 shows Petaling 2.



Fig. 2. Petaling 2

3. Large Small Leaves: (Sk Number. 465 / Kpts / TP.240 / 7/1993, July 2, 1993)

Age begins to flower: 7 months
 Fruit shape: oval
 Fruit color: dark green young fruit, reddish yellow ripe fruit
 Start flowering until ripe fruit: 196 days
 The average fruit: 73.52 items
 Perfect fruit percentage: \pm 48.46%
 Average yield: 3.86 tons / ha
 Disease Resistance: A little resistant to jaundice, tolerant of stem rot.
 It is recommended to be planted in areas that have not received jaundice. Figure 3 shows Large small leaves.



Fig. 3. Large small leaves

4. Chunuk: (SK Number 467 / KPTS / TP.240 / 7/1993, July 2, 1993)

Age begins to flower: 8 months
 Fruit shape: round
 Fruit color: young green fruit, reddish yellow ripe fruit
 Start flowering until ripe fruit: 225 days
 The average fruit fruit: 66.56 items
 Percentage of perfect fruit: \pm 43.39%
 Average yield: 1.97 tons / ha
 Disease Resistance: Sensitive to jaundice, tolerant of stem rot.
 Tana is recommended to be cultivated as shrub pepper. Figure 4 shows Chunuk.



Fig. 4. Chunuk

5. Natar 1: (SK Number 274 / Kpts / KB.230 / 4/1988, April 21, 1988)

Age begins to flower: 10 months
 Fruit shape: round
 Fruit color: young green fruit, orange red ripe fruit,
 Start flowering until ripe fruit: 8 months,
 Average fruit fruit: 57.3 items,
 Perfect fruit percentage: \pm 66.7%,
 Average yield: 4.00 tons / ha (\pm 2.5 kg / tree) of dried black pepper,
 Disease Resistance: Rather resistant to jaundice, medium to mildly resistant to stem rot.
 Planting is recommended in areas where the rate of stem rot infection is not yet high. This variety is responsive to fertilizer and light. Trimming climbing poles live 1 x 4 months, as high as \pm 3 meters is needed. Figure 5 shows Natar 1.



Fig. 5. Natar 1

6. Natar 2: (SK Number 275 / Kpts / KB.230 / 4/1988, April 21, 1988)

Age begins to flower: \pm 10 months
 Fruit shape: round to oval
 Fruit color: light green young fruit, orange red ripe fruit
 Start flowering until ripe fruit:
 \pm 7 months



Average fruit: 56 items

Perfect fruit percentage: 60%

The average yield: 3.53 tons / ha (± 2.5 kg / tree) of dried black pepper

Disease Resistance: Slightly resistant to jaundice, low to sensitive to stem rot.

It is recommended to plant in areas with moderate to high fertility, have not contracted stem rot. For Lampung, it is not permissible for enforcement posts to live in too thick leaves. The enforcement pole must be cut 1 x 4 months, as high as ± 3 meters. Figure 6 shows Natar 2.



Fig. 6. Natar 2

2.6 Expert System Application

The lack of knowledge about the determination of pepper seeds with export quality in Indonesia is still very limited, so in the field of trade and agriculture, computer technology is also needed. One of them is the determination of export-quality pepper seeds. computerized to help trade and agriculture in determining export quality pepper seeds, this application is website-based, so that later this system can be accessed by the public online via the internet anywhere and anytime. This paper discusses how to build an expert system application for the determination of export quality pepper seeds that can be accessed by the wider community without requiring much cost in determining export-quality pepper seeds .

III RESEARCH METHODS

A. Method of collecting data

a. Observation

Observation method is a research method wherein the researcher observes and looks directly at the object of research regarding all activities related to the purpose of the research, by analyzing evaluating systems is running and providing solutions through the information system that will be built so that it can be more useful [61-67] .

In this paper the Observation Method that will be used:

1. Participant Observation

In this observation, researchers are directly involved in the daily activities of people or situations that are observed as data sources [68-75].

2. Non-participant Observation

is an observation that the researcher does not participate directly in the activities or processes that are being observed [76-78].

b. Questionnaire

Questionnaires are a method of collecting data by giving a set of questions or written statements to the respondent to answer. Questionnaires are a more efficient method of collecting data if researchers have known exactly which variables to measure

and know what is expected from respondents. In addition, the questionnaire is also suitable for use if the number of respondents is quite large and spread over a wide area .

c. Library Study

This method is a technique of collecting data by studying references in the form of documents / files and collecting data, legislation, books, research journals and so on. Through literature studies a study of laws and regulations related to processing the potential of the region is carried out. The need for data that reveals the indicators used by prospective investors for investment decision making is obtained through literature studies of books and research journals. Library studies are also conducted to determine the information technology capabilities that will be applied in the system [13].

B. System Development Life Cycle (SDLC)

SDLC stages in the construction of a Web information system:

1. Planning

Planning is feasibility and interview, observation, Quesener. If at the Feasibility stage the results are good then immediately go to the investigation stage and be given a form to the client to record client requirements. In the investigative system, it can be in the form of interviews, quotas or observation. In this stage the first thing to do is to give the form to the user that is used to find out the user's request.

2. Analysis

- Technology Analysis Requires product information for storage. News information is used as a database like Mysql, MSAccess. Analyzing what technology is used by Web design owners such as using graphic design requires technology such as Adobe Photoshop, Macromedia Flash, Dreamweaver
- Information analysis Regarding data information that will be fixed data and dynamic data, the fixed data information category is: company profile, vision and mission, company history, company background. Dynamic information is information that changes every period of time every day or every hour.

3. Design

Information Design. In this stage, information on links from each page is modeled, if there is a database in the system, development and design databases are used.

- Graphic design. In this stage it is adjusted from color, layout, image and graphic.
- Database Application
- Model Development Database Design PHP Library Development. The stage for modeling all existing peruses, such as peruses data storage, updates articles, and displays data from the database.

4. Implementation

- Program and Installation Writing. It is the stage of writing a program that has been analyzed and designed by all, the program used is PHP and the database used by MySql

- b. Design Review. In this stage not only testing the design used but testing all systems that have been implemented such as no location, wrong image, system testing such as data storage, article updates and others.
- c. Selection of Hardware and Software Resources. In this stage software and hardware are used for Web servers.
- d. Web Testing and Web Documents. Test the Web with various existing browser technologies, as well as checking Web documents.

- Developers often make unnecessary delays because project team members have to wait for other teams to complete the task because having this dependency leads to inefficient use of time.

C. Research Framework

Based on the support of the theoretical foundation obtained from exploration theory which is used as a conceptual reference for research variables, the Thinking Framework can be prepared as shown in figure 7.

The system development life cycle has several stages, namely:

1. System analysis, which is the initial stage of SDLC, is a specially educated person to develop the system professionally.
2. System design has two main objectives, namely providing system logic design or system design in general (general system design), and providing detailed system design (detailed system design).
3. Implementation of the system, the process of replacing or leaving the old system with a new system.
4. Operation and maintenance of several advantages and disadvantages. The advantage is that it provides stages that can be used as guidelines for developing the system, and will provide better system results. Then disadvantage, which is only providing stages only, the results of this method depends on the results in stages, analysis, takes a long time, requires a relatively larger cost, and the results are not flexible to be modified.

In order for system development to work efficiently and effectively, the system development methodology needs to be known.

A popular and widely used system development methodology is a structured system development methodology, which provides top down methods and decomposition methods and some system development methods.

The SDLC or Linear Sequential model is often called the Waterfall Model. This model proposes a systematic and partial software development approach that starts at the level and progress of the system in all analysis, design, code, testing, and maintenance.

This model is arranged in layers, each stage in this model is done sequentially, one before the other. This model is usually used to make software on a large scale and that will be used for a long time. It is suitable for large system development.

1. Advantage

- Easy to apply.
- Provide templates about methods of analysis, design, coding, testing, and maintenance.

2. Disadvantage

- Rarely do real projects follow the recommended sequential flow model because this model can do indirect iterations.
- Customers find it difficult to express needs explicitly, making it difficult to accommodate uncertainty at the start of the project.
- Customers must be patient because they have to wait until the end of the project is passed. An error if not known from the start will be a big problem because it has to repeat from the beginning.

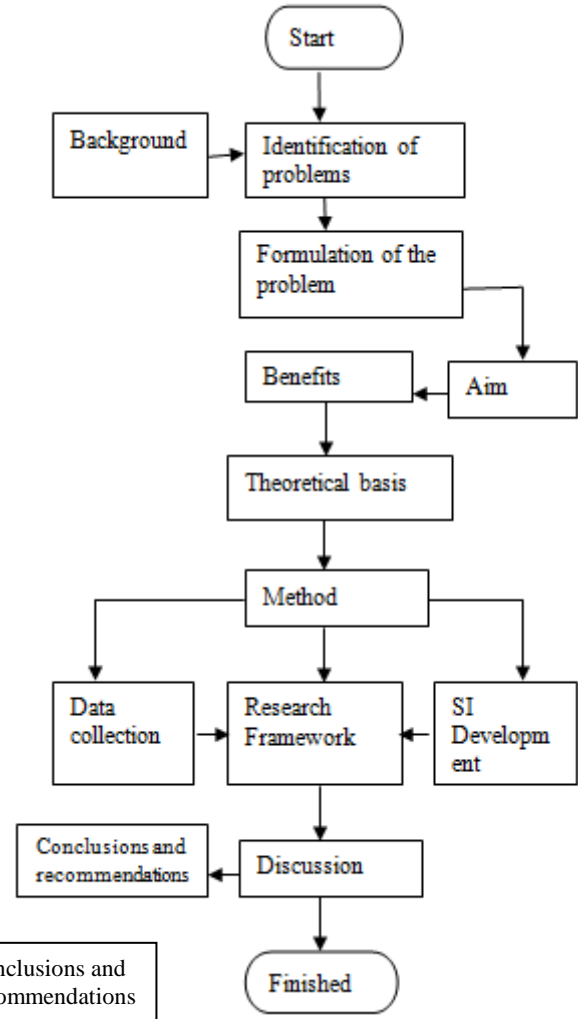


Fig. 7. Research Framework

The research framework explains the stages in the research that is carried out, namely starting from the background of the problem then identifying problems in the system that is running. After identifying the problem, it is continued by formulating a problem that will later be used as a reference material to provide research benefits and objectives. After that the theoretical foundation explains the theory or system that is in accordance with the research then the method used from the start of data collection, to the research framework. Then explain in detail the discussion of the system that will be used to provide conclusions and suggestions. Then the study is completed.

IV DISCUSSION

A. System planning

After analyzing all existing data and information, the next stage is a system design that describes the real system concept.

1. Flow chart

In doing system design, a flowchart is needed in Figure 8

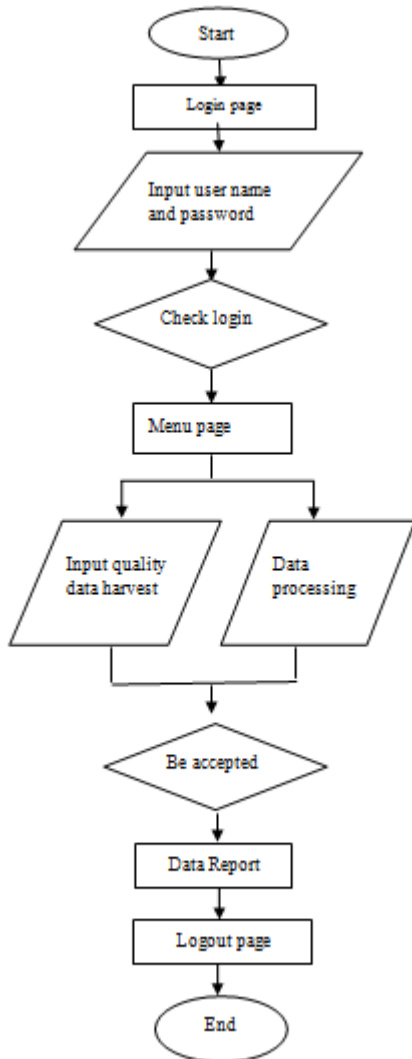


Fig. 8. Flowchart

2. Context Diagram

In designing the system, a context diagram is needed in Figure 9 as follows:

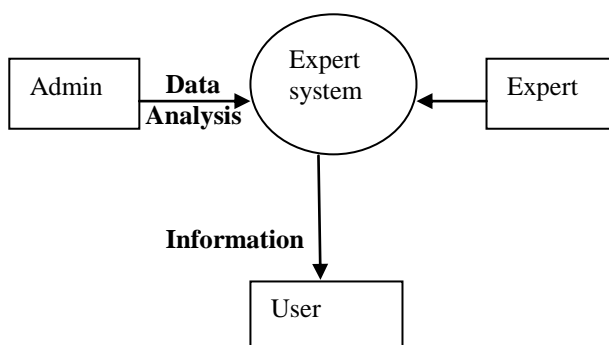


Fig. 9. Expert System Context Diagram

3. Data Flow Diagram (DFD)

Data Flow Diagrams (DFD) are data flow diagrams that function to map environmental models, which are presented with a single circle represented by the whole system. This expert system DFD is depicted in figure 10.

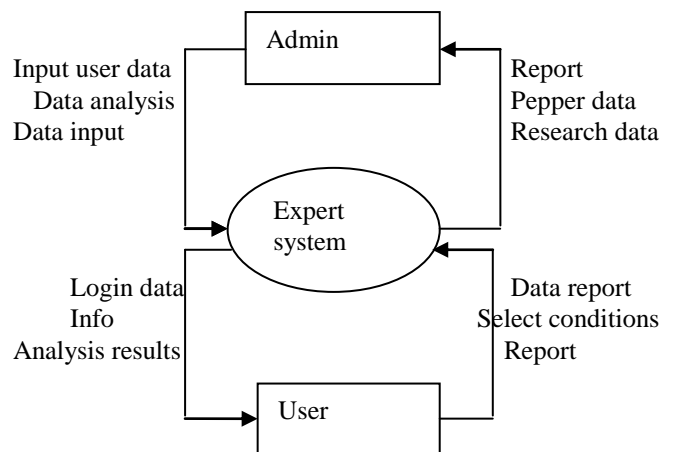


Fig. 10. Data Flow Diagram

3. Entity Relationship Diagram (ERD)

ERD is a model to explain the relationship between data in a database based on basic data objects that have relationships between relations. ERD to model data structures and relationships between data, to illustrate it using several notations and symbols. Figure 11 shows entity relationship diagram.

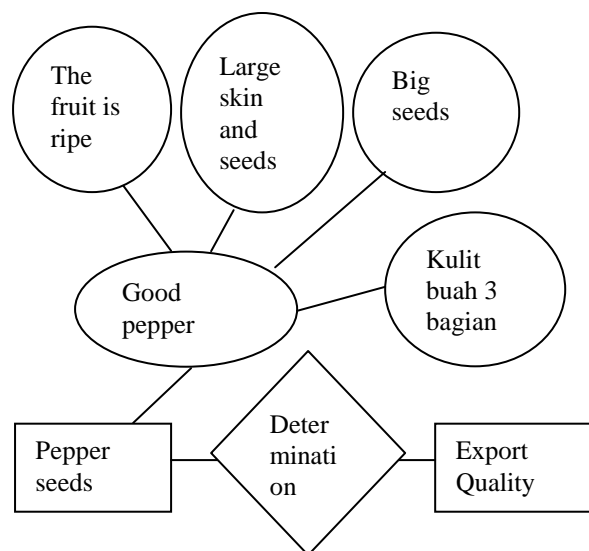


Fig. 11. Entity Relationship Diagram

B. Interface Design

The expert system interface design determines quality nutmeg seedlings using a website application. Figure 12 shows design the login page interface. Figure 13 shows homepage interface.

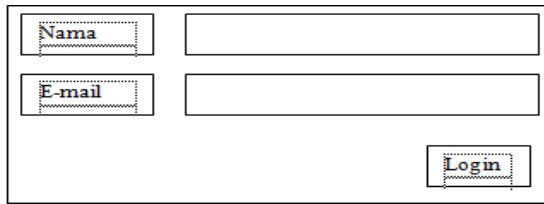


Fig. 12. Design the Login page interface

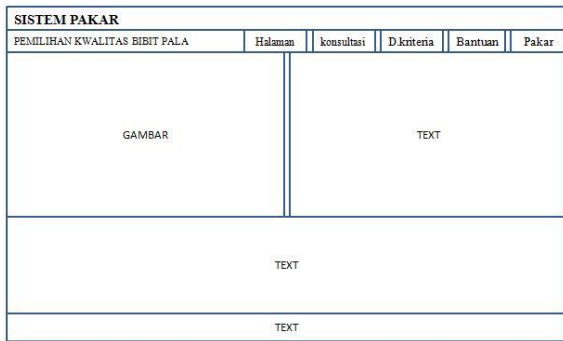


Fig. 13. Homepage interface

C. Analysis

The analysis is done by collecting the required data from the results of the research as well as several related references. The process of determining the parameters of export quality pepper seeds is determined in 6 criteria as shown in table 1.

Table 1. Criteria for export quality pepper seeds

ID-CRITERIA	CRITERIA OF PEPPER EXPORT QUALITY
G001	Already dead
G002	Hard seed
G003	Not broken
G004	There are no pests or diseases
G005	It's dry
G006	Varieties and the origin of selected pepper

Table 1 explains the list of criteria for export quality pepper seeds used in the system. There are 6 criteria that are used, namely already dead, seeds hard, not broken, No attack of pests or diseases, Already dry, varieties and the origin of selected pepper.

Table 2. Knowledge Base

NO	RULE
1.	IF the seeds are already dead AND do not show physical attack THEN disease or pest

2.	IF the seeds are already fried AND it has dried THEN physiological quality
3.	IF AND varieties of origin of selected pepper THEN genetic quality

Table 2 explains the rules used in the quality criteria system that has been determined in the determination of export-quality pepper seeds.

Table 3. Characteristics of pepper seeds export quality

No	Name	Characteristics of Seeds		Category
		Young	Cook	
1	Petaling 1	Green	Red Orange	Very Superior
2	Petaling 2	Green	Red Orange	Very Superior
3	Lampung Daun Kecil	Dark green	Reddish yellow	Less superior
4	Chunuk	Green	Reddish yellow	Less superior
5	Natar 1	Green	Red Orange	Very Superior
6	Natar 2	Green	Red Orange	Superior

Table 3 explains the characteristics of export-quality pepper seeds starting from the name pepper, the characteristics of seeds when they are young until they are ripe, from which it will be easier to know the category of pepper seeds, and it will be easier for anyone if they want to know where pepper is export quality.

D System Implementation

1. Data input page

By selecting the consultation menu, the system will display the data input page, this page is a page to fill in the data of users who want to consult, before consulting the user must first fill in their personal data, namely the name line to fill in the username, gender line to fill in the gender user, address line to fill in the user's address, then the user can choose the advanced button to register if the user has filled in all the data and the reset button to cancel. The following figure 14 is the display of user data input pages.

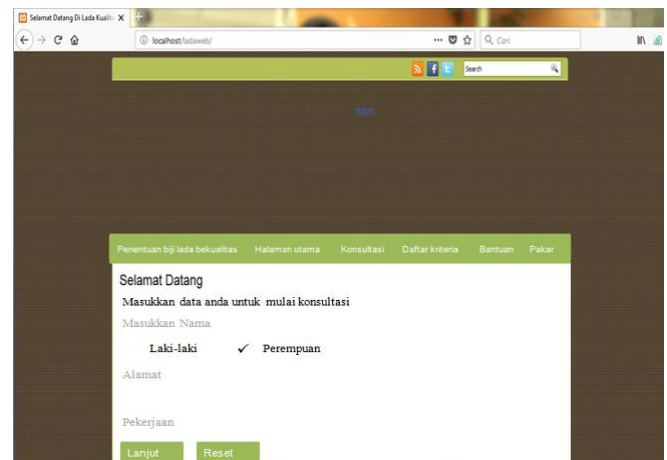


Fig. 14. Implementation of the user data input page interface to start a website-based consultation.

2. Page answer questions

After the user enters consultation data, then the user is faced with a page answering the question. This page is a page to answer questions based on the criteria given to the user by the system. On this page there is a line of questions, the line select true (YES) or wrong (NO), and the answer button to answer the question.

The following figure 15 is a page display of answering questions.

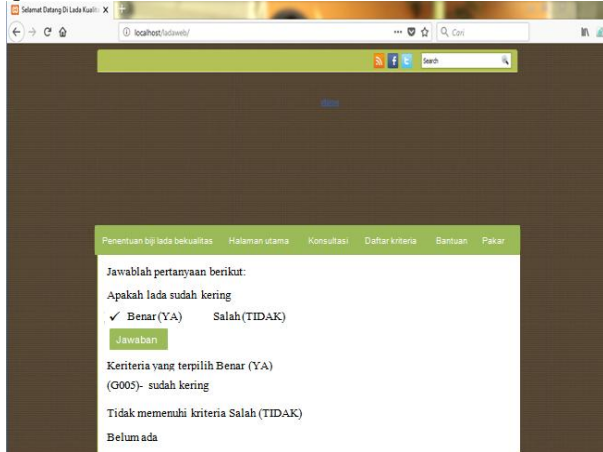


Fig. 15. Implementation of the web-based pepper criteria matching page interface

3. Analysis results

If the user has already answered the question posed by the system, the system will display the results of the prediction of the results of the input from the user. Users can also see the solutions displayed by the expert system as shown in figure 16.

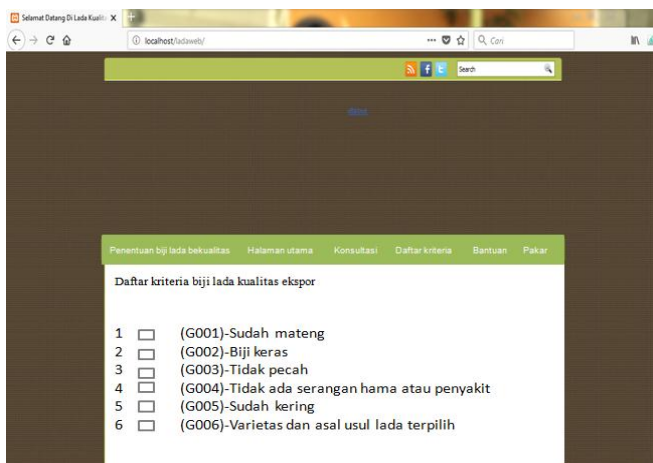


Fig. 16. Implementation of a web-based criteria page interface

4. Analysis of Results

The development of an expert system determines that pepper seeds export quality based on the website as a whole can work well. In the Admin section the data management process includes the addition of data about pepper seeds and the addition of consultation data to run well, while in the User section can determine the quality of pepper seeds by searching the consulted data entered, so users can know which pepper seeds have export quality .

V CONCLUSION AND SUGGESTION

A. Conclusion

From the results of the discussion above, a number of things can be summarized:

1. Using the website application in this study can be used to select export-quality pepper seeds for pepper production with the characteristics specified in this study.
2. The things that need to be considered in choosing export quality pepper seeds are already thick, the seeds are hard, not broken, there are no attacks of pests or diseases, and they are dry.
3. The design of expert systems in selecting export-quality pepper seeds above can be used to determine the criteria of good pepper seeds and can facilitate pepper farmers.

B. Suggestions

Further testing with a broader scope of knowledge, From the expert system that has been created, the author only uses the forward chaining method because according to the author this method is suitable for use in the system created. It does not rule out the possibility of another, better method that can be used.

REFERENCES

1. Oktarina, Y. 2009. Analysis of Farming and Marketing of Pepper (Piper Nisrum L.) in Tanjung Durian Village, Kec. Buay Pemaca, OKU Regency, South. Vol 1. No 2. Page 1.
2. Fazarina, D.A., Hakim, D.B., Sahara. 2016. *Analysis of Pepper Price Integration in Domestic and International Markets*. Page 2. Agricultural Economics Study Program, Postgraduate Program of IPB, Faculty of Economics and Management, IPB Campus IPB, Dramaga Bogor, 16680, Indonesia.
3. Akram, A.M., Hartulistiyoso, E., Purwanto, Y.A. 2017. *Effect of Water Content on Some Physical Properties of White Pepper Seeds*. Vol 37. No 1. Page 1. Department of Mechanical Engineering and Biosystems, Faculty of Agricultural Technology, Bogor Agricultural Institute, Jl. Raya Darmaga Campus IPB Darmaga Bogor, West Java 16680, Indonesia.
4. Aminudin, N., Huda, M., Hehsan, A., Ripin, M.N., Haron, Z., Junaidi, J., Irviani, R., Muslihudin, M., Hidayat, S., Maselena, A., Gumanti, M., Fauzi, A.N., Application program learning based on Android for students experiences, *International Journal of Engineering and Technology (UAE)*, Vol. 7, No. 2.27, 2018, pp. 194-198.
5. Abadi, S., Huda, M., Hehsan, A., Mohamad, A.M., Basiron, B., Ihwani, S.S., Jasmi, K.A., Safar, J., Mohamed, A.K., Embong, W.H.W., Noor, S.S.M., Brahmono, B., Maselena, A., Fauzi, A.N., Aminudin, N., Gumanti, M., Design of Online Transaction Model on Traditional Industry in order to Increase Turnover and Benefits, *International Journal of Engineering and Technology (UAE)*, Vol. 7, No. 2.27, 2018, pp. 231-237.
6. Lakshmanaprabu, S. K., Shankar, K., Gupta, D., Khanna, A., Rodrigues, J. J., Pinheiro, P. R., & de Albuquerque, V. H. C. (2018). Ranking analysis for online customer reviews of products using opinion mining with clustering. *Complexity*, 2018.
7. Huda, M., Maselena, A., Atmotiyoso, P., Siregar, M., Ahmad, R., Jasmi, K.A., Muhamad, N.H.N, Mustari, I.M., Basiron, B., Big Data Emerging Technology: Insights into Innovative Environment for Online Learning Resources, *International Journal of Emerging Technologies in Learning*, Vol. 13, No. 1, 2017, pp. 23-36.
8. Maselena, A., Hasan, M.M., Skin Diseases expert system using Dempster-Shafer theory, *International Journal Intelligent Systems and Applications*, vol. 5, 2012, pp. 38-44.
9. Fauzi, Huda, M., Teh, K.S.M., Haron, Z., Ripin, M.N., Hehsan, A., Abas, H., Rafiq, M., Irawan, J., Abadi, S., Maselena, A., The Design of Fuzzy Expert System Implementation for Analyzing Transmissible Disease of Human, *International Journal of Pharmaceutical Research*, Vol. 10, Issue 4, 2018.
10. Budiyanto, G., Ipnuwati, S., Al Gifari, A.A., Huda, M., Jalal, B.,



- Latif, A.A., Maseleno, A., Hananto, A.L., Web based expert system for diagnosing disease pest on banana plant, International Journal of Engineering and Technology(UAE), Vol. 7, No. 4, pp. 4715-4721.
11. Anggraeni, E.Y., Pardimin, Dacholfany, I., Akla, Huda, M., Teh, K.S.M., Hehsan, A., Junaidi, J., Yusuf, F.M., Abas, H., Husin, M.F.A., Apriani, D., Latif, A.A., Maseleno, A., Modelling effectiveness of IS learning methodology with AHP method, International Journal of Engineering and Technology(UAE), Vol. 7, No. 4, pp. 4708-4714.
 12. Mulawarman, A., Sudrajat, A., Hendri, N., Kamar, K., Mulyadi, D., Budiyanto, G., Huda, M., Latif, A.A., Maseleno, A., FMADM for determining superior commodity at agroindustry area, International Journal of Engineering and Technology(UAE), Vol. 7, No. 4, pp. 4667-4673.
 13. Pardimin, Apriadi, Ninsiana, W., Dacholfany, M.I., Kamar, K., Teh, K.S.M., Huda, M., Hananto, A.L., Muslihudin, M., K. Shankar, K., Kamenez, N.V., Maseleno, A., Developing Multimedia Application Model for Basic Mathematics Learning, Journal of Advanced Research in Dynamical and Control Systems, Issue 14-Special Issue, 2018, pp. 1347-1356. Oktafianto, Akbar, M.R.A., Fitriani, Y., Zulkifli, Sodikin, Wulandari, Maseleno, A., Dismissal working relationship using Analytical Hierarchy Process Method, Int. J. Pure Appl. Math, Vol. 118, No. 7, 2018, pp. 177-183.
 14. Susilowati, T., Anggraeni, E.Y., Fauzi, Andewi, W., Handayani, Y., Maseleno, A., Using profile matching method to employees position movement, International Journal of Pure and Applied Mathematics, Vol. 118, No. 7, 2018, pp. 415-422.
 15. Maseleno, A., Fauzi, Nungsiyati, Noviyarti, T., Muslihudin, M., Irviani, R., Optimal dengue endemic region prediction using fuzzy simple additive weighting based algorithm, International Journal of Pure and Applied Mathematics, Vol. 118, No. 7, 2018, pp. 472-477.
 16. Maseleno, A., Pardimin, Huda, M., Ramlan, Hehsan, A., Yusuf, Y.M., Haron, Z., Ripin, M.N., Nor, N.H.M., Junaidi, J., Mathematical theory of evidence to subject expertise diagnostic, ICIC Express Letters, Vol. 12, No. 4, 2018.
 17. Aminudin, N., Sundari, E., Shankar, K., Deepalakshmi, P., Irviani, R., Fauzi, Maseleno, A., Weighted product and its application to measure employee performance, International Journal of Engineering & Technology (UAE), Vol. 7, No. 2.26, 2018, pp. 102-108.
 18. Sugiyarti, E., Jasmi, K.A., Basiron, B., Huda, M., Shankar, K., Maseleno, A., Decision support system of scholarship grantee selection using data mining, International Journal of Pure and Applied Mathematics, Vol. 119, No. 15, 2018, pp. 2239-2249.
 19. Abadi, S., Huda, M., Basiron, B., Ihwani, S.S., Jasmi, K.A., Hehsan, A., Safar, J., Mohamed, A.K., Embong, W.H.W., Mohamad, A.M., Noor, S.S.M., Novita, D., Maseleno, A., Irviani, R., Idris, M., Muslihudin, M., Implementation of Fuzzy Analytical Hierarchy Process on Notebook Selection, International Journal of Engineering and Technology (UAE), Vol. 7, No. 2.26, 2018, pp. 102-108.
 20. Kurniasih, D., Jasmi, K.A., Basiron, B., Huda, M., Maseleno, A., The uses of fuzzy logic method for finding agriculture and livestock value of potential village, International Journal of Engineering & Technology (UAE), Vol. 7, No. 3, 2018, pp. 1091-1095.
 21. Adela, H., Jasmi, K.A., Basiron, B., Huda, M., Maseleno, A., Selection of dancer member using simple additive weighting, International Journal of Engineering & Technology (UAE), Vol. 7, No. 3, 2018, pp. 1096-1107.
 22. Maseleno, A., Sabani, N., Huda, M., Ahmad, R., Jasmi, K.A., Basiron, B., Demystifying learning analytics in personalised learning, International Journal of Engineering & Technology (UAE), Vol. 7, No. 3, 2018, pp. 1124 -1129.
 23. Amin, M.M., Nugratama, M.A.A., Maseleno, A., Huda, M., Jasmi, K.A., Design of cigarette disposal blower and automatic fresher using mq-5 sensor based on atmega 8535 microcontroller, International Journal of Engineering & Technology (UAE), Vol. 7, No. 3, 2018, pp. 1108 -1113.
 24. Huda, M., Maseleno, A., Jasmi, K.A., Mustari, I., Basiron, B., Strengthening interaction from direct to virtual basis: insights from ethical and professional empowerment, International Journal of Applied Engineering Research, Vol.12, No. 17, 2017, pp. 6901-6909.
 25. Maseleno, A., Tang, A.Y.C., Mahmoud, M.A., Othman, M., Saputra, S., Muslihudin, M., Fuzzy AHP method to determine headache types based on symptoms, Investigacion Clinica, Vol. 58, 2017.
 26. Muslihudin, M., Latif, A., Ipnuwati, S., Wati, R., Maseleno, A., A solution to competency test expertise of engineering motorcycles using simple additive weighting approach, Int J. Pure Appl. Math, Vol. 118, No. 7, 2018, pp. 261-267.
 27. Mukodimah, S., Mulihudin, M., Andoyo, A., Hartati, S., Maseleno, A., Fuzzy simple additive weighting and its application to toddler healthy food, Int. J. Pure Appl. Math, Vol. 118, No. 7, 2018, pp. 1-7.
 28. Muslihudin, M., Susanti, T.S., Maseleno, A., The priority of rural road development using fuzzy logic based simple additive weighting, Int. J. Pure Appl. Math, Vol. 118, No. 8, 2018, pp. 9-16.
 29. Irviani, R., Dinulhaq, I., Irawan, D., Renaldo, R., Maseleno, A., Areas prone of the bad nutrition based multi attribute decision making with fuzzy simple additive weighting for optimal analysis, Int. J. Pure Appl. Math, Vol. 118, No. 7, 2018, pp. 589-596.
 30. Assahubulkahfi, M., Sam, Y.M., Maseleno, A., Huda, M., LQR Tuning by Particle Swarm Optimization of Full Car Suspension System, International Journal of Engineering & Technology (UAE), Vol. 7, No. 2.13, 2018, pp. 328-331.
 31. Maseleno, A., Tang, A.Y.C., Mahmoud, M.A., Othman, M., Negro, Y.S., Boukri, S., Shankar, K., Abadi, S., Muslihudin, M., The Application of Decision Support System by using Fuzzy SAW Method in Determining the Feasibility of Electrical Installations in Customer's House, International Journal of Pure and Applied Mathematics, Vol. 119, No. 16, 2018, pp. 4277-4286.
 32. Sujana, A.P., Sitanggang, A.S., Maseleno, A., Application of E-Transport through Android-Based Ticketing Applications, Journal of Advanced Research in Dynamical and Control Systems, Issue 13-Special Issue, 2018, pp. 1347-1356.
 33. Susilowati, T., Dacholfany, M.I., Amini, S., Ikhwan, A., Nasir, B.M., Huda, M., Prasetyo, A., Maseleno, A., Satria, F., Hartati, S., Getting Parents Involved in Child's School: Using Attendance Application System Based on SMS Gateway, International Journal of Engineering and Technology (UAE), Vol. 7, No. 2.27, 2018, pp. 167-174.
 34. Abadi, S., Huda, M., Hehsan, A., Ripin, M.N., Haron, Z., Muhamad, N.H.N., Rianto, R., Maseleno, A., Renaldo, R., Syarifudin, A., Design of student score application for assessing the most outstanding student at vocational high school. International Journal of Engineering and Technology, Vol. 7, No. 2.27, 2018, pp. 172-177.
 35. Aminudin, N., Sundari, E., Shankar, K., Deepalakshmi, P., Fauzi, Irviani, R., Maseleno, A., Weighted Product and Its Application to Measure Employee Performance, International Journal of Engineering and Technology (UAE), Vol. 7, No. 2.26, 2018, pp. 102-108.
 36. Putra, D.A.D, Jasmi, K.A., Basiron, B., Huda, M., Maseleno, A., Shankar, K., Aminudin, N., Tactical steps for e-government development, International Journal of pure and applied mathematics, Vol. 119, No. 15, 2018, pp. 2251-2258.
 37. Anggraeni, E.Y., Huda, M., Maseleno, A., Safar, J., Jasmi, K.A., Mohamed, A.K., Hehsan, A., Basiron, B., Ihwani, S.S., Embong, W.H.W., Mohamad, A.M., Noor, S.S.M., Fauzi, A.N., Wijaya, D.A., Poverty Level Grouping using SAW Method, International Journal of Engineering and Technology (UAE), Vol. 7, No. 2.27, 2018, pp. 218-224.
 38. Abadi, S., Huda, M., Jasmi, K.A., Noor, S.S.M., Safar, J., Mohamed, A.K., Embong, W.H.W., Mohamad, A.M., Hehsan, A., Basiron, B., Ihwani, S.S., Maseleno, A., Muslihudin, M., Satria, F., Irawan, D., Hartati, S., Determination of the Best Quail Eggs using Simple Additive Weighting, International Journal of Engineering and Technology (UAE), Vol. 7, No. 2.27, 2018, pp. 225-230.
 39. Susilowati, T., Teh, K.S.M., Nasir, B.M., Don, A.G., Huda, M., Hensafitri, T., Maseleno, A., Oktafianto, Irawan, D., Learning Application of Lampung Language based on Multimedia Software, International Journal of Engineering and Technology (UAE), Vol. 7, No. 2.27, 2018, pp. 175-181.
 40. Abadi, S., Nasir, B.M., Huda, M., Ivanova, N.L., Sari, T.I., Maseleno, A., Satria, F., Muslihudin, M., Application model of k-means clustering: Insights into promotion strategy of vocational high school, International Journal of Engineering and Technology (UAE), Vol. 7, No. 2.27, 2018, pp. 182-187.
 41. Ristiani, Pardimin, Teh, K.S.M., Fauzi, A., Hananto, A.L., Huda, M., Muslihudin, M., Shankar, K., Maseleno, A., 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, Vol. 10, 02-Special Issue, 2018.
 42. Hamid, A., Sudrajat, A., Kawangit, R.M., Don, A.G., Huda, M., Jalal, B., Akbar, W., Onn, A., Maseleno, A., Determining basic food quality using SAW, International Journal of Engineering and Technology(UAE), Vol. 7, No. 4, pp. 3548-3555, 2018.

43. Oktafianto, Kawangit, A.S., Kawangit, R.M., Don, A.G., Huda, M., Saputri, A.D., Latif, A.A., Maseleno, A., Determining housing location using weighted product, *International Journal of Engineering and Technology (UAE)*, Vol. 7, No. 4, pp. 3563-3568, 2018.
44. Huda, M., Maseleno, A., Teh, K.S.M., Don, A.G., Basiron, B., Jasmi, K.A., Mustari, M.I., Nasir, B.M., Ahmad, R., Understanding Modern Learning Environment (MLE) in Big Data Era, *International Journal of Emerging Technologies in Learning (iJET)*, Vol. 13, No. 5, 2018, pp. 71-85.
45. Lakshmanaprabu, S. K., Shankar, K., Ilayaraja, M., Nasir, A. W., Vijayakumar, V., & Chilamkurti, N. (2019). Random forest for big data classification in the internet of things using optimal features. *International Journal of Machine Learning and Cybernetics*, 1-10. <https://doi.org/10.1007/s13042-018-00916-z>
46. Uthayakumar, J., Metawa, N., Shankar, K., & Lakshmanaprabu, S. K. (2018). Financial crisis prediction model using ant colony optimization. *International Journal of Information Management*. <https://doi.org/10.1016/j.ijinfomgt.2018.12.001>
47. Uthayakumar, J., Metawa, N., Shankar, K., & Lakshmanaprabu, S. K. (2018). Intelligent hybrid model for financial crisis prediction using machine learning techniques. *Information Systems and e-Business Management*, 1-29. <https://doi.org/10.1007/s10257-018-0388-9>
48. Lakshmanaprabu, S. K., Mohanty, S. N., Shankar, K., Arunkumar, N., & Ramirez, G. (2019). Optimal deep learning model for classification of lung cancer on CT images. *Future Generation Computer Systems*, 92, 374-382.
49. Karthikeyan, K., Sunder, R., Shankar, K., Lakshmanaprabu, S. K., Vijayakumar, V., Elhoseny, M., & Manogaran, G. (2018). Energy consumption analysis of Virtual Machine migration in cloud using hybrid swarm optimization (ABC-BA). *The Journal of Supercomputing*, 1-17.
50. Lydia, E. L., Kumar, P. K., Shankar, K., Lakshmanaprabu, S. K., Vidhyavathi, R. M., & Maseleno, A. (2018). Charismatic Document Clustering Through Novel K-Means Non-negative Matrix Factorization (KNMF) Algorithm Using Key Phrase Extraction. *International Journal of Parallel Programming*, 1-19.
51. Shankar, K., Lakshmanaprabu, S. K., Gupta, D., Maseleno, A., & de Albuquerque, V. H. C. (2018). Optimal feature-based multi-kernel SVM approach for thyroid disease classification. *The Journal of Supercomputing*, 1-16.
52. Lakshmanaprabu, S. K., Shankar, K., Khanna, A., Gupta, D., Rodrigues, J. J., Pinheiro, P. R., & De Albuquerque, V. H. C. (2018). Effective Features to Classify Big Data Using Social Internet of Things. *IEEE Access*, 6, 24196-24204.
53. Maseleno, A., Tang, A. Y., Mahmoud, M. A., Othman, M., Negoro, S. Y., Boukri, S., ... & Muslihudin, M. The Application of Decision Support System by Using Fuzzy Saw Method in Determining the Feasibility of Electrical Installations in Customer's House. *International Journal of Pure and Applied Mathematics*, 119(16).
54. Muslihudin, M., Wanti, R., Hardono, N., Shankar, K., Ilayaraja, M., Maseleno, A., ... & Mukodimah, S. (2018). Prediction of Layer Chicken Disease using Fuzzy Analytical Hierarchy Process. *International Journal of Engineering & Technology*, 7(2.26), 90-94.
55. 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.
56. Aminudin, N., Sundari, E., Shankar, K., Deepalakshmi, P., Fauzi, R. I., & Maseleno, A. (2018). Weighted Product and Its Application to Measure Employee Performance. *International Journal of Engineering & Technology*, 7(2.26), 102-108.
57. Putra, D. A., 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.
58. 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.
59. Susilowati, T., Jasmi, K. A., Basiron, B., Huda, M., Shankar, K., Maseleno, A., & Julia, A. (2018). Determination of Scholarship Recipients Using Simple Additive Weighting Method. *International Journal of Pure and Applied Mathematics*, 119(15), 2231-2238.
60. Shankar, K. (2017). Prediction of Most Risk Factors in Hepatitis Disease using Apriori Algorithm. *Research Journal of Pharmaceutical Biological and Chemical Sciences*, 8(5), 477-484.
61. Septiropa, Z., Osman, M.H., Rahman, A.B.A., Arifin, M.A.M., Huda, M., Maseleno, A., Profile of cold-formed steel for compression member design a basic combination, *International Journal of Engineering and Technology (UAE)*, Vol. 7, No. 2.27, 2018, pp. 284-290.
62. Abadi, S., Huda, M., Teh, K.S.M., Haron, Z., Ripin, M.N., Hehsan, A., Sarip, S., Hehsan, M.R., Amrullah, M., Maseleno, A., Hazard Level of Vehicle Smoke by Fuzzy Multiple Attribute Decision Making with Simple Additive Weighting Method, *International Journal of Pharmaceutical Research*, Vol. 10, Issue 4, 2018.
63. Kamenez, N.V., Vaganova, O.I., Smirnova, Z.V., Bulayeva, M.N., Kuznetsova, E.A., Maseleno, A., Experience of the use of electronic training in the educational process of the Russian higher educational institution, *International Journal of Engineering and Technology (UAE)*, Vol. 7, No. 4, pp. 4085-4089, 2018.
64. Vaganova, O.I., Zanfira, L.N., Smirnova, Z.V., Chelnokova, E.A., Kaznacheeva, S.N., Maseleno, A., On the linguistic training of future teachers of unlike specialties under the conditions of Russian professional education, *International Journal of Engineering and Technology (UAE)*, Vol. 7, No. 4, pp. 4090-4095, 2018.
65. Vaganova, O.I., Kamenez, N.V., Sergeevna, V.I., Vovk, E.V., Smirnova, Z.V., Maseleno, A., Possibilities of information technologies to increase quality of educational services in Russia, *International Journal of Engineering and Technology (UAE)*, Vol. 7, No. 4, pp. 4096-4102, 2018.
66. Smirnova, Z.V., Zanfira, L.N., Vaganova, O.I., Bystrova, N.V., Frolova, N.V., Maseleno, A., WorldSkills as means of improving quality of pedagogical staff training, *International Journal of Engineering and Technology (UAE)*, Vol. 7, No. 4, pp. 4103-4108, 2018.
67. Aminin, S., Dacholfany, M.I., Mujib, A., Huda, M., Nasir, B.M., Maseleno, A., Sundari, E., Masrur, M., Design of library application system, *International Journal of Engineering and Technology (UAE)*, Vol. 7, No. 2.27, 2018, pp. 199-204.
68. Aminudin, N., Huda, M., Kilani, A., Embong, W.H.W., Mohamed, A.M., Basiron, B., Ihwani, S.S., Noor, S.S.M., Jasmi, K.A., Higher education selection using simple additive weighting, *International Journal of Engineering and Technology (UAE)*, Vol. 7, No. 2.27, 2018, pp. 211-217.
69. Maseleno, A., Huda, M., Jasmi, K.A., Basiron, B., Mustari, I., Don, A.G., and Ahmad, R. Hau-Kashyap approach for student's level of expertise. *Egyptian Informatics Journal*, 2019.
70. Maseleno, A., Tang, A.Y.C., Mahmoud, M.A., Othman, M., Shankar, K., Big Data and E-Learning in Education, *International Journal of Computer Science and Network Security*, Vol. 18, No. 5, pp. 171-174.
71. Amin, M.M., Sutrisman, A., Stiawan, D., Maseleno, A., Design Restful Webservice of National Population Database for supporting E-health interoperability service, *Journal of Theoretical and Applied Information Technology*, vol. 96, issue 15, 2018.
72. Surendar, A., Akhmetov, L.G., Ilyashenko, L.K., Maseleno, A., Samavatian, V., Effect of thermal cycle loadings on mechanical properties and thermal conductivity of a porous lead-free solder joint, *IEEE Transactions on Components, Packaging, and Manufacturing Technology*, 2018, pp. 1769-1776.
73. Surendar, A., Samavatian, V., Maseleno, A., Ibatova, A.Z., Samavatian, M., Effect of solder layer thickness of thermo-mechanical reliability of a power electronic system, *Journal of Material Science: Materials in Electronics*, Springer, September 2018, Volume 29, Issue 17, pp. 15249-15258.
74. Samavatian, M., Ilyashenko, L.K., Surendar, A., Maseleno, A., Samavatian, V., Effect of System Design on Fatigue Life of Solder Joints in BGA Packages Under Vibration at Random Frequencies, *Journal of Electronic Materials*, November 2018, Volume 47, Issue 11, pp. 6781-6790.
75. Javanshir, I., Maseleno, A., Tasoujian, S., Oveisi, M., Optimization of suspension system of heavy off-road vehicle for stability enhancement using integrated anti-roll bar and coiling spring mechanism, *Journal of Central South University*, September 2018, Volume 25, Issue 9, pp. 2289-2298.
76. Surendar, A., Bozorgian, A., Maseleno, A., Ilyashenko, L.K., Najafi, M., Oxidation of Toxic Gases via Ge-B36N36 and Ge-C72 Nanocages as Potential Catalysts, *Inorganic Chemistry Communications*, Elsevier, Vol. 96, October 2018, pp. 206-210.

77. Namdarian, A., Tabrizi, A.G., Maselena, A., Mohammadi, A., Mossavifard, S.E., One step synthesis of rGO-Ni₃S₂ nano-cubes composite for high-performance supercapacitor electrodes, International Journal of Hydrogen Energy, Elsevier, vol. 43, Issue 37, 13 September 2018, pp.17780-17787.
78. Motlagh, A.H., Klyuev, S.V., Surendar, A., Ibatova, A.Z., Maselena, A., Catalytic Gasification of Oil Sludge with Calcined Dolomite, Petroleum Science and Technology, Taylor and Francis, pp. 1-5, 2018.