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"Prospects and Defies for Future Research and Innovation of Informatics and Business in Post-Pandemic Era"

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INSTITUT INFORMATIKA DAN BISNIS DARMAJAYA

LPPM Research and Community Service Affairs

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PROSPECTS AND DEFIES FOR FUTURURE RESEARCH AND INNOVATION OF INFORMATICS AND BUSINESS IN POST-PADEMIC ERA

Bandar Lampung, Lampung, Indonesia
17 November 2021

INSTITUT INFORMATIKA DAN BISNIS DARMAJAYA
Lampung,
Indonesia

Foreword

First of all, we would like to express unbounded praise and gratitude to ALLAH SWT, The Most Gracious and Almighty God, that brings us love and grace for all of us so that the 7th International Conference Informatics Technology and Business (ICITB) can be run well. The 7th International Conference Informatics Technology and Business (ICITB) is the event head by the Research, Learning Development, and Community Service Institution. This event is intended as a forum for disseminating the result of the scientific research on the community service conducted by reputable researchers and for exchanging the information among researchers and the wider community.

The 7th ICITB theme is "**PROSPECTS AND DEFIES FOR FUTURURE RESEARCH AND INNOVATION OF INFORMATICS AND BUSINESS IN POST-PADEMIC ERA**" is a very crucial issue in the environment that we are facing in the development of Indonesia. The 7th ICITB can be used as a tool to improve the quality of research results and future service. Moreover, it is also expected to be a forum for gathering and disseminating the research results that support the development of Indonesia.

The 7th ICITB participants come from all three countries. There are more than 100 people from various institutions from universities, research and development agencies, practitioners, government, teachers, and students. Participants are divided into several major research topics related to Information Technology, and Economics and Business which are expected to cover all aspects of the 7th ICITB Thus, the significances of this event are the high participation of students in the 7th ICITB.

Therefore, we would like to thank all parties and participants who have helped and support the implementation of the 7th ICITB.

Bandar Lampung, 17 November 2021
Dr. Muhammad Said Hasibuan
Chairman of 7th ICITB

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CaFiAR: Software to Learn Fish Cultivation in the Bucket to Support Food Security Program in Society

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***Abstract*— Budikdamber is a method of cultivating fish and vegetables in the bucket to support food security in the community. This cultivation is easy to install, cheap, and suitable for narrow areas or limited water. This technique is implemented in various community groups; however, many of them are facing difficulties because of a lack of information and experiences. To overcome this issue, an application, CaFiAR, based on augmented reality technology was built to bestow information of 3D pictures of ready to harvest and sick catfish. The 3D objects were developed using Blender and Android Studio software. After several tests, we found this application behaving according to its framework and acceptable among the cultivator.**

Keywords—software, fish, cultivation, food, security, orphanage

I. INTRODUCTION

Fish cultivation in the buckets, also known as budikdamber, is a technique of cultivating fish in a container or bucket as a medium to substitute the pound. This cultivation has many advantages such as being suitable on a narrow land, limited water area, tools and materials are easy to find, and zero electricity [1]. Thus, we can use this cultivation technique to support food needs in households, boarding schools, and orphanages to meet the nutritional and food security of the community [2]. Budikdamber is implemented in various regions in Indonesia, such as Bandar Lampung [2], Way Kanan [3], North Lombok [4], and North Maluku [5].

The community groups that develop this cultivation experience difficulty because most of them do not have sufficient knowledge about cultivation and harvest management. Usually, information is obtained through social media such as YouTube, Instagram, and Facebook. Based on our experiences with the development economic autonomy team in some orphanages in Lampung, these media did not provide all the required information, such as the catfish's growth.

Currently, the team use brochures containing management procedures and pictures of ready-to-harvest fish as examples. However, the images are unclear, partial, and there is no example of sick fish. To overcome this problem, we have built CaFiAR, a catfish Augmented Reality, the 3D application to give a clear picture of sick and harvest-ready catfish.

Some application to classify fish using 3D technology was published, such as introducing ornamental fish to toddlers [6] and betta fish to help farmers to identify 73 variants of this fish [7]. The CaFiaR is not only built as a learning media for the farmers, but also to support the expansion of the Budikdamber and food independence program. This app is acting as an education tool to allow the community to learn to cultivate in new ways; attractive, interactive, and existing, thus, it can advance their knowledge [8].

This paper is organized as follow; the first part provided a piece of information about the background behind the development of 3D catfish, in part two, we explored some related researches, continued by a scheme we proposed in this project. Moreover, we discussed the result of this research in part four and concluded it in part five.

II. RELATED WORK

Augmented Reality (AR) has been used in many sectors as an education medium. In 2014, zooAR was proposed to replace the signage with AR to let the visitors have individualized connections with animals in the zoo with minimum budget and keep the natural environment safe [9]. To find out visitors' satisfaction and difficulty in using this app, one hundred eighty surveys were collected in three exhibits of panther, orangutan, and elephant at Tampa's Lowry Park Zoo. The result was the majority of them like the zooAR as an education medium rather than signage.

In 2017, Fransiska, et al [10] proposed ARANIMALS software to virtually introduce some animals such as bears, lions, cows, and horses to the children to help them know the shape and the voices of these animals interactively. As this software is intended for pupils, the splash screen and menu are animated.

Karundeng, et al [12] also take the advantage of AR technology by creating software called Aria, to familiarize people with rare animals in five islands of Indonesia. The 3D animals were built by using blender and Asset 3D applications.

In terms of learning biology using AR, Weng, et al [13] stated students found studying more interesting and enjoyable, though they found it was difficult to discover the marker and required amount of time to scan the marker that might be due to inadequate internet reception. These statements gathered from the experimental groups consist of 68 ninth graders in one of the junior high schools in Indonesia.

AR technology also offered an ability to detect fish disease, specifically Labeo bata species, along with artificial intelligence [14]. This technology allows users to identify and visually match fish diseases.

III. PROPOSED SCHEME

To develop CaFiAr, we used this five-phase framework from collecting data, designing, modeling, coding and testing, to distribute the apps (table 1).

TABLE 1. FRAMEWORK

Phase	Purpose
Communication	At this stage, we collected data on cultivation and installation of budikdamber, harvest, problems in cultivation, and user needs. For this purpose, we interviewed some parties: Experts in the field of fisheries/inventor of the budikdamber technique. Manager of the orphanages. In addition, we did observations at the orphanages during the installation and maintenance of cultivation to get information about the knowledge of the cultivators.
Quick design	Based on the data collected at the previous stage, we determined the user need.
Quick design modeling	The design modeling stage will quickly focus on what end-user can see in the Apps. We divided this stage into four models: Menu structure Use case diagram Activity diagrams Interface
Prototyping	We built CaFiAR using Blender and Android Studio Software, continued by testing it to explore the holes and user views.
Software distribution	The software would be installed directly on the smartphone of orphanages management and uploaded to the Apps store.

A. USER NEEDS

Based on interviews and observation, we make a list of what kind of information the user needs to begin and run the cultivation. The list consists of:

General information about budikdamber.

Material about the installation and maintenance of budikdamber.

Figure the growth of catfish.

3D object of healthy and sick catfish.

B. QUICK DESIGN

The menu structure (fig.1) describes the feature of the application. When the application is running, a *splash screen* is displayed then switch to the home menu page as the main view. This menu has three sub-menus to choose: general information, installation, maintenance, and fish growth. Scan AR menu has two-sub menus to guide user on how to scan and view the 3D Catfish by clicking AR scan guide and Scan respectively.

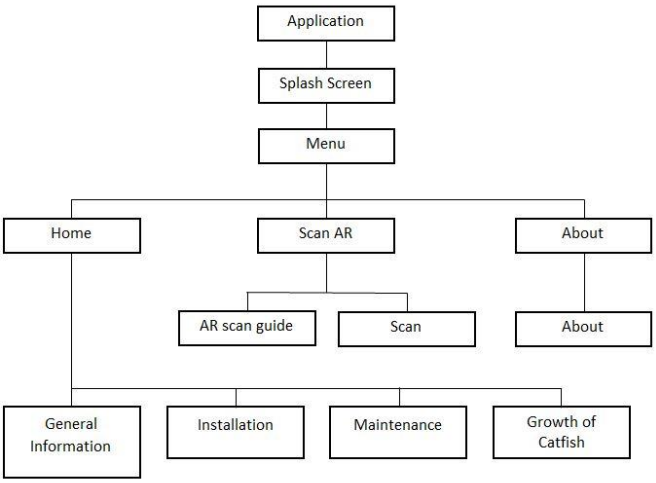

Fig 1. Structure of Menu CaFiAR

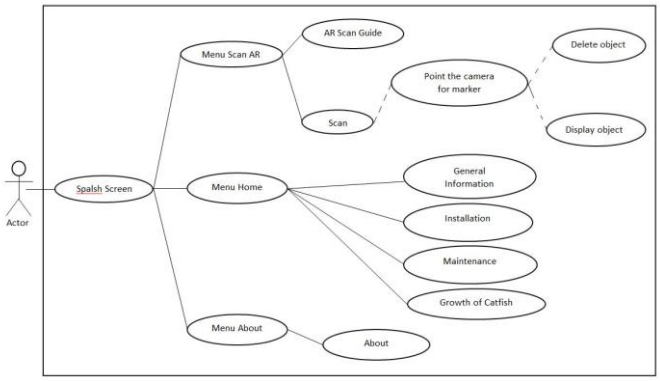

Fig 2. Use Case CaFiAR

While the use case diagram illustrates the relationship between the actors (the cultivator) and the system, the activity diagram describes the workflow of the existing system in software. We have drawn three diagrams: home, scan AR, and about. Moreover, we designed ten interfaces to visualize the software.

C. PROTOTYPING

In this stage, we created the 3D object frame by adjusting the shape modelling of the source of the existing object. The 3D design was built based on the pictures taken during the fish harvesting. Fig 3 is the creation of a 3D object frame by adjusting the shape modelling of the existing object source.

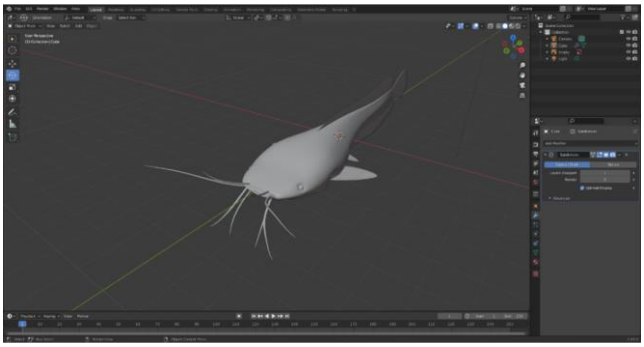

Fig 3. The 3D Modelling

We tested this application on foster children in one of our fostered orphanages through a community partnership service program. This experimental group consisted of 24 children, all of whom were boys.

IV. RESULT AND DISCUSSION

The growing of catfishes had different times until harvest yields. These are influenced by many factors, such as the level of water turbidity and bucket drain. Hence, the cultivators need to have a good understanding of these issues.

This research has produced 3D software to allow the community to learn how to farm fish, particularly catfish, in the bucket. In addition, there is some information on how to plant spinach using plastic cups and charcoal. This is to make sure that the cultivators can get benefit from fish and vegetables as well.

When the cultivators activate the software, the splash screen will appear to welcome them (fig. 4). This page has duration of 5 seconds before entering the home menu view.

Fig 4. Splash Screen

Figure 5 demonstrates the home page that works for calling four sub-menus. Figure 6 displays the installation plant media page consisting information on planting some vegetables such as kale and spinach in the bucket.

Fig 5. Home Menu

Fig 6. Installation Plant Media

Additionally, in figure 7, some pictures are enlightening about the growth of catfish, including the length and weight of the fish. Further, figure 8 is a page to display a 3D shape of a healthy and sick catfish. The 3D object will appear after the camera has detected a flat surface then marker points appear to show 3D objects.

Fig 7. Cat Fish Growth

Fig 8. 3D Catfish

We run the application in various light conditions and distances to explore how its reaction in such scenarios. Tables 2 and 3 in the index show several assessments from three different environments. We can see the application can run in dark, low, and bright light also it is able to scan the marker up to a 2-meter distance.

To find out if this application can help farmers to get some knowledge of the growth and sick fish, we tested this program in one of our cultivation communities, where at this moment they cultivate 2,000 catfish using budikdamber method. This community consist of 24 foster kids between aged 10-14 years. Their education level is primary school and junior high school. The entire participant had experienced using a smartphone, though not using it daily due to orphanage regulation. Half of them have interacted with some 3D apps previously.

There are 11 questions divided into four groups: a first three questions are about general question age, sex, and level of education of the respondents; the second two questions are asking their experience using 3D with optional answer YES or NO; the third two questions are exploring their knowledge about the fish with the possible answer is YES and NO; and the last group of question is asking about their experience using the CaFiAR software.
The distribution of the age of respondents was: the most age, belonging to 10 respondents, is 13 years, followed by eight kids aged 12 years, and two groups of three kids are ages of 10 and 14 years respectively (figure 9).

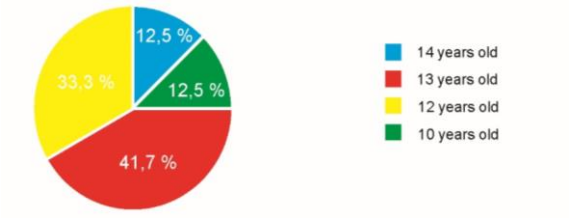

Fig 9. Age Distribution

The answers on the sheet revealed that all the youngster do not have knowledge about the sick and ready harvest fish (figure 10).

Fig 10. Respondent knowledge

The last part of the questionnaire investigated if the kids understand and can operate the application. The respondents who response with very easy and easy were 41,7% and 58.3% respectively. None of them thought it was either difficult or very difficult (fig 11).

Fig 11. Operate the App

Also, we throw question if this application helps them in knowing the growth of catfish and other knowledge on budikdamber. 83,3% of them stated it is very helpful and 16,7% said helpful (fig 12).

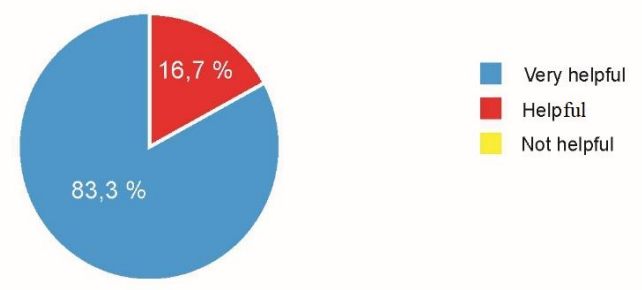

Fig 12 Utilize of CaFiAR

Moreover, we asked them if they feel uncomfortable such as nausea or dizziness when using the app. 24 respondents found this application is comfortable to use (fig. 13).

Fig 13. the feeling of Using CaFiAR

The last question delivered was if they want to recommend this app to other farmers, they all responded with yes (fig. 14).

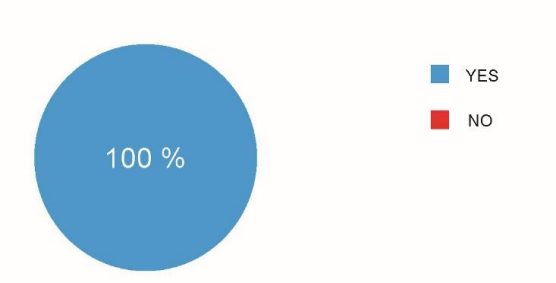

Fig 14. Recomend the App

After 76 days of cultivations, these young farmers measured the length and weight of 100 fishes using their knowledge from the CaFiAR. The average length is 20 cm and the weight is 80 grams that mean ready to harvest. They also investigated if there was sick fish; the result was all of them were healthy (figure15).

Fig 15. Catfish in the Bucket

Based on these results, this application has helped the young farmers to learn how to cultivate the catfish using budikdamber technique.

V. CONCLUSION

In summary, budikdamber is a new technique in fish farming. Efforts to convey information about fish growth by distributing brochures still have some shortcomings. The sample of fish distributed with the flyer is unclear, such as not all sides of the fish can be seen there and no samples of sick fish. As a result, some cultivators do not have a clear understanding of fish cultivation.

We successfully developed software under augmented technology, called CaFiAR, to visualize a 3D model of catfish. In Addition, this application has some features such as installing and taking care of the budikdamber and using the bucket to plant the vegetables. Further, clear pictures of fish growth also presented.

We tried this application with various tests such as distance and light. Besides, we tested it on our foster children where we do fish cultivation in buckets. Based on these trials, the application runs well and can help the cultivators to know the condition of the fish.

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REFERENCES

[1] J. Nursandi, “Budidaya Ikan Dalam Ember ‘Budikdamber’ dengan Aquaponik di Lahan Sempit,” *Pros. Semin. Nas. Pengemb. Teknol. Pertan.*, vol. VII, no. 2013, pp. 129–136, 2015, [Online]. Available: http://jurnal.polinela.ac.id/index.php/PROSIDING.

[2] R. Syahputri, N. Nurfiana, J. Darmawan, and A. Widiantoko, “Program Pemberdayaan Ekonomi Mandiri Melalui Budidaya Perikanan Dan Perkebunan Dalam Ember Di Panti Asuhan Budi Mulya 2,” *SHARE “SHaring - Action - REflection,”* vol. 7, no. 2, pp. 91–98, 2021, doi: 10.9744/share.7.2.91-98.

[3] H. Kurniawan *et al.*, “DENGAN AQUAPONIK DI LAHAN SEMPIT Correspondent Author : henry_stk@polinela.ac.id Kampung Bumi Baru merupakan Tingkat Pendidikan Mitra,” vol. 17, no. 2, pp. 112–126, 2020.

[4] A. R. Scabra, M. I. Abdurrahman, U. Az Zuhud, and A. S. Widodo, “Introduksi Teknologi Budikdamber Di Desa Gondang Kabupaten Lombok Utara,” *Indones. J. Fish. Community Empower.*, vol. 1, no. 2, pp. 171–178, 2021, doi: 10.29303/jppi.v1i2.187.

[5] R. Andriani, F. Muchdar, S. Malan, and S. Sardi Titaheluw, “Freshwater Fish Cultivation Innovation and Its Development Potential in Fitu Village Ternate City, North Maluku Province,” *Altifani J. Int. J. Community Engagem.*, vol. 1, no. 2, p. 68, 2021, doi: 10.32502/altifani.v1i2.3535.

[6] A. Wulandari, S. Andryana, and A. Gunaryati, “Pengenalan Ikan Hias Laut Pada Anak Usia 3 Tahun Dengan Metode Marker Based Tracking Berbasis Augmented Reality,” *J. Teknol. dan Manaj. Inform.*, vol. 5, no. 2, 2019, doi: 10.26905/jtmi.v5i2.3711.

[7] M. Sari, Hasanuddin, and R. Aditya, “PENGENALAN IKAN CUPANG (BETTA FISH) MENGGUNAKAN AUGMENTED REALITY,” *J. Teknol. Inf. Univ. Lambung Mangkurat*, vol. 1, no. April, pp. 26–36, 2018.

[8] D. Siegle, “Seeing Is Believing: Using Virtual and Augmented Reality to Enhance Student Learning,” *Gift. Child Today*, vol. 42, no. 1, pp. 46–52, 2019, doi: 10.1177/1076217518804854.

[9] N. Kelling and A. Kelling, “Zooar: Zoo based augmented reality signage,” *Proc. Hum. Factors Ergon. Soc.*, vol. 2014-Janua, pp. 1099–1103, 2014, doi: 10.1177/1541931214581230.

[10] E. D. Fransiska, T. M. Akhriza, S. Informasi, T. Informatika, and M. Informatika, "IMPLEMENTASI TEKNOLOGI AUGMENTED REALITY SEBAGAI MEDIA PEMBELAJARAN INFORMATIF DAN INTERAKTIF UNTUK PENGENALAN PENDAHULUAN Augmented Reality (AR) yang Aplikasi ARANIMALS bisa lebih interaktif karena dapat memberikan pesan dan respon kepada anak-anak , s," *eminar Nas. Sist. Inf.*, no. September, pp. 636–645, 2017.

[11] K. Martono, A. F.-2017 4th I. C. on, and undefined 2017, "Design of learning media for fish classification with augmented reality technology," *ieeexplore.ieee.org*, Accessed: Oct. 28, 2021. [Online]. Available: https://ieeexplore.ieee.org/abstract/document/8257716/.

[12] C. O. Karundeng, D. J. Mamahit, and B. A. Sugiarso, "Rancang Bangun Aplikasi Pengenalan Satwa Langka di Indonesia Menggunakan Augmented Reality," *J. Tek. Inform.*, vol. 13, no. 1, pp. 1–8, 2018, doi: 10.35793/jti.13.1.2018.20852.

[13] C. Weng, S. Otanga, S. M. Christianto, and R. J. C. Chu, "Enhancing Students' Biology Learning by Using Augmented Reality as a Learning Supplement," *J. Educ. Comput. Res.*, vol. 58, no. 4, pp. 747–770, 2020, doi: 10.1177/0735633119884213.

[14] H. Chakravorty, "New Approach For Disease Fish Identification using Augmented Reality and Image Processing," vol. 9, no. 3, pp. 1–8, 2021.

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An Enterprise Architecture Plan For Balai Riset dan Standardisasi Industri Bandar Lampung

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***Abstract*—Baristand Industri Bandar Lampung is a government agency that has a vision and mission to become a professional and competitive testing, inspectionand calibration service agency. In order to realize its vision and carry out its mission, Baristand Industri Bandar Lampung requires the support of adequate facilities to carry out its business processes as a Testing Institute, Technical Inspection Institute and Calibration Institute. In carrying out its business processes, the Baristand Industri Bandar Lampung does not yet have an automated and integrated system. So far, the services provided have been carried out using computer aids, but have not used special centralized applications. This study aims to design Enterprise Architecture (EA) using the Federal Enterprise Architecture Framework (FEAF) with the aim of producing a blueprint containing business, information and technology architecture modeling that is used as a reference for creating and developing information technology in accordance with the business objectives of the Baristand Industry Bandar Lampung. The results of this study are to design information systems at the Baristand Industri Bandar Lampung, in the form of semantic models, activity diagrams, Entity Relationship Diagrams (ERD), sitemap, network architecture, table structures in databases, information system input and output, hardware and software requirements for operating systems, Data Definition Language (DDL), methods and addressing for internet connection.**

Keywords—Baristand Industry Bandar Lampung, Enterprise Architecture, FEAF

I. INTRODUCTION

The application of information technology (IT) in government organizations is fundamental in realizing organizational efficiency and effectiveness. It aims to improve the organization's ability to process, distribute, and distribute information, as well as to provide public services. Therefore, good strategic planning is needed to determine the direction of IT implementation in government organizations.

The strategic planning as outlined in the Blue Print Enterprise Architecture (EA) can be a guideline for government organizations to implement IT in the next 5 years. This is expected to be able to encourage the achievement of the vision and mission that has been set by the organization. However, most government organizations have human resources (HR) constraints in compiling the right Blue Print EA to support the performance of the organization.

EA is an architectural model to map the business structure in depth and provide clear specifications that function for coordination and supervision of business parts to achieve goals. To maximize the use of EA, a framework is needed that can model and detail the various phases of EA[1].The existence of the framework is expected to facilitate the management of complex systems and align the business with the technology to be developed. So far, there are several frameworks commonly used in EA modeling, including: Zachman Framework, TOGAF (The Open Group Architecture Framework), FEAF (Federal Enterprise Architecture Framework), and TEAF (Treasury Enterprise Architecture Framework)[2].

This research is aimed at developing an EA at Balai Riset dan Standardisasi Industry Bandar Lampung or abbreviated as Baristand Industri Bandar Lampung which has a vision of "becoming a professional and competitive testing, inspection and calibration service institution". To support the business processes of Baristand Industry Bandar Lampung needs to design an automated and integrated system.

Related to these problems, it is necessary to have an IT development solution at the Baristand Industry Bandar Lampung which is carried out in a planned and measurable manner according to the capabilities of the institution. The IT development plan is outlined in the form of an EA Blue Print which is prepared using FEAF. The selection of FEAF as a framework for designing EA at the Baristand Industry Bandar Lampung is based on that FEAF is considered quite good and suitable to be applied to systems in government agencies.

II. LITERATURE REVIEW

A. Enterprise Architecture (EA)

EA is an explanation of how an organization designs a system to support business and technology needs in realizing its mission and vision as well as achieving targeted results[3].The emergence of EA begins with a complex system of how organizations have to spend huge amounts of money in designing or developing their own systems and business alignment with technology, how organizations have difficulty aligning business needs with technology[4].

B. Federal Enterprise Architecture Framework (FEAF)

In developing EA, one of the techniques used is FEAF, which was introduced in 1999 by the Federal CIO Council, aimed at developing EA within the Federal Agency or a system that crosses multiple inter-agency boundaries[5].Provides standards for developing and documenting architectural descriptions in areas of high priority, as appropriate for describing architecture for the Federal government.

In Figure 1 FEAF supports enterprise architecture components, namely business, data, application, and

technology architectures and adopts the three main columns of the Zachman framework consisting of data descriptions, function descriptions, and network descriptions which have six parts of the architecture, each part has a reference models that can be used as architectural models, namely; strategy, business, data, applications, infrastructure, and security[3].

FEAF produces four processes, each level providing an understanding or frame of reference for the following year.In level three, describes the development of the eight components in more detail that leads to a logical structure for classifying and organizing the descriptive depiction of Federal companies at level IV[5]. FEAF Component Structure can be seen in Figure 1.

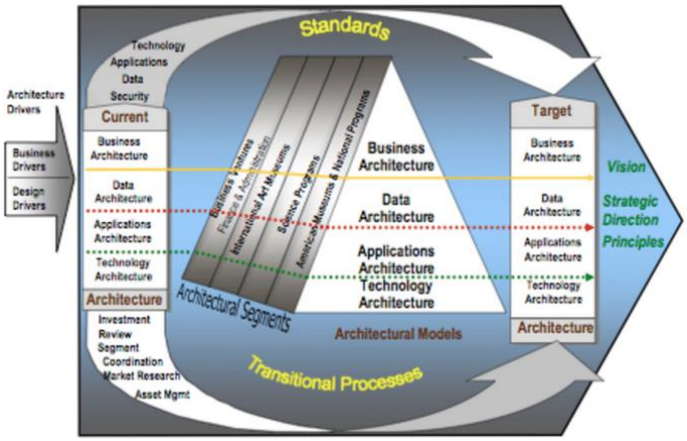

Fig. 1. FEAF Component Structure[1]

Research related to EA modeling is to compare enterprise architecture frameworks consisting of the Zachman, TOGAF, FEAF and Garner frameworks, each of which has weaknesses and strengths, such as Zachman who has strengths in taxonomy completeness, TOGAF in process, Gartner has strengths in practice guidance and business focus, while in the FEAF framework is in the partitioning guidance and prescriptive catalog[4]. The FEAF provides a structure for developing, maintaining and implementing the top-level operational environment and supporting the implementation of IS/IT systems. The objectives of the FEAF are to enable federal governments and organizations to achieve improvements in technology and reduce government IT overspending, facilitate IT integration and data sharing between institutions, use common architectural practices, serve customer needs better quickly and cost-effectively and help institutions meet EA's legislative mandate.

The characteristics and advantages of the Zachman, TOGAF and FEAF EA frameworks can be seen in table 1 and table 2 below;

TABLE I. CHARACTERISTICS OF EA FRAMEWORK

Enterprise architecture framework	**Characteristics**
Zachman	- Positioning framework - Results catalyst - EA's limited usability - History in manufacturing - Wide acceptance - Limited holistic perspective - Planning tool
TOGAF	- Enterprise architecture development methodology - History in defense - Open standard - Neutral - Wide acceptance - Holistic perspective - Process/planning tools
FEAF	- EA Reference Model - Federal government enterprise architecture - Standards adopted by the United States government - Displays a comprehensive view perspective - It is a tool for planning and communication

TABLE II. ADVANTAGES OF ENTERPRISE ARCHITECTURE FRAMEWORK

Enterprise architecture framework	**Advantages of enterprise architecture**
TOGAF	- Widely used, has strength in process - Can be accessed publicly - Full support for technology architecture.
Zachman	- Generate different viewpoints - Pioneer of enterprise architecture and well-known.
FEAF	- Simple and easy to use - Specially designed for government - Have a reference model

C. PEST

PEST is an analysis of business external environmental factors covering the political, economic, social and technological fields[6]. PEST is used to assess the market of a business unit or organization, the direction of PEST analysis is a framework for assessing a situation and assessing the strategy or position, direction of the company, marketing plans or ideas. In this analysis can be taken a new opportunity or threat for the company. The four factors that are components of PEST are as follows:

- Political factors, including government policies, legal issues, and include formal and informal rules of the environment in which the company conducts activities.
- Economic factors, including all factors that affect the purchasing power of customers and affect the climate of a company's business.
- Social factors, including all factors that can affect the needs of customers and affect the size of the existing market share.
- Technological factors, including all things that can help in dealing with business challenges and support the efficiency of business processes.

D. SWOT Analysis

SWOT analysis is a method for identifying various actors systematically to formulate strategies based on the logic obtained, maximizing strengths, and opportunities, then simultaneously minimizing weaknesses and threats[7]. SWOT analysis compares the external factors of opportunities and threats with the internal factors of strengths and weaknesses.

III. RESEARCH METHODOLOGY

The research methodology is shown by research with steps based on the FEAF framework which has four stages to produce an information system blueprint, these stages refer to four levels, as shown in Figure 2.

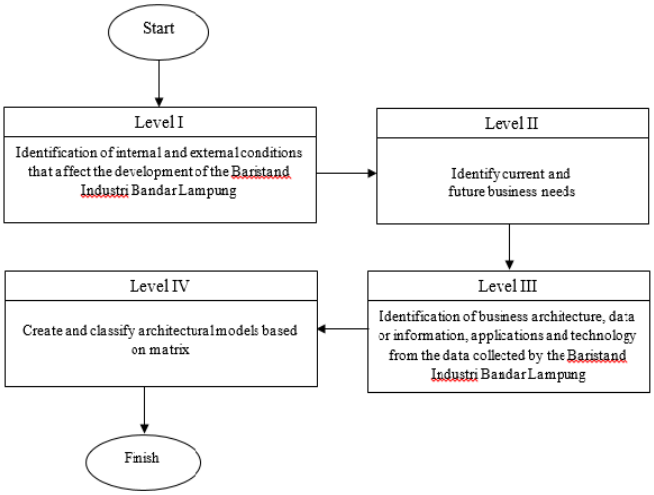

Fig. 2. Research Steps

The stages in the research based on the FEAF framework are as follows;

1) Level I

This stage is an important stage in the FEAF adaptation process because this stage is a preparation process to define what kind of EA you want to build in accordance with the needs and strategic goals of the organization. This stage uses SWOT (Strength, Weakness, Opportunities, Threat) analysis tools and PEST (Politic, Economy, Social, and Technology) analysis. Analysis tools are used to identify the current state of the organization and will provide analysis results for use in the next stage.

2) Level II

At this level, value chain analysis techniques are used to identify the current process or service needs of the Baristand Bandar Lampung Industry services and the need for it in the future. By using value chain analysis techniques, it is expected to facilitate the grouping of main activities and supporting activities. The results of the value chain analysis on the Baristand Industry Bandar Lampung business process can be seen in Figure 3.1.

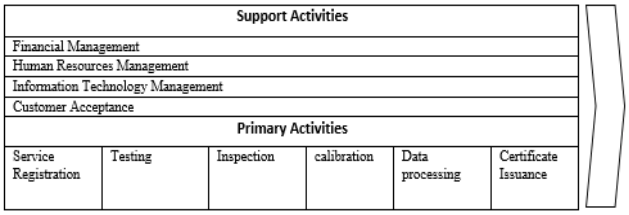

Fig. 3. Results of Value Chain Analysis

3) Level III

At this level using the analysis technique of Business System Planning (BSP), carried out in two stages, namely;

a) Identifying the organization's business goals, at this stage the researcher makes details and modeling of the information architecture of the organization's business processes such as vision and mission, service announcements, main tasks and organizational functions and organizational governance in the Baristand Industry Bandar Lampung.

b) Identify business processes, business processes that have been identified using the value chain are described again in more detail using the identification and business process analysis form.

4) Level IV

At this level, identify the details of the object of each architectural model, namely data, applications, and technology using the FEAF matrix. The FEAF matrix divides the four architectures into 5 perspectives, namely scope, business model, information systems model, technology model, and detailed specifications.

a) The scope is how big the system will be, the development environment

b) The business model is the business process handled by the system

c) Information system model, namely the type of data, data flow, and its function in business processes

d) Technology models, namely programming languages, input/output devices and other supporting technologies to develop the system

e) Detailed specifications, namely development modules and system structure.

Based on the five perspectives, it will be further divided to be more focused with the help of the questions of what (entity), how (activity), and where (location).And finally the proposed information system is issued in this phase, which is expected to help the organization. The FFAF matrix can be seen in Figure 4.

	Data Architecture	Application Architecture	Technology Architecture
Planner Perspective	List of Business Objects	List of Business Processes	List of Business Locations
Owner Perspective	Semantic Model	Business Process Model	Business Logistics System
Designer Perspective	Logical Data Model	Application Architecture	System Geographic Deployment Architecture
Builder Perspective	Physical Data Model	Systems Design	Technology Architecture
Subcontractor Perspective	Data Dictionary	Programs	Network Architecture

Fig. 4. Matriks FEAF Level IV

The explanation of the five perspectives is as follows;

a) Planner Perspective

Provide an overview of the scope that will be developed in Baristand Industry Bandar Lampung. The three cells defined are as follows:

- Column What (List of Business Object) column contains data or information needed for the continuity of the business process functions at the Baristand Industry Bandar Lampung, namely service registration, testing, inspection,

calibration, issuance of service certificates and financial management.

- Column How (List of Business Process), contains the business processes that occur at the Baristand Industry Bandar Lampung with the aim of achieving organizational performance. The business process is divided into two activities, namely main activities and supporting activities.
- Column Where (List of Business Locations), contains a general description and geographical conditions located at the Office of Baristand Industry Bandar Lampung, which is located at Jl.By Pas Soekarna Hatta KM.1 Rajabasa Bandar Lampung.

b) Owner Perspective

This Owner's perspective is a business design and shows business entities, processes and their relationships. The three cells are defined as follows;

- Column What (Semantic Model), contains a semantic model that is used to explain the relationship between data in a logical database[8], the model is divided into business processes including service registration, testing, inspection, calibration and payment.
- Column How (Business Process Model), contains activity diagrams (flowcharts), namely the manual flow of business processes that occur, namely other services registration, testing, inspection, calibration and payment.
- Column Where (Business Logistics System), contains the location used to carry out business processes at the Baristand Industry Bandar Lampung, namely the service registration service, the process of issuing certificates and payment services, the testing process, the inspection process and the calibration process.

c) Designer Perspective

The designer's perspective explains that the system model that is designed must take into account the data elements, logical process flows and functions that describe the business entities of data and processes. The three cells are defined as follows;

- Column What (Logical Data Model), contains an Entity Relationship Diagram (ERD) one of the modeling class diagrams that describes the structure of the system in terms of defining the classes that will be created to build the system. Classes have what are called attributes and methods or operations[9].
- Column How (Application Architecture), contains the application architecture that describes the proposed information system.
- Column Where (System Geographic Deployment Architecture), contains a logical model of the relationship between nodes on a network and an overview in the form of a network topology.

d) Builder Perspective

Describes the technology model that must be adapted to the information system model such as input/output devices or other technology requirements. The three cells identified are as follows:

- Column What (Physical Data Model), contains a physical data model that is represented as a table and attributes that will be used to build the system
- Column How (System Design), contains input data to be processed and the output generated by the system.
- Column Where (Technology Architecture), in this column provides a physical description of the technology needs at the Bandar Lampung Industry Baristand office. These needs are in the form of hardware and software.

e) Subcontractor Perspective

Describe the detailed specifications used before the system is implemented. The three cells identified are as follows:

- Column What (Data Definition), contains Data Definition Language (DDL) which are the commands used to define the structure of the database
- Column How (Program), contains the methods or actions needed to build the system.
- Column Where (Network Architecture), contains the network architecture, namely addressing each node on the network so that they can communicate with each other.

IV. CONCLUSION

From the research that has been done, it is concluded that the design of a service EA on Baristand Industri Bandar Lampung which using FEAF can produce a blueprint containing business, information and technology architecture modeling, information and technology.The resulting blueprint can be used as a reference to create and develop information technology in accordance with the business objectives of the Baristand Industri Bandar Lampung, EA that has been generated can be applied to three institutes in the Baristand Industri Bandar Lampung, namely testing, inspection and calibration

REFERENCES

[1] R. Yunis and Theodora, "Penerapan Enterprise Architecture Framework Untuk Pemodelan Sistem Informasi," *JSM STMIK Mikroskil*, vol. 13, no. 2, pp. 159–168, 2016.

[2] N. Safitri and R. Pramudita, "Pengembangan Kerangka Kerja Arsitektur Enterprise," *Bina Insa. ICT J.*, vol. 4, no. 1, pp. 73–82, 2017.

[3] E. Setiawan, I. Wisnubadhra, and S. F. Rahayu, "Usulan Model Feaf Untuk Perencanaan Strategis Sistem Informasi Pada Pt . Sumber Buana Motor," *Semin. Nas. Ilmu Komput. (SNIK 2015)*, no. Snik, pp. 125–128, 2015.

[4] S. Lusa and D. I. Sensuse, "Kajian Perkembangan Dan Usulan Perancangan Enterprise Architecture Framework," *Semin. Nas. Apl. Teknol. Inf.*, vol. 2011, no. Snati, pp. 17–18, 2011.

[5] H. Ma'sum, "TEMATIK - Jurnal Teknologi Informasi Dan

Komunikasi Vol. 3, No. 1 Juni 2016," *J. Teknol. Inf. Dan Komun.*, vol. 3, no. 1, pp. 86–99, 2016.

[6] O. Hengki, Rizan, "Prototipe E-Commerce Berdasarkan Konsep Business Model Canvas (BMC) Untuk Meningkatkan Daya Saing," *Proceeding Conf. Inf. Technol. Inf. Syst. Electr. Eng.*, pp. 206–215, 2016.

[7] A. D. Hardi, "Analisis Strategi Pengembangan Bisnis Di PT. EM Advertising," *Agora*, vol. 4, no. 1, pp. 199–206, 2016.

[8] N. Putri *et al.*, "Model Data Semantic Merancang Konseptual Sistem Basis Data Pada Model Object Relationship Attribute – Semi Structured (ORA- SS)," vol. 5, pp. 3636–3645, 2021.

[9] E. W. Fridayanthie and J. Charter, "Rancang Bangun Sistem Informasi Simpan Pinjam Karyawan Menggunakan Metode Object Oriented Programming (Studi Kasus: PT. Arya Buana Sakti Tangerang)," *J. Techno Nusa Mandiri*, vol. 13, no. 2, pp. 149–156, 2016.

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Prediction of Coffee Bean Quality Using Segmentation Methods And K-Nearest Neighbor

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***Abstract*—The condition of people's coffee farming management is relatively poor when compared to large state-owned plantations. The main problem in smallholder plantations is the quality of the results that do not meet standardization. This study designs a system that is able to identify the quality of coffee beans using Segmentation, K-Nearest Neighbor and Gray Level Co-occurrence Matrix methods. Based on the test results using texture feature extraction, the highest accuracy was obtained at K-5 of 85%. It is possible that if the K value used is too small, there will be a lot of noise which reduces the level of accuracy in data classification, but if the K value is too large it can cause errors in the range of values taken, which will indirectly affect the level of accuracy. The results of the study were the identification of coffee beans with good quality or poor quality. It is hoped that this research can contribute to improving the quality of people's coffee so that it can increase the production of people's coffee that is able to compete in the market.**

Keywords—Gray Level Co-occurrence Matrix, K-Nearest Neighbor, Segmentation

I. INTRODUCTION

Coffee is one of the plantation commodities in Indonesia which has an important role in economic activities in Indonesia. Coffee plants are also one of Indonesia's leading export commodities which contribute to the country's foreign exchange in addition to coming from oil and gas. On the other hand, the potential for coffee exports is very promising, there is also a potential domestic coffee market opportunity that can excite coffee farmers [1]. In determining the quality of really good coffee, there are many obstacles due to the subjective nature in the selection of coffee beans or a lack of understanding of science so that it requires someone who is really an expert or expert, so it can be ascertained that the coffee beans are in the good, good category [2].

Indonesia has implemented quality standards for coffee beans based on physical tests on the basis of the number of defects since 1990. This quality standard has been revised several times and is currently contained in the Indonesian National Standard (SNI) Number 01-2907-2008. Revision of quality standards is carried out to respond to the dynamics of the demands of the growing domestic and global market. Thus, the quality criteria in SNI must always refer to the international requirements issued by the ICO (International Coffee Organization) [3]. In accordance with the decision of the ICO (International Coffee Organization) since October 1, 1983 until now, to determine the quality of coffee in Indonesia using the Defects Value System. By using this system, the more defects there are, the lower the coffee quality will be, and the fewer defects, the better the coffee quality [4]

The problem of identifying the quality of coffee beans can be overcome by detecting the texture of the coffee beans using digital image processing. The method used in this research is image segmentation, Gray Level Co-occurrence Matrix and K-Nearest Neighbor with good and bad seeds classification.

Based on the test results, this system obtained the highest level of accuracy in the K3 test of 85% to identify the image of coffee beans using the image segmentation method, Gray Level Co-occurrence Matrix and K-Nearest Neighbor.

II. METHODS

A. Coffee

The coffee plant is a genus of Coffea which is included in the Rubiaceae family and has about 100 species. The Coffea genus is one of the important genera that has high economic value and is developed commercially, especially Coffea Arabica, Coffea Liberica, Coffea Kanephora including Robusta coffee. The coffee plant is a tropical plant originating from Africa.

Arabica coffee can grow at an altitude of 700-1,400m above sea level with temperatures ranging from 15-24˚C and a

soil pH of 5.3-6.0 and an average rainfall of 2000-4000mm/ year and the number of dry months 1-3 months. / yr. Robusta coffee can grow at an altitude of 300-600 m above sea level with rainfall of 1500-3000 mm/ year with a temperature of 24-30˚C and a soil pH of 5.5-6.0 [5].

B. Preproccessing

Preprocessing is the first step taken after getting from image acquisition. This process is done to make it easier for the system to recognize objects. For the steps carried out in preprocessing as shown in Figure 1.

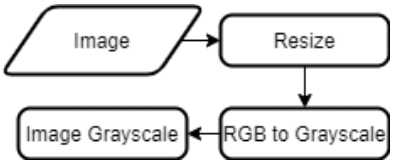

Fig. 1. Pre-Processing

Based on Fig.1, resizing is a process to reduce the image size to 200×200 aiming to ease the work of the system in image processing. The next resized image will be converted to a grayscale image. This process serves to convert a three-dimensional image into a one-dimensional one with the same intensity, so that the computational process does not require a long time. For converting RGB images to grayscale images such as equation 1[6].

$$grayscale = 0{,}299R + 0{,}587G + 0{,}114\,B \quad (1)$$

C. Region Growing Segmentation

Image segmentation is the process of dividing a digital image into several regions or groups, where each area consists of a set of pixels. Image segmentation simplifies and changes the image representation to something more meaningful and easier to analyze. Image segmentation is used to find the object you want to find and the boundaries of object shapes such as lines, curves in the image [7].

Region growing is a simple area-based image segmentation method. This method is also classified as a pixel-based image segmentation method because this method includes a selection process from the starting points[8]. This segmentation approach examines neighboring pixels from the starting points and determines whether neighboring pixels should be merged into regions. This process is iterative (iteration), with the same behavior as the usual data clustering algorithm [9].

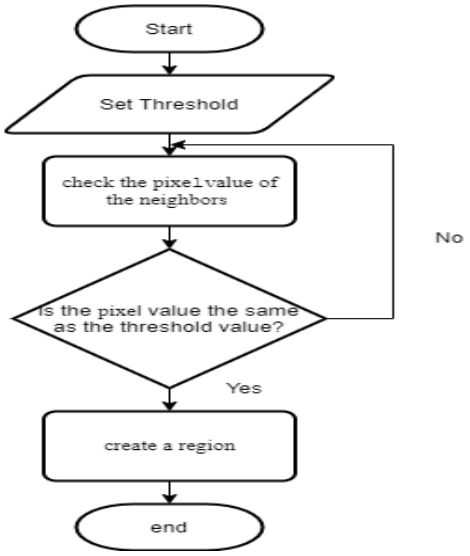

Fig. 2. Flowchart Region Growing

The stages in the region growing segmentation begin by determining the Seed Point Image. It then examines the neighbors of the selected Seed Point Seed point, selecting eight surrounding neighbors. Then process the neighboring pixels after getting eight neighboring pixels, then the next process is selecting pixels. Each neighboring pixel will be checked according to the gray color with reference to the seed point and threshold. Then specify the foreground and background. The segmented image is shown in Fig. 3.

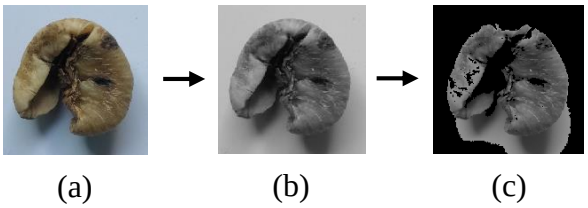

Fig. 3. (a)Citra RGB, (b)Citra Grayscale, (c)Citra Segmentasi

D. Feature Extraction

Feature extraction is the process of taking the characteristics of an object that can describe the characteristics of the object [10]. Gray Level Co-occurrence Matrix is an image feature extraction method that is widely used for image classification which is quite effective in classifying because it is able to provide detailed texture information of an image. Texture extraction is done to retrieve basic information from an image before it is used for the next process[11]. The GLCM method uses several features of a statistical approach such as energy, entropy, contrast, and so on [12].

The following are the steps used in taking texture features from an image [13]:

1) The color image is converted to a grayscale image
2) Each value of the RGB image is converted to gray using the equation (1)
3) New pixel = setPixel(255, gray value, gray value, gray value)
4) Segmentation of color values into 16 bin

5) Calculate the co-occurance matrix values in four directions of 0, 45, 90, and 135 . respectively
6) Calculate information on texture characteristics, namely contrast, correlation, homogeneity, and energy.

E. K-Nearest Neighbor Classification

K-Nearest Neighbor (K-NN) is a method that uses a supervised algorithm where the results of the new test sample are classified based on the majority of the categories in K-NN. The purpose of this algorithm is to classify new objects based on attributes and training samples [14]. According to[15] the equation used for the knn algorithm:

$$d(xi, xj) = \sqrt{\sum_{r=1}^{n}(a_r(x_j) - a_r(x_j))^2} \quad (2)$$

$d(xi, xj)$: euclidean distance
xi : record to i
xj : record to j
a_r : data to r
i,j : 1,2,3…n

III. RESULT AND DISCUSSION

Testing this system is done by preparing the image that will be used as training data. The data used as training data in the application that was built amounted to 480 data with details of 240 good seed data and 240 bad seed data. The test data consisted of 20 images with details of 10 good seed data and 10 bad seed data. The training phase begins with image preprocessing. Furthermore, image segmentation serves to separate the background and image objects. Then get the texture feature extraction from the training image. The texture characteristics that have been obtained can then be trained using KNN. After that the training data from the results of the KNN training have been defined as data as shown in Figure 7.

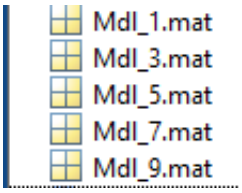

Fig. 5. Training Data

The next process is testing the new test image. This process is carried out to determine the accuracy of the model built in the training process, then test or testing data is used to predict the classes. Furthermore, the KNN function is to determine the class of test data with the classification results parameters obtained at the data training stage. The system will display the results of the coffee bean classification according to the system's predictions. Predictions of good quality coffee beans are shown in Figure 6 and predictions of poor/poor quality coffee beans are shown in Figure 7.

Fig. 6. examples of good coffee beans

Fig. 7. example of bad coffee beans

In Experiment 1, the test was carried out with the parameter K worth 1. The accuracy obtained was 75% as shown in Table I.

TABLE I. TESTING WITH K-1

Class	Class Positive	Classified Negative
+	TP (10)	FN (0)
-	FP (5)	TN (5)
$accuracy = \frac{TP + TN}{(TP + TN + FP + FN)}$ $= \frac{15}{20} \times 100 = 75\%$		

In experiment 2, the test was carried out with the parameter K value 3. The results of the experiment 2 got an accuracy of 65% as shown in Table II.

TABLE II. TESTING WITH K-3

Class	Class Positive	Classified Negative
+	TP (8)	FN (2)
-	FP (5)	TN (5)
$accuracy = \frac{TP + TN}{(TP + TN + FP + FN)}$ $= \frac{13}{20} \times 100 = 65\%$		

Experiment 3 tests were carried out with a feasible K parameter 5. The results of test 3 got an accuracy of 85% as seen in Experiment 3, the test was carried out with a feasible K parameter 5. The results of trial 3 got an accuracy of 85% as shown in Table III.

TABLE III. TESTING WITH K-5

Class	Class Positive	Classified Negative
+	TP (10)	FN (0)
-	FP (3)	TN (7)
$accuracy = \frac{TP + TN}{(TP + TN + FP + FN)}$ $= \frac{17}{20} \times 100 = 85\%$		

In experiment 4, the test was carried out with the parameter K worth 7. The results of the experiment 4 got an accuracy of 70% as shown in Table IV.

TABLE IV. TESTING WITH K-7

Class	Class Positive	Classified Negative
+	TP (8)	FN (2)
-	FP (4)	TN (6)
$accuracy = \frac{TP + TN}{(TP + TN + FP + FN)}$ $= \frac{14}{20} \times 100 = 70\%$		

In experiment 5, the test was carried out with the parameter K worth 9. The results of the experiment 5 got an accuracy of 65% as shown in Table V.

TABLE V.TESTING WITH K-9

Class	Class Positive	Classified Negative
+	TP (8)	FN (2)
-	FP (5)	TN (5)
$accuracy = \frac{TP + TN}{(TP + TN + FP + FN)}$ $= \frac{17}{20} \times 100 = 65\%$		

Where True Positive (TP), True Negative (TN), False Positive (FP), and False Negative (FN). From the test results of all experiments, the maximum accuracy at K-5 is 85% while the minimum accuracy at K-3 and K-9 is 65% as shown in Table VI.

According to the book [16], the level of accuracy can be diagnosed as follows:

Accuracy 0.90 – 1.00 = *Excellent Classification*
Accuracy 0.80 – 0.90 = *Good Classification*
Accuracy 0.70 – 0.80 = *Fair Classification*
Accuracy 0.60 – 0.70 = *Poor Classification*
Accuracy 0.50 – 0.60 = *Failure*

TABLE VI. TEST RESULT

No	Testing	K	Accuracy
1	Testing 1	1	75%
2	Testing 2	3	65%
3	Testing 3	5	85%
4	Testing 4	7	70%
5	Testing 5	9	65%

IV. CONCLUSION

Based on the results of the design, implementation and testing that has been done, the coffee bean quality prediction system with Segmentation and KNN methods is able to predict the quality of coffee beans with indicators of good beans and bad beans. The results of the accuracy test generated using the Confusion Matrix based on the K value used and the diagnosis of the accuracy level can be concluded that the system is a good classification with the success rate of identifying the quality of coffee beans getting the highest accuracy value at K-5, which is 85%.

For further development this system can be developed using other methods or it can be combined with different methods so that the accuracy results can be compared. Types of coffee can be added, such as arabica, gayo, liberika, or perhaps it can be compared with fermented coffee beans from civet/civet animals.

REFERENCES

[1] E. D. Martauli, "April 2018 Volume 01 No 02 ANALYSIS OF COFFEE PRODUCTION IN INDONESIA Elvin Desi Martauli," vol. 01, no. 02, pp. 112–120, 2018.

[2] N. Firmansyah, "KUALITAS KOPI BERBASIS WEB DENGAN," vol. 5, no. 3, pp. 298–306, 2017.

[3] Standar Nasional Indonesia, "Standar Nasional Indonesia : Biji kopi ; Biji kakao ; dan Rumput laut SNI Biji kopi," *Badan Standarisasi Nasional, Jakarta*, pp. 1–60, 2017.

[4] B. Raharjo and F. Agustini, "Metode Forward Chaining pada Sistem Pakar Penilaian Kualitas Biji Kopi Berbasis Web," vol. 4, pp. 73–82, 2020.

[5] D. I. Sulawesi, B. Selatan, and P. Abad, "Abstrak," vol. 12, no. 1, pp. 13–26, 2017.

[6] F. Zikra, K. Usman, and R. Patmasari, "Deteksi Penyakit Cabai Berdasarkan Citra Daun Menggunakan Metode Gray Level Co-Occurence Matrix Dan Support Vector Machine," 2021.

[7] L. Angriani, "Segmentasi Citra dengan Metode Threshold pada Citra Digital Tanaman Penyelenggara : Program Studi Teknik Informatika Fakultas Ilmu Komputer Universitas Muslim Indonesia Makassar , Indonesia Editor : Tim Editor SNRIK 2015 Penerbit : Fakultas Ilmu Komputer," no. July, 2018.

[8] S. Karnila, S. Irianto, and R. Kurniawan, "Face Recognition using Content Based Image Retrieval for Intelligent Security," *Int. J. Adv. Eng. Res. Sci.*, vol. 6, no. 1, 2019, doi: 10.22161/ijaers.6.1.13.

[9] A. M. Simarmata, S. Kom, M. Kom, T. P. Sinaga, and O. William, "DETEKSI PENYAKIT LIMFOMA DENGAN MENGGUNAKAN," no. 2, 2019.

[10] D. Satria and M. Mushthofa, "Perbandingan Metode Ekstraksi Ciri Histogram dan PCA untuk Mendeteksi Stoma pada Citra Penampang Daun Freycinetia," *J. Ilmu Komput. dan Agri-Informatika*, vol. 2, no. 1, p. 20, 2013, doi: 10.29244/jika.2.1.20-28.

[11] M. Brilliant, S. Y. Irianto, S. Karnila, and R. Z. Abdul Aziz, "Land Cover Changes Detection Using Region Growing Segmentation," in *Journal of Physics: Conference Series*, 2020, vol. 1529, no. 2, doi: 10.1088/1742-6596/1529/2/022066.

[12] M. Ramadhani, "Klasifikasi Jenis Jerawat Berdasarkan Tekstur dengan Menggunakan Metode GLCM," *e-Proceding of Enggineering*, vol. 5, no. 1, pp. 870–876, 2018.

[13] I. G. Rai *et al.*, "Ekstraksi Fitur Warna , Tekstur dan Bentuk untuk Clustered-Based Retrieval of Images (CLUE)," vol. 16, no. April, 2017.

[14] W. P. Hidayanti, "Penerapan Algoritma K-Nearest Neighbor Untuk Klasifikasi Efektivitas Penjualan Vape (Rokok El ektrik) pada ' Lombok Vape On ,'" vol. 3, no. 2, 2020.

[15] S. Nurjanah, A. M. Siregar, and D. S. Kusumaningrum, "Penerapan Algoritma K – Nearest Neighbor (Knn) Untuk Klasifikasi Pencemaran Udara Di Kota Jakarta," *Sci. Student J. Information, Technol. Sci.*, vol. 1, no. 2, pp. 71–76, 2020.

[16] Florin Gorunescu, *Data Mining (Concepts, Models and Techniques)*. springer, 2011.

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***Abstract*—The City of Bandar Lampung is a quickly creating city, to spread data and to work on great public administrations for the local area, the Bandar Lampung Regional Government has carried out a data framework e-government based site, with the location https://bandarlampungkota.go.id/ yet there are numerous objections from clients of the site which expresses that data on the difficult to come by site, reaction the site long enough when gotten to, etc, so it should be assessed convenience on site to work on the simplicity and productivity in the utilization of clients. The advancement of good-quality pages requires complex strategies for plan and assessment. One of the devices to realize the fulfillment level of a framework is through convenience testing. In this way, ease of use testing is led to test the fulfillment level of clients. Advancement of a Site Ease of use Assessment (Webuse) as a norm for estimating ease of use, with a-based survey assessment technique web that permits clients to survey the convenience of the site to be assessed. The site this review alludes to the Webuse to assess ease of use on the site Bandar Lampung Regional Government with the elements of Content, Organization and Readability, Navigation and Links, User Interface Design, and Performance and Effectiveness. Webuse centers around fostering an assessment framework convenience electronic with an abstract activity approach that includes the interest of clients to give an appraisal of a site. In the analysis of the usability website it can be seen that the level of usability website Bandar Lampung City Government is at point 0.74 on "*good*" level. The purpose of this study was to determine the level usability of the website Bandar Lampung City Government in service to provide optimal information and services to users. 4 elements of Webuse produce Cronbach's Alpha worth which is more noteworthy than 0.70, it tends to be deciphered that the exploration instrument utilized is truly dependable, so it is deserving of additional examination.**

Keywords—e-government, Usability, Webuse, website.

I. INTRODUCTION

The role of the website is an important requirement of an organization, including the Bandar Lampung City Government which also implements e-government through the web, with the address https://bandarlampungkota.go.id/. To improve the governance of information and services, evaluation is needed in order to maximize the goals and objectives and be in line with the vision and mission of the Bandar Lampung City government.

As indicated by Karat (1994), ease of use is one of the principles in the use of *User Centered Design* (UCD). *User Centered Design* (UCD) is another worldview in the improvement of online frameworks. Convenience is one of the indicators that can depict the nature of a framework according to the perspective of people who use it where accomplishing ease of use in a site requires a blend of arranging in understanding the setting of utilizing the framework as a reason for recognizing and assessing the framework through client testing (J. Neilsen, 1994). To discover a framework can be utilized by clients adequately, productively and agreeably is to assess the site from the perspective ease of use (Bevan, 2009).

Website Usability Evaluation (Webuse) centers around fostering an assessment framework ease of use based web with an emotional activity approach that includes the interest of clients to give an appraisal of a site. The advancement of the methodology Webuse as a norm for estimating ease of use, with a-based poll assessment strategy web that permits clients to survey the convenience of the site to be assessed (Chiew and Salim, 2003)[1]. This review alludes Webuse way to deal with assess the ease of use in site Bandar Lampung regional government with the of *the Content, Organization and Readability, Navigation and Link, User Interface Design* and *Performance and Effectiveness.*

II. LITERATURE REVIEW

A. Usability Testing

Ease of use is a piece of client experience that action how great of an item or a framework can be utilized to accomplish objective viably, proficient, and fulfilled. The

nature of the framework is additionally tried and assessed as an objective of ease of use testing. Lestari[2] characterizes ease of use as a framework quality level that is not difficult to learn, simple to utilize, and persuade individual to utilize the framework. Chiew and Salim tracked down that there were two essential inquiries for convenience, particularly for intelligent framework: (1) How a framework can be created to guarantee ease of use level of a framework; (2) How framework ease of use level can be shown or estimated[3].

Convenience level of a framework has five parts: learnability, viability, productivity, memorability, and fulfillment. Learnability of the framework can be characterized as how quick clients can excited about utilizing the framework and run the framework work appropriately. Viability of a framework can be characterized as how exact and complete the client can do with the framework to accomplish explicit objectives. Productivity is the manner by which assets is extended according to accomplish objectives by utilizing framework. Memorability is a term of how client capacity to remember information about spesific menu or capacity. What's more, the last part is fulfillment. Fulfillment is the manner by which client feel good and get uplifting outlook by utilizing the framework or item. To gauge the ease of use level, testing ought to be directed. The test is called ease of use testing.

Convenience testing is one of approaches to estimated and assess a framework ease of use level. This test likewise gives some genuine perspective on how genuine clients passage and utilize the framework. Ease of use testing centers around estimating client action to accomplish explicit objective by utilizing the framework. Ease of use testing of a framework can be estimated a few objectives: (1) Adequacy of framework; (2) Productivity of framework; (3) Security of framework; (4) Utility degree of framework; (5) Simplicity to learn; (6) Straightforwardness to retain.

There are a few boundaries that can be utilized in convenience testing: (1) Achievement rate is an estimation of client achievement rate to follow through with given responsibilities by utilizing a framework or a web; (2) The time an assignment requires is a boundary that is utilized to quantify how long a period expected to complete a job by utilizing a framework; (3) Blunder rate is a boundary that is utilized to know clients mistake rate while doing given undertakings by utilizing the framework; (4) Client's emotional fulfillment is a boundary to gauge client fulfillment for a framework[4].

B. Website Usability Evaluation (Webuse).

The Webuse (*Website Usability Evaluation*) method developed by Chiew and Salim (2003) focuses on developing a web-based usability evaluation system to measure websites from usability aspects. The Webuse method can evaluate websites from usability aspects on all types of websites and domains. The Webuse method was developed related to website usability including the concept of usability methods, evaluation and evaluation systems. The questionnaire-based usability evaluation method allows users to conduct evaluations to assess the usability of the evaluated website. The results obtained from the respondents' responses to the questionnaire were analyzed using the Webuse method. Webuse is a questionnaire developed to evaluate the usability of a website. This questionnaire consists of 30 questions with five answer options divided into four dimensions, that it[5]:

1. Content, Organization and Readability

"Good content is content that is easy to understand by users, clear, and well organized. Website a well-organized can provide a quick understanding for users" according to Leavitt and Shneiderman (Marcus, 2011). *"Meanwhile, the readability of a website is measured by whether the system functions properly and provides accurate"* information (Baltzan and Phillips, 2009).

2. Navigation and Links

The method used to find and access information on a website effectively and efficiently to help users is website called *Navigation*. Meanwhile, *Links* function to connect users by selecting and clicking *links* on pages *hypertext* (homepage), which causes a new page to open. *Good links* should use text rather than graphics so that they are easily understood by users according to Leavitt and Shneiderman (Marcus, 2011).

3. User Interface Design

User interface design is a method and procedure that requires careful consideration when designing and developing websites. The important things in designing user interface design include setting goals, defining users and providing useful content. *"To ensure the best results, it is necessary to consider various issues of user interface design and good performance for users"* according to Leavitt and Shneiderman (Marcus, 2011).

4. Performance and Effectiveness

Website performance can be measured by how quickly a website carries out certain processes or transactions so as to produce fast and efficient user performance (Baltzan and Phillips, 2009). *"Meanwhile, effectiveness is the success of a website in producing the right information for users"* according to Leavitt and Shneiderman (Marcus, 2011)[6].

The evaluation process using Webuse method can be seen in Figure 1. The steps which are taken in the evaluation of Website of the Bandar Lampung City using Webuse method approach are as follows[7].

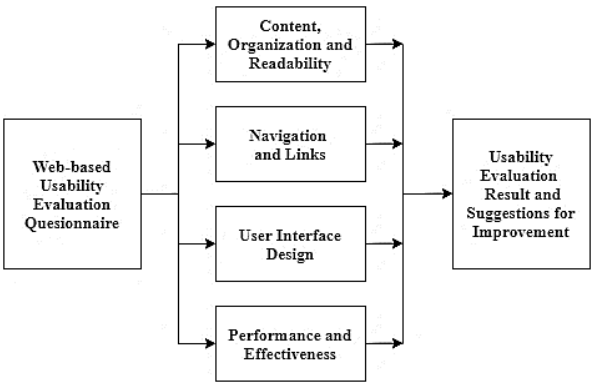

FIG. 1. WEBUSE EVALUATION PROSES

Disseminating questionnaires to respondents. The number of respondents used in this study was 50 people. Respondents fill out questionnaires according to the indicators of existing questions. Merit is used based on the

user's answer to each question, then it will be accumulated for each category. Category points are the average values of each category. Usability points are the mean value of each usability.

From that are questionnaire, there are scores that can represent how good the usability level of a website is. The value is divided into 5 value ranges, each value representing a good or bad level of usability. The merit value of the Webuse questionnaire can be seen in Table I below[6]:

TABLE I. MERIT SUITABILITY AND RESPONSE CHOIS

Option	Merit
Strongly Disagree	0.00
Disagree	0.25
Fair	0.50
Agree	0.75
Strongly Agree	1.00

The general consequences of site ease of use focuses are the mean worth places of ease of use for 4 classes. The convenience level depends on the quantity of ease of use focuses. Table II shows the convenience levels and comparing ease of use focuses and in Table III depicts the topic of each merit[5].

TABLE II. POINTS AND LEVEL USABILITY WEBSITE

Point	Level Usability
$0 \leq x \leq 0.2$	*Bad*
$0.2 \leq x \leq 0.4$	*Poor*
$0.4 \leq x \leq 0.6$	*Moderate*
$0.6 \leq x \leq 0.8$	*Good*
$0.8 \leq x \leq 1.0$	*Excellent*

TABLE III. 30 GROUPING QUESTIONS IN 4 ELEMEN QUESTIONNAIRE

Category	Attri-bute	Usability Level
Content, Organization and Readability	1	I can easily access the website bandarlampungkota.go.id
	2	This website contains material and content that interests me
	3	The materials and content they provide are always updated
	4	I can easily find what I want on this website
	5	The content on this website is well managed
	6	I can read/view content easily
	7	I feel comfortable and familiar with the content presented on this website
	8	I don't need to scroll left and right while reading the content of this website
	9	I feel that the image content with the news content is very appropriate
Navigation and Links	10	It's easy for me to browse this website by using the link or back button in the browser
	11	The links on this website are well maintained and maintained
	12	All links in the navigation work well by displaying the page according to the link title
	13	Placement Links or menus are standardized and I can easily recognize them
	14	This Website provides helpful hints and Links for me to get the information I want
	15	This website doesn't open many new browser windows when I browse the website
User Interface Design	16	The interface design on this website is attractive/attractive
	17	I feel comfortable with the colors used on this website
	18	This website does not contain features that annoy me such as scrolling or blinking text and re-animation
	19	This website has a consistent look
	20	This website does not contain many ads
	21	The website design is reasonable and easy to learn how to use
	22	Display image content neat (no stretch/flat)
	23	The fonts used on this website are easy to read
	24	The size and thickness of the letters are appropriate so that it makes it easier for me to read the content on this website
Performance & Effectiveness	25	When accessing the bandarlampungkota.go.id website, it can be opened quickly and without problems
	26	I can see visited and unvisited links/links
	27	I can access the website all the time
	28	This website responds to all actions I take according to my expectations
	29	This website can be used efficiently
	30	This website always gives clear and useful messages when I don't know how to process/do something

C. User Centered Design.

User Centered Design (UCD) is a new paradigm in the development of web-based systems. The concept of UCD is that the user is at the center of the system development process, and the objectives/properties, context and system environment are all based on user experience (Simatupang, 2014).

According to Lightbown, UCD is an iterative process that revolves around the user. Therefore, it is not surprising that the user is at the center. This means that every process carried out will involve the user's perspective. The purpose of the UCD approach is to produce products with high values usability (Mulia, 2016)[7].

D. Questionnaire Collection.

A questionnaire is a research tool or survey consisting of a series of written questions, aimed at obtaining responses from a selected group of people. The questionnaire must be designed in such a way that every question in it is valid. According to Sugiono, determining the sample size for the study are as follows[7]:

- The decent sample size in the study was between 30 and 500.
- When the sample was divided into several categories, the number of members of the study sample is at least 30.
- If the research will undertake the analysis multivariate (correlation or multiple regression for example), then the number of sample members is at least 10 times the number of variables studied. For example, there are 5 research variables (independent + dependent), then the number of sample members = 10 x 5 = 50.
- For simple experimental research, which uses an experimental group and a control group, the number of sample members is between 10 to 20 each[6].

E. Validity and Reliability Test

One of the most important parts of research using a questionnaire is to test the validity and reliability of the questionnaire[8].

1. Validity Test

Test is used to determine the extent of the accuracy and accuracy of a measuring instrument in measuring data.

$$r_{xy} = \frac{n\sum_{i=1}^{n} x_i y_i - \sum_{i=1}^{n} x_i \sum_{i=1}^{n} y_i}{\sqrt{\left(n\sum_{i=1}^{n} x_i^2 - \left(\sum_{i=1}^{n} x_i\right)^2\right)\left(n\sum_{i=1}^{n} y_i^2 - \left(\sum_{i=1}^{n} y_i\right)^2\right)}}$$

r_{xy} : correlation coefficient between variable X and variable Y
xi_i : data velue n-1 for the variable group X
y_i : data velue n-1 for the variable group Y
n : data

A statement is said to be valid if the score of the statement is positively correlated significant with the total score. If r_{count} for each statement > from r_{table} then Ho is rejected which means it is valid and if r_{count} is smaller than r_{table} then Ho is accepted which means the statement is invalid.

2. Reliability Test

Test is a consistency of a measurement result. To determine the reliability of a statement, a comparison of the value of r_{table} with r_{hasil} is carried out (Cronbach's Alpha in the data output).

$$r_i = \left(\frac{k}{k-1}\right)\left(1 - \frac{\sum \sigma_b{}^2}{\sigma_t{}^2}\right)$$

$\Sigma\alpha_{b^2}$: number of items variance
α_{b^2}: total variance

Conditions when Cronbach`s Alpha questionnaire greater than a minimum value of Cronbach`s Alpha (α) is 0.70 then the question is reliable and if Cronbach`s Alpha smaller questionnaire than the minimum value of Cronbach's Alpha (α) then the question is not reliable[9].

III. DISCUSSION AND RESULT

In the analysis stage of the initial conditions, the researcher explores information about the Bandar Lampung City Government website using questionnaires and observation techniques. Making a questionnaire requires responses to find out information about problems or complaints on website users. While the observation is done by the researcher trying to use the website directly with the aim of being able to find problems based on the researcher's point of view.

A. Website Evaluation

- Questionnaire Creation.

  The design of the questionnaire using google form refers to the method Webuse. The list of questions contained in the questionnaire is designed based on the analytical method to be used, namely *Importance* and *Performance* to determine the factors that affect user satisfaction and the factors that need to be improved according to the users who are respondents[3].

FIG. 2. QUESTIONNAIRE TEMPLATE

- Data Collection.

  The Collection was carried out based on the questionnaire design that had been carried out in the previous stage. Determination of the number of respondents refers to the literature study that has been done, for decent sample size in the study is a minimum of 30 people. The questions on the evaluation questionnaire consist of 5 answers which indicate the respondent's agreement to the question. These questions have a weight between 1 and 5, respectively, where the answers will be converted to a merit value as described in Table I. The questionnaire is distributed online with the help of google forms to respondents. The results are in the form of Points Usability, Levels Usability, and Level Percentages Usability. The three will be displayed in the form of a table below[5]:

TABLE I. POINT AND LEVEL USABILITY WEBSITE

Cat	Point	Level	Cat	Point	Level
COR1	0.79	Moderate	**UID1**	0.78	Moderate
COR2	0.72	Moderate	**UID2**	0.76	Moderate
COR3	0.71	Moderate	**UID3**	0.75	Moderate
COR4	0.67	Moderate	**UID4**	0.77	Moderate
COR5	0.72	Moderate	**UID5**	0.77	Moderate
COR6	0.77	Moderate	**UID6**	0.77	Moderate
COR7	0.74	Moderate	**UID7**	0.77	Moderate
COR8	0.75	Moderate	**UID8**	0.74	Moderate
COR9	0.76	Moderate	**UID9**	0.75	Moderate
NL1	0.78	Moderate	**PE1**	0.75	Moderate
NL2	0.73	Moderate	**PE2**	0.67	Moderate
NL3	0.72	Moderate	**PE3**	0.79	Moderate
NL4	0.75	Moderate	**PE4**	0.73	Moderate
NL5	0.75	Moderate	**PE5**	0.73	Moderate
NL6	0.72	Moderate	**PE6**	0.69	Moderate

TABLE II. RECAP OF POINT AND LEVEL USABILITY WEBSITE

Category	Average of Point Usability	Usability Level
Content, Organization and Readability	0.73	Good
Navigation and Links	0.74	Good
User Interface Design	0.76	Good
Performance and Effectiveness	0.73	Good

In the analysis of the usability website it can be seen that the level of usability website Bandar Lampung City Government in the "***good***" usability level. This proves that website of the Bandar Lampung City Government has level usability that is in accordance with the wishes and needs of users. However, COR and PE have the usability lowest level, with points of usability 0.73 compared to other categories. So it shows that usability in the COR and PE categories is not fully achieved. This is also shown from the response of users websites who complain about the functions of COR and PE which is not good. So in the development of the website it further is necessary to focus on the development of the COR and PE categories in order to further improve its usability. While the UID category is the category with the points, usability highest that it 0.76, it needs to be maintained in order to meet usability to users[9].

- Testing the Validity and Reliability of the Questionnaire.

  The validity test was carried out from the results of the questionnaire. The validity test uses the coefficient of the product-moment relation coefficient (r_{table}) with a significant level of 5%. With the number of respondents (n) = 50, we get a r_{table} of 0.279, meaning that the questionnaire is considered valid if the calculated correlation value (r_{count}) is greater than the limit value of r_{table} ($r_{count} > r_{table}$). All items of the questionnaire statement in this study were declared valid because the calculated correlation value of each statement item was > 0.279. After conducting the validity test, a reliability test was conducted to determine the consistency of the questionnaire used as a measuring tool. Tests were carried out to ensure that the previously distributed questionnaires were valid and reliable. All questionnaire items must be valid and reliable for further processing. The questionnaire is declared valid if $r_{count} > r_{table}$ and reliable if the questionnaire Cronbach`s Alpha score > the minimum value of Cronbach`s Alpha (α) is 0.70[10].

TABLE III. VALIDITY QUESTIONNAIRE TEST RESULT

No	Category	r*count*	r*table*	Description
1	COR1	0.787	0.279	Valid
2	COR2	0.766	0.279	Valid
3	COR3	0.771	0.279	Valid
4	COR4	0.887	0.279	Valid
5	COR5	0.868	0.279	Valid
6	COR6	0.882	0.279	Valid
7	COR7	0.863	0.279	Valid
8	COR8	0,814	0.279	Valid
9	COR9	0.732	0.279	Valid
10	NL1	0.774	0.279	Valid
11	NL2	0.858	0.279	Valid
12	NL3	0.885	0.279	Valid
13	NL4	0.897	0.279	Valid
14	NL5	0.938	0.279	Valid
15	NL6	0.792	0.279	Valid
16	UID1	0.703	0.279	Valid
17	UID2	0.804	0.279	Valid
18	UID3	0.771	0.279	Valid
19	UID4	0.852	0.279	Valid
20	UID5	0.751	0.279	Valid
21	UID6	0.694	0.279	Valid
22	UID7	0.868	0.279	Valid
23	UID8	0.772	0.279	Valid
24	UID9	0.810	0.279	Valid
25	PE1	0.823	0.279	Valid
26	PE2	0.839	0.279	Valid
27	PE3	0.797	0.279	Valid
28	PE4	0.922	0.279	Valid
29	PE5	0.888	0.279	Valid
30	PE6	0.862	0.279	Valid

TABLE IV. RELIABILITY QUESTIONNAIRE TEST RESULT.

No.	Category	Cronbach's Alpha	N of items	Result
1	*Content, Organization and Readability*	**0.833**	30	realible
2	*Navigation and Links*	**0.770**	30	realible
3	*User Interface Design*	**0.815**	30	realible
4	*Performance and Effectiviness*	**0.767**	30	realible

Results of reliability testing can be seen from Table VII and unknown Cronbach's Alpha number for the **COR questionnaire is 0.833, the NL questionnaire is 0.770, the UID questionnaire is 0.815 and the PE questionnaire is 0.767**. So all these results of the 4 dimensions of Webuse are greater than the minimum value of Cronbach's Alpha (α) which is 0.70, therefore it can be concluded that the research instrument to be used is really reliable[11].

B. Website Evaluation Results

Solution design evaluation was carried out using the Webuse questionnaire which was distributed to 50 respondents from various professions with a range of 4 categories age conducted on 22 until 24 October 2021.

Based on the results of the evaluation conducted on website the Bandar Lampung City Government, it can be concluded that the Usability of the Website is currently at the "*Good*" level with value usability of 0.74 which means that users are satisfied with the use of the website but still necessary to improve the usability of the website.

IV. CONCLUTION

The final conclusion that can be drawn from the research conducted was the result obtained for the Webuse method for the ***Content, Organization & Readability*** category was 0.73 included in the ***"Good"*** usability level. The ***Navigation and Link*** category was 0.74 included in the ***"Good"*** usability level. The ***User Interface Design*** category was 0.76 included in the ***"Good"*** usability level. For the ***Performance and Effectiveness*** category was 0.73 and include in the ***"Good"*** usability level.

In spite of showing great outcomes, this review is as yet trying and to work on the convenience of the site. This is valuable so the site turns out to be not difficult to utilize and expands client fulfillment. Aside from the things that should be fixed, the site https://bandarlampungkota.go.id has something interesting. Among other writing styles are simple and easy to follow.

For further research on the same topic, the author suggests taking samples from all possible users, not just the general public, because it can maximize the evaluation carried out. In addition, in further research, the researcher suggests using other guidebooks such as the *Usability Guidelines for Accessible Web Design* so that the usability of a website can be improved better[12].

REFERENCES

[1] M. Sulistiyono and A. Nurwandari, "IMPLEMENTASI SISTEM INFORMASI LAYANAN PERJALANAN WISATA MENGGUNAKAN METODE USER-CENTERED DESIGN DAN WEBUSE Abstraksi Keywords : Pendahuluan Tinjauan Pustaka Metode Penelitian," *INFOS Journal-Information Syst. J.*, vol. 2, no. 1, pp. 20–24, 2019.

[2] "Rumus Korelasi uji reabilitas." .

[3] A. Rafi'i Al Abdulraheem, R. Abumalloh, and W. Abu-Ulbeh, "Evaluation of Jordanian Banks Websites Usability," *Int. J. Eng. Technol.*, vol. 7, no. 2.29, p. 826, 2018, doi: 10.14419/ijet.v7i2.29.14265.

[4] N. R. Riyadi, "PENGUJIAN USABILITY UNTUK MENINGKATKAN ANTARMUKA APLIKASI MOBILE myUMM STUDENTS," *Sistemasi*, vol. 8, no. 1, p. 226, 2019, doi: 10.32520/stmsi.v8i1.346.

[5] Andiputra and R. Tanamal, "Analisis Usability Menggunakan Metode Webuse Pada Website Kitabisa.Com [Analysis of Usability Using Webuse Method on Website Kitabisa.Com]," *Bus. Manag. J.*, vol. 16, no. 1, pp. 11–15, 2020.

[6] M. A. Ma'ruf, N. Agitha, and M. Mardialina, "Sistem Informasi Berbasis Web Pada Program Studi Hubungan Internasional Universitas Mataram Menggunakan Content Management System," *J. Begawe Teknol. Inf.*, vol. 2, no. 1, pp. 36–45, 2021, doi: 10.29303/jbegati.v2i1.177.

[7] N. Aini, R. Ibnu Zainal, and A. Afriyudi, "Evaluasi Website Pemerintah Kota Prabumulih Melalui Pendekatan Website Usability Evaluation (Webuse)," *J. Ilm. Betrik*, vol. 10, no. 01, pp. 1–6, 2019, doi: 10.36050/betrik.v10i01.20.

[8] E. N. Kamilah, "Pengaruh keterampilan mengajar guru terhadap hasil belajar siswa pada mata pelajaran Akuntansi Universitas," *Pengaruh keterampilan mengajar guru terhadap Has. belajar siswa pada mata pelajaran Akunt. Univ.*, p. 91, 2015.

[9] B. Fajrianti, A. Rachmadi, and F. A. Bachtiar, "Evaluasi dan Perbaikan Desain Antarmuka Pengguna Situs Web SMK Negeri 1 Bangsri dengan Menggunakan WEBUSE dan Human Centered Design," vol. 2, no. 9, pp. 3168–3177, 2018.

[10] D. Pratiwi, M. C. Saputra, and N. H. Wardani, "Penggunaan Metode User Centered Design (UCD) dalam Perancangan Ulang Web Portal Jurusan Psikologi FISIP Universitas Brawijaya," *J. Pengemb. Teknol. Inf. dan Ilmu Komput.*, vol. 2, no. 7, pp. 2448–2458, 2017, [Online]. Available: http://j-ptiik.ub.ac.id/index.php/j-ptiik/article/view/1609.

[11] M. G. L. Putra, N. R. Sabilla, and S. R. Natasia, "Evaluasi Usability Website Berita Online Prokal.Co Menggunakan Evaluasi Heuristic dan Webuse," *J. Teknol. Inf. dan Ilmu Komput.*, vol. 7, no. 5, p. 911, 2020, doi: 10.25126/jtiik.2020753707.

[12] H. Simatupang, S. Widowati, and R. R. Riskiana, "Evaluasi Website Dinas Kebudayaan dan Pariwisata Kota Bandung Menggunakan Metode WEBUSE dan Importance-Performance Analysis (IPA)," *e-Proceeding Eng.*, vol. 7, no. 3, pp. 9804–9821, 2020.

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Parking Lots Space Detection With *Floyd Warshall* Algorithm At Kartini Shopping Mall Bandar Lampung

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***Abstack*--Mall Kartini is the second largest central place in Bandar Lampung City with a building area of 40,000 m² and consists of 4 floors and a parking capacity of up to 200 vehicles. With available space during peak hours, 11.00 AM to 1.00 PM for the parking space jumped to 50% from usual hours. Based on the survey results, 80% of the 100 vehicle users who will park have obstacle turning around to get a parking space. To determine this problem, this study used the Floyd–Warshall method to compare all possible paths in the graph for each side of all existing vertices. The result of this study stated that a designed application gave a displays information on space parking lots by applying the Floyd–Warshall algorithm in calculating the shortest path. Furthermore, it was able to compare all possible paths on the graph for each side of all existing vertices. Based on the results of the Black Box testing, several component were carried out, including: Device 1 with Android version 8.0, Device 2 with Android version 9.0 and Device 3 with Android version 10. All test components were successfully carried out. Moreover, the difference for the appearance of the application was impacted due to the difference device in screen size.**

Keywords-- Android, Parking Space, Floyd-Warshall Algorithm

I. INTRODUCTION

Kartini Mall is one of the second largest shopping centers in Bandar Lampung City. This mall was founded around 2003 with a building area of 40,000 m² and consists of 4 floors and a parking capacity of 200 vehicles. Kartini Mall building operates from 10.00AM to 09.30PM. Based on the survey results, 80% of 100 drivers who will park have difficulty in turning around when they get a parking lot which turns out to be full when the vehicle is about to park because the information on the available parking space is not obtained by the driver in real time [1]. It is managed by 15 officers, each of whom is tasked with managing payment counters, arranging parking [2] spaces so that vehicles are more organized according to the available land.

In addition, in one day there are usually approximately 150 vehicles parked, but during peak hours at 11.00AM to 01.00PM the crowded parking area jumps to 50% from usual hours, this creates problems for motorists, especially female parking visitors or drivers who are not good at driving their vehicles.

II. LITERATURE REVIEW

A. Parking

The word parking comes from the word "park" which means park. According to the Indonesian dictionary, parking is defined as a place to store parking is defined as an activity to put or store vehicles in a certain place whose duration depends on the completion of the needs of the rider. Parking is placing vehicles from a place or area for a certain parking period (duration).

B. Android

Android [3] is an operating system [4] for smartphones and tablets. The operating system can be illustrated as a 'bridge' between the device (device) and its users, so that users can interact with their devices and run applications available on the device. A mobile phone is a mobile device such as a mobile phone or mobile computer that is used to access network services.

C. Algoritma Floyd Warshall Method

According the application of the Floyd Warshall algorithm is carried out based on the results obtained from the problem analysis stage. Floyd Warshall's algorithm is very efficient from a data storage point of view because it can be implemented by simply changing a distance matrix. For data acquisition, this study uses secondary data obtained through state of the art reviews of other similar studies as well as through internet access. The parking location suggested by the system is based on the location of the parking lot with the shortest path that can optimize the distance traveled by visitors to the building entrance. The shortest path problem is the problem of finding a path between two vertices such that the sum of the weights of their constituent arcs is minimized. To determine the shortest path in determining the parking layout [5] in this study using the Floyd Warshall method to calculate the shortest path from the entrance to the parking lot.

III. METODE ALGORITMA FLOYD WARSHALL

Floyd Warshall's algorithm[5] is one of the variants of dynamic programming, a method for solving the problem of finding the shortest route. This method performs problem solving by looking at the solution to be obtained as an interrelated decision. That is, solutions are formed from solutions that come from the previous stage and there is a possibility of more than one solution. This algorithm can also be applied to an application that finds the closest road route from one area to another. with this method the results obtained can be more optimal but require a large enough resource if used for complex searches. Floyd Warshall's algorithm is one of the variants of dynamic programming, a method for solving the problem of finding the shortest route. This method performs problem solving by looking at the solution to be obtained as an interrelated decision. That is, solutions are formed from solutions that come from the previous stage and there is a possibility of more than one solution. This algorithm can also be applied to an application that finds the closest road route from one area to another. with this method the results obtained can be more optimal but require a large enough resource if used for complex searches. The following is the application of the Floyd Warshall Algorithm Method in making the closest Empty Parking Land application.

Floyd-Warshall algorithm to find the shortest path is as follows:

1) W = W0
2) For k = 1 until n, do :
   For i = 1 untul n, do :
   for j = 1 until n, do :
   if W[i,j] > W[i,k] + W[k,j] then swap W[i,j] with W[i,k] + W[k,j].

Description:

W0 = connectedness matrix graph to the initial weight
W* = minimal matrix connectedness
Wi,j = shortest path from point vi to vj
In iteration to find the shortest path, Floyd Warshall algorithm forms n matrix, corresponding to iterations-k. This will cause the process to be slow, especially for large n values. Although the processing time is not the fastest, Floyd-Warshall algorithm is often used to calculate the shortest path because of its simplicity.

The Floyd-Warshall algorithm here compares all possible paths in the graph for each edge of all vertices. This can happen because of the estimated decision making (choice of the shortest path) to determine the vacant parking lot for each floor of the building, at each stage between two nodes, until the estimate is known as which optimal value will be presented as information. In this case study, we are at the starting point where we will look for the nearest vacant parking lot from the 1st floor of the building, then we must pass at least one point, the point between A1, B1 and B2, the network model is shown in the following figure:

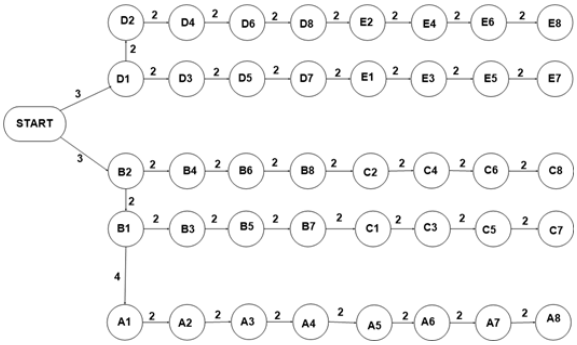

Figure 1. Parking Lot Graph Representation

	Start	B2	B4	B6	B8	C2	C4	C6	C8	B1	B3	B5	B7	C1	C3	C5	C7
Start		3								2							
B2	∞		2	4	6	8	10	12	14	2	4	6	8	10	12	14	16
B4	∞	∞		2	4	6	8	10	12	∞	∞	∞	∞	∞	∞	∞	∞
B6	∞	∞	∞		2	4	6	8	10	∞	∞	∞	∞	∞	∞	∞	∞
B8	∞	∞	∞	∞		2	4	6	8	∞	∞	∞	∞	∞	∞	∞	∞
C2	∞	∞	∞	∞	∞		2	4	6	∞	∞	∞	∞	∞	∞	∞	∞
C4	∞	∞	∞	∞	∞	∞		2	4	∞	∞	∞	∞	∞	∞	∞	∞
C6	∞	∞	∞	∞	∞	∞	∞		2	∞	∞	∞	∞	∞	∞	∞	∞
C8																	
B1	∞	∞	∞	∞	∞	∞	∞	∞	∞		2	4	6	8	10	12	14
B3	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞		2	4	6	8	10	12
B5	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞		2	4	6	8	10
B7	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞		2	4	6	8
C1	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞		2	4	6
C3	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞		2	4
C5	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞		2
C7																	

Figure 2. Distance between Block

In the application of the Floyd-Warshall algorithm above, the working stages of the algorithm are:

1. Looking for any nodes that can be passed to get to the destination node or D
2. Add up the edge value on the node with the edge on the node to be traversed starting from the initial node to the destination node. The starting node here is at node B4

   B4 = B2 + B4
   = 2m + 2m
   = 4m

   B4 = B2
   = 2m
3. Produce the smallest path information from the sum of the edges on the nodes that can be traversed. From the sum results above, the smallest value is obtained, namely on the B2 path with a total number of 2m edges.

IV. RESULT AND DISCUSSION

This research contains Unified Modeling Language (UML) modeling, namely the use of case diagrams, class diagrams, and activity diagrams. The explanation of each diagram is as follows:

1. Use Case Diagrams [6]

Proposed Software Use Case Diagram

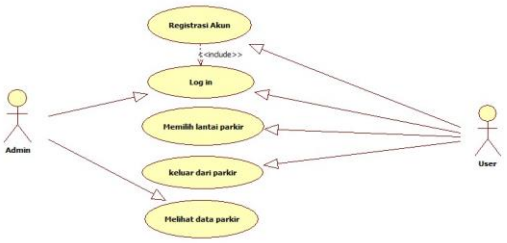

Figure 3. Use Case Diagram

2. Class Diagram

Activity Diagram of the Driver Running the System

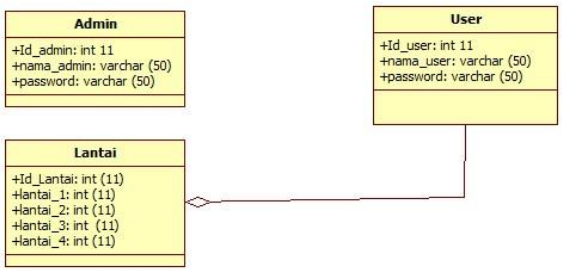

Figure 4 . Class Diagram

3. Activity Diagram

Activity Diagram of the Driver Running the System

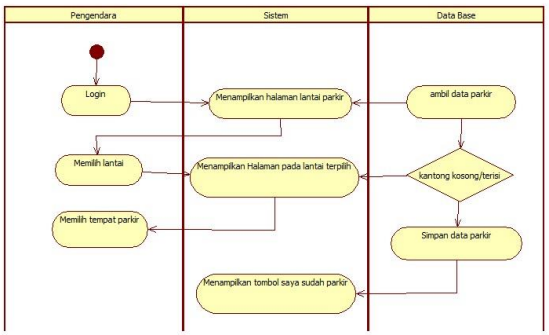

Figure 5. Activity Diagram

The closest vacant parking lot application based on Android [6] is designed using the Floyd Warshall Algorithm method as the implementation flow and is built using the Java programming language as the implementation of the functions of the Android [7] Application display. This application runs on Android devices and is operated online.

This application is used to help especially consumers in providing the nearest empty parking lot in the Kartini Mall area.

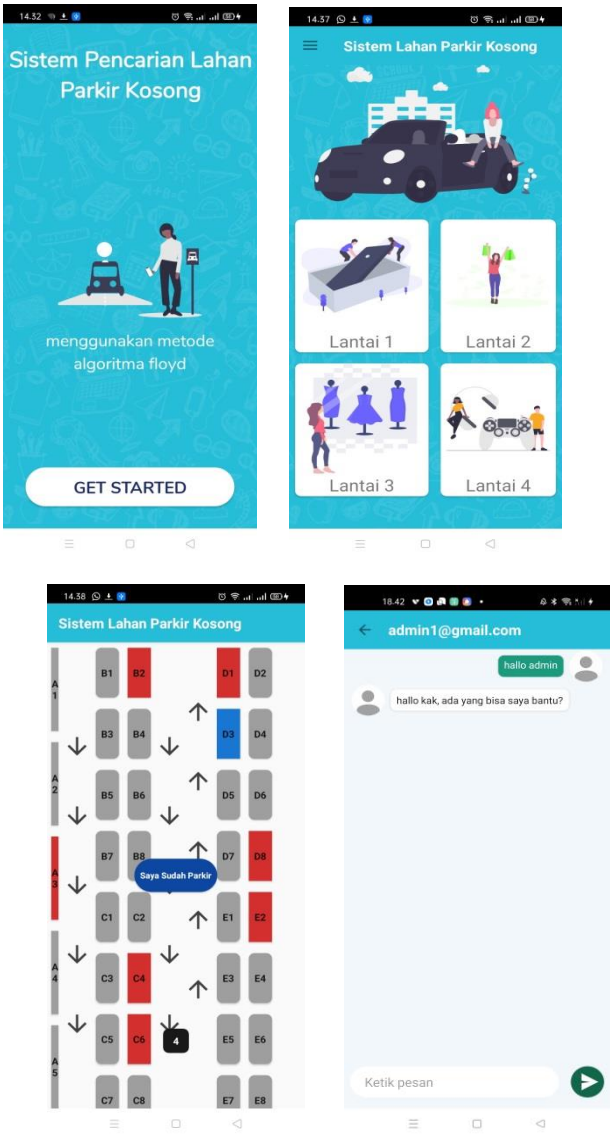

Figure 6. The display of the empty parking lot search system application.

5. CONCLUSION

Based on the results [8] of the implementation and testing that has been done on the vacant parking lot application, it can be concluded that the Empty Parking Land application can make it easier for consumers to find the nearest empty parking lot where consumers generally complain because they have to rotate the parking area many times.

This application displays information for vacant parking lots by applying the Floyd Warshall algorithm as a search that can be used in calculating the shortest path, and is able to compare all possible paths in the graph for each edge of all existing vertices.

REFERENCES

[1] S. Karnila, S. Irianto, and R. Kurniawan, "Face Recognition using Content Based Image Retrieval for Intelligent Security," *Int. J. Adv. Eng. Res. Sci.*, vol. 6, no. 1, 2019, doi: 10.22161/ijaers.6.1.13.

[2] H. B. Wahyudi, "Sistem Pendeteksi Lahan Parkir Menggunakan Raspberry Pi , Sensor Ultrasonik dan Mikrokontroller," *J-Intech*, vol. 4, no. 1, 2016.

[3] Y. P. Sari, "Game Edukasi Kesenian Lampung Berbasis Android," in *Seminar Nasional Hasil Penelitian dan Pengabdian IBI DARMAJAYA*, 2019, vol. 1.

[4] A. Agustian, S. Rahayu, and L. Nurlani, "Aplikasi E-Futsal dengan Metode Mobile-GIS dan GPS Berbasis Android," *J. Teknol. Rekayasa*, vol. 3, no. 1, 2018, doi: 10.31544/jtera.v3.i1.2018.115-128.

[5] Ni Ketut Dewi Ari Jayanti, "Penggunaan Algoritma Floyd Warshall Dalam Masalah Jalur Terpendek Pada Penentuan Tata Letak Parkir," *Semin. Nas. Inform.*, vol. 1, 2014.

[6] Haviluddin, A. T. Haryono, and D. Rahmawati, "Aplikasi program php dan Mysql," *Mulawarman Univ. Press*, vol. 53, no. 9, 2016.

[7] "Implementasi Sistem Pelaporan Sarana dan Prasarana Kegiatan Belajar Mengajar Berbasis Android (Studi Kasus : Institut Informatika dan Bisnis Darmajaya)," *J. Inform.*, vol. 19, no. 1, 2019, doi: 10.30873/ji.v20i2.

[8] H. Gunawan and Y. P. Sari, "Sosialisasi Pembuatan E-KTP Berbasis Android," 2017.

Method for Detection and Mitigation Cross Site Scripting Attack on Multi-Websites

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***Abstract*—Cross-Site Scripting (XSS) attack exploits scripting security bugs and issues on the website. XSS attack focuses and occurred on client browser application or frontend. It consists of three types of attacks: stored, reflected, and document object manipulation. The XSS attacks can cause fatal and dangerous problems, such as theft of user data, account takeovers, and illegal access to banking transactions or important data. Studies on XSS detection and mitigation have been carried out by some researchers, but it still leaves some problems, such as there is no connected mitigation to respond to the attack, using only a single-layer security mechanism and fewer payload data to test, weak measurement of the defense effectiveness from XSS attack, and the use of insufficient experiment and data testing. In addition, the method used in previous research still fails to solve all types of XSS attack. Most of the previous research also separates the method of attack detection and its mitigation. Therefore, this study proposes not only for detection but also for mitigation to overcome XSS attacks. The proposed method in this study is divided into two parts: detection and mitigation method. The proposed detection method is by using machine learning, based on lexical analysis. Then, the proposed mitigation method is the multi-layer security method which consists of five layers of the security. The proposed method has been structured systemati-cally and procedurally. In previous research, the partial methods proposed in this paper has been effectively implemented. There-fore, the proposed method is regarded as appropriate method to detect and mitigate XSS attack.**

Keywords—XSS, cross site scripting, mitigation system, machine learning, cyber-attack, lexical analysis

I. INTRODUCTION

Cross-Site Scripting (XSS) attacks can cause very serious problems. Based on some cases that previously occurred, XSS attacks can be used to do data theft, account takeover, manipulate users' decisions, or become pre-initial attack to do further attacks [1]. A big company like eBay and Amazon for example has been recorded to have experienced an XSS attack. This method exploits a security vulnerability on the scripting or sanitation side [2]. In other words, XSS will be executed through the client's browser. XSS security vulnerabilities occur when applications or software do not sanitize or validate input, variables, or parameters properly. That vulnerability allows attackers to send JavaScript code using browser requests. To send the malicious code, the attacker can send the code using forms, URL, or document object manipulation (DOM).

XSS attack is not actually the new method of cyber-attack. This type of attack has long been discovered, and not as new term in cyber security [2]. However, in fact, based on Open Web Application Security Project (OWASP) Top-10 Web Vulnerabilities 2017, XSS becomes one of vulnerability which is often found on most of cyber-attack in the world [3]. In addition, XSS vulnerabilities also still found OWASP Top-10 Web Vulnerabilities 2021 (statistics-based proposal) [4]. The appearance of XSS attacks on the data certainly shows that XSS attacks occur and develop consistently. XSS security vulnerabilities are still considered a common problem, so attackers can take advantage of this attack to carry out further attacks. In fact, as already explained, this XSS attack can cause serious problems. Therefore, it is important to formulate and develop more effective method to overcome this type of attack. The detail of OWASP Top-10 web vulnerabilities could be seen on table 1.

TABLE 1. OWASP TOP-10 WEB VULNERABILITIES 2017 AND 2021

OWASP Top-10 2017		**OWASP Top-10 2021 Proposal**	
A1	Injections	A1	Injections
A2	Broken Authentication	A2	Broken Authentication
A3	Sensitive Data Exposure	A3	Cross-Site Scripting (XSS)
A4	XML External Entities (XXE)	A4	Sensitive Data Exposure
A5	Broken Access Control	A5	Insecure Deserialization
A6	Security Misconfiguration	A6	Broken Access Control
A7	Cross-Site Scripting (XSS)	A7	Insufficient Logging & Monitoring
A8	Insecure Deserialization	A8	Server-Side Request Forgery (SSRF)
A9	Known Vulnerabilities	A9	Known Vulnerabilities
A10	Insufficient Log & Monitoring	A10	Security Misconfiguration

Based on data from the Indonesia National Cyber and Crypto Agency (usually called BSSN), there were around 12.9 million cyber threat attempts to Indonesia during 2018. A total of 513,900 of the total attacks were malware. Not only that, during January - April 2020, BSSN recorded that there were around 88,414,296 cyber-attack activities in Indonesia [5]. With that high attack statistic level, each attack used very complex and varied methods and techniques. Unfortunately, no single Indonesian institution has complete data about the attack description. Therefore, it

is not easy to give exact prediction about what methods used by attackers. To detect and mitigate the attack and in relation to the XSS attack, some research data published by cyber-security company and researchers may be used as represented reference to predict the attackers' methods.

As mentioned, XSS attack has appeared in OWASP Top-10 web vulnerabilities [6]. This type of attack become one of common cyber-attack method used by several attackers. In addition, international cyber-security companies, Rapid7 and Netwrix also put XSS attack method as one of top most common types of cyber-attack [7-8]. They also explain several impacts when attacker exploit XSS vulnerability. In this case, since XSS mentioned as top-most common types of cyber-attack and web vulnerabilities, it is indisputable fact that XSS attack should get attention and cannot be underestimated. Therefore, based on those facts, detection and mitigation method or mechanism become an important thing to continuously developed and studied.

II. PREVIOUS RESEARCH

Several research have discussed XSS attack detection and mitigation method. In general, the study of XSS attacks discusses how to develop accurate attack detection and take preventive actions against XSS attacks. Most recent studies that discuss XSS detection are still use limited sample of XSS attack datasets and have lack procedure in testing the effectiveness of detection. Those studies did not use powerful attack application to test whether the detection was successful implemented or not. In addition to detection, the study also discusses how to defend or prevent XSS attacks. Research [9] used machine learning with hybrid features to detect XSS attack. The use of hybrid features in XSS detection is quite accurate, but there is no mitigation mechanism explained and developed. Still related to the machine learning based detection method, research [10] explore artificial intelligence (AI) term to detect XSS attack. The term is multilayer perceptron technique. The same as previous research, it was only focused on how to build or develop accurate XSS detection. Using multi-layer perceptron to detect XSS attack pattern is not easy to implement, it may need more or high computer resource only for detecting XSS attack. In addition, it was not also easy to embed the detection engine in web application architecture.

Most studies on the prevention of XSS attacks have not been carried out comprehensively. The experiment done by research [11] for example, the defensive method was implemented in very simple web application with 8 pages only. The similar case also occurred on research [12], XSS attack simulation or testing is only based on single pieces of JavaScript code so the result of experiment may not be reliable and representative. The data used are also limited, taken from small scope of cases. It is related to the research [13]. This research use Code Igniter XSS filtering library to filter or sanitize user requests. Unfortunately, there was still no sufficient explanation or measurement about the effectiveness of XSS filtering in solving all types of XSS attack: stored, reflected, and DOM. Similar to previous researches, the research [14] only focus on how to detect XSS attack by using OWASP Security Shepherd. Mitigation and defensive system were not implemented yet.

Based on several previous research explained, there are still five common weakness and problem found, they are:

- the use of limited data in detecting XSS attack.
- weak implementation of XSS attack simulation.
- lack of use attack application or technique to simulate XSS attack to the proposed or developed method.
- the use of very common JavaScript code to examine the effectiveness detection method, so the level of effectiveness is not easy to be concluded.
- unintegrated detection and mitigation method.
- unable to protect multi-websites.
- there is no detailed specification of target website, such as description about security level, provided vulnerabilities, other web vulnerabilities interference.
- the use of single layer security technique.
- not all XSS attack types are solved.

III. CROSS SITE SCRIPTING

XSS attacks exploit the user's browser or frontend. To perform this attack, the attacker will use JavaScript code which run on client browser. If the website has an XSS vulnerability, the JavaScript code can be executed, against the business process of the application [15]. The code can be submitted via search box, form value, and DOM. To check whether the website has XSS vulnerability or not, the attacker simply does some experiments or trial and error. When the test XSS attack is successful, the attacker will devise a scenario to carry out further attacks. The motivation for the attack will certainly vary, depending on the attacker's motives. In more advanced method and techniques, XSS vulnerabilities can be scanned by certain software.

XSS attack has three types of methods, they are (1) stored XSS, (2) reflected XSS, and (3) Document Object Manipulation or DOM based XSS [16]. The essential difference between these types is in how attacker implement the attack procedures and technique. In case of real attack implementation, although there are only three types of XSS attack, there are many techniques that can be used to exploit XSS vulnerabilities. That's why it is urgent and important to develop detection system to detect varied XSS attack pattern accurately.

Stored XSS occurs when the attacker sends and saves malicious JavaScript code to the database, file, or filename. The system saves the code because of a lack of sanitation and validation. When the user or victim accesses the page containing the code, the browser will execute XSS code. In contrast to the stored, reflected XSS can be executed without saving the code into the database. It acts like a mirror or reflection. Most type of this XSS attack occurs in the search box, filter widgets, or URL. Reflected XSS is more frequently used by attackers because they can see the result faster than stored XSS. DOM XSS can be implemented by modifying DOM in the victim's browser. DOM XSS is more difficult to detect, but also difficult to implement. To see the clear differences between each type of XSS attack, see the following XSS code example in table 2.

TABLE 2. THE DIFFERENCES BETWEEN TYPE OF XSS ATTACK

	XSS Type	Code Explanation and Example
1	Stored XSS	The malicious XSS code is saved on the database and executed when user or victim access the page contained that saved malicious code. ——————————————— <!DOCTYPE html> <html lang="en"> <head> <title></title> <link rel="stylesheet" href="css/main.css" /> </head> <body> ** <script> malicious XSS code </script> ** </body> </html>
2	Reflected XSS	Most of search box or page will show the search keyword on the result page. The attacker can use the search box to send malicious XSS code. ——————————————— Sample of malicious XSS code: **<script>alert(document.cookie)</script>** ——————————————— When the keyword submitted, the URL will be the following pattern: http://www.victim.site/search.php?keyword=**<script>alert(document.cookie)</script>**
3	DOM XSS	This type of XSS can be done by modifying DOM element in a web page. Modifying URL parameter on navigation menu for example. http://www.victim.site/page.html?default=**<script>alert(document.cookie)</script>**

To describe why XSS can be one of dangerous attack method and how this attack method is implemented, it is needed to explain simple XSS attack scenario. This is how attacker do account takeover using stored XSS technique. Before explaining the scenario, it is important to know that this is very simple and common scenario of XSS attack procedure. Those scenarios are (1) attacker send XSS malicious code and save it to the victims website, (2) the malicious code will redirect user or web visitor to the phishing page prepared by attacker, (3) the phishing is a login page and the victim is asked to login to the page, (4) because the attacker makes the page similar to original one, the victim login to the phishing page, (5) attacker steal the credential or account of victim (username/e-mail and password), (6) attacker login to the original page using victim's account and change the password and other identification, and (7) attacker uses victim authority to do further illegal actions. See figure 1 to check overall scenario.

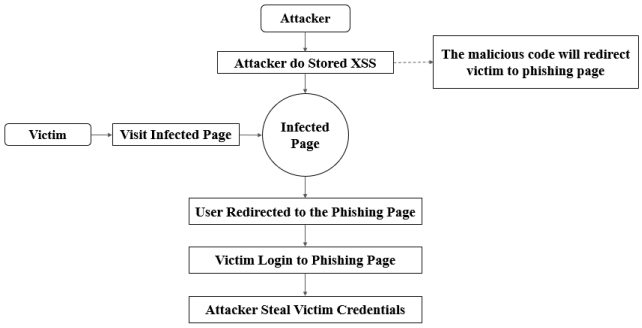

Figure 1. Simple XSS Attack Scenario in Account Takeover

IV. METHODS

The method proposed in this study is divided into 2 parts. First, the machine learning method to detect XSS attacks. To detect more accurately, the detection uses machine learning model. The second proposed method is a multi-layer security to mitigate or prevent XSS attack. Therefore, to ease the explanation, the proposed method will be divided into two separated explanations. To get an idea of the overall method proposed in this paper, see Figure 2.

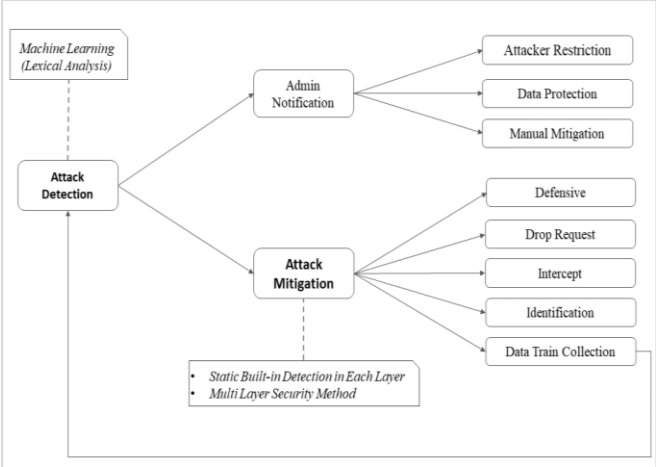

Figure 2. XSS Attack Detection and Mitigation Scenario

Both detection and mitigation method have mutualistic relationship. When the detection engine detects XSS attack, the system can notify the web administrator and activate or trigger the mitigation engine. In addition to build wall system defense, mitigation engine collects XSS attack pattern to NoSQL database (JSON) as feedback. The detection engine can use the database for optimizing further detection result. Meanwhile, in case of web administrators' action, they might take certain action to avoid the attack, such as restrict attacker IP or Mac Address (if identified), take data protection acts, or carry out manual mitigation. With these two forms of notification, the web application gets more option to customize security level and action.

A. Machine Learning Detection

The proposed method used to detect XSS attack in this study is machine learning model. XSS attack patterns are string-based attacks packaged in the form of JavaScript code. The composition string of XSS code can be written very complex and varied, so the application or system must have a comprehensive attack code detection method. It is a must to have complete dataset to develop comprehensive detection. The use of machine learning is to ease the detection of complex attack string pattern. In addition, the detection also can be carried out independently, without involving multiple administrator actions. Therefore, the detection can be carried out more effectively.

In case of machine learning implementation, XSS dataset can be taken from GitHub and Kaggle. Figures 2 and 3 show two datasets that have different scope or source. XSS code in Github dataset taken from URL or request parameters, and Kaggle taken from HTML source. To get more accurate machine learning model, the dataset is separated into two

datasets, for training and testing purpose. To ease the process of detection implementation, Turicreate can be used as engine. This library can ease the implementation of detection using machine learning. Turicreate has complete and powerful machine learning or even AI features. Related to XSS pattern detection, it has a text classifier feature. The feature can be used to classify the text or XXS codes into recognized pattern with the use of lexical analysis. Thus, it is assumed as an effective engine to build the method of XSS attack code detection [17]. This Apple machine learning engine can do lexical analysis or computation so the detection method can accurately predict whether the query or code is malicious or not.

Meanwhile, to check the effectiveness and the stability of the detection method, Zap or OWASP Zed Attack Proxy application could be used because it has XSS attack features. Zap is used to send the payload, so the machine can test and learn the attack string pattern used during the payload. To get more description about dataset, see figure 3 and 4 to see dataset sample.

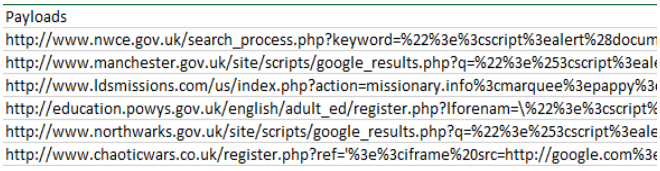

Figure 3. XSS Dataset From Requests Parameters (Github)

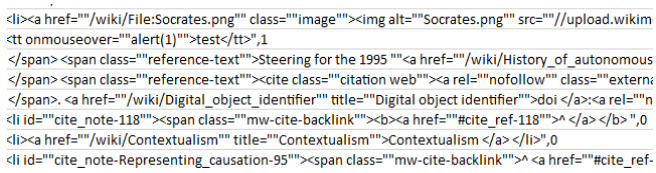

Figure 4. XSS Dataset From HTML/Page Source (Kaggle)

The establishment procedures of XSS detection in this study are divided into three stages: machine learning preparation, detection integration, and detection implementation. The machine learning preparation has seven steps as follows: (1) data preparation; (2) data pre-processing; (3) data modeling; (4) data training (5) data testing; (6) performance evaluation; and (7) performance optimization. To optimize the performance, n-gram value set to the text analytic. It is done to see the accuracy level based on n-gram value. N-gram is a term in Natural Language Processing (NLP). It can be defined as continuous sequences of words, symbols, tokens in a sentence or document. In more technical terms, n-gram can be also assumed as neighboring sequences of items in a sentence. When optimized n-gram has been formulated, model can detect the XSS code patterns, and the interpretation can be the table

TABLE 3. XSS PATTERN INTERPRETATION BASED ON N-GRAM

XSS Pattern	n-gram 1	n-gram 2	n-gram 3
Pattern 1	False	True	True
Pattern 2	True	True	False
Pattern 3	True	True	True
Pattern 4	True	True	False
Pattern 5	True	True	True

True means the detection is valid, and false is invalid. It means that n-gram value can affect to the accuracy of detection. In addition, there are some procedures taken to get more accurate result, such as separating data modelling into training and testing, and evaluating performance of machine learning model. It is also important to use a comprehensive XSS dataset with very complete data features, so the detection engine can be more accurate. Related to machine learning detection procedures, see figure 5.

Figure 5. Machine Learning Detection Procedures

As shown on the figure 5, data processing has three subprocess, as follows data cleaning, features selection, and target description. After machine learning is ready to be implemented in real payload, the detection and mitigation methods need to be integrated. In this case, the detection become a trigger to create an admin notification and activate the mitigation. The detection engine do prediction XSS cyber threat [18], and the mitigation engine build secured defense system. To clearly get description, see the figure 6.

To develop integrated and synchronized detection and multi-layer security engine, the detection engine can be embedded in web application, as a service or task. In addition, it can also be placed on web server mod security or HTTP layer. It is also important to know that each security layer has built-in attack detection, although it has not built with machine learning mechanism. See figure 6 below to check the integration of detection and mitigation mechanism.

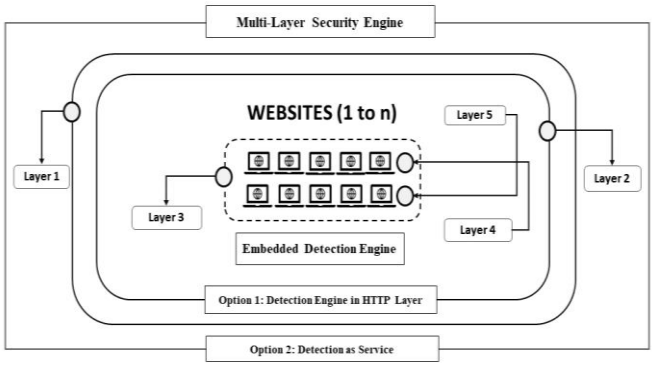

Figure 6. Integration of Detection and Mitigation Mechanism

After machine learning model is embedded as detection engine, Zap and Arachni is implemented to establish XSS attack simulation to sample websites run on web server. Those application have very comprehensive XSS attack features so the pentester, researcher, or web administrator can evaluate web security level, especially for evaluating XSS attack pattern. Those applications can also run multi-threaded tasking and service, so the process of XSS attack can be rapidly fast and powerful. Payload attack implemented by Zap and Arachni can produce detailed attack statistic or report. Since the mechanism is supported by attack report, it can be used to compare security level effectiveness between the propose and previous methods. In

addition, it can also be used as proof that the proposed method has accurate detection and reliable defensive system that can solve security problems found. It is also to measure the effectiveness level of proposed method. See figure 7 to see the implementation of XSS attack using Zap and Arachni.

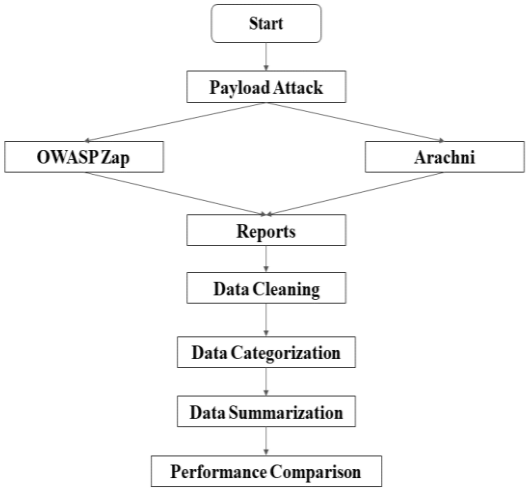

Figure 7. Attack Simulation Detection and Mitigation Zap and Arachni

B. *Lexical Analysis or Computation Technique*

In context of this study, lexical analysis is the method to extract and classify sentences into structured-identified value [19]. This analysis technique is used to ensure whether the input (payload) is XSS malicious code or not. Therefore, sentences in lexical analysis assumed as codes or URL used by attacker to insert XSS code. Lexical analysis is used to extract features from XSS dataset. This type of analysis extracts XSS codes into several parameters or characteristics. The text will be extracted as ASCI so the machine learning engine can classify whether the string is XSS codes or not. In case of detecting XSS code pattern, lexical analysis is simple but powerful method. With this analysis model, the process of detecting XSS malicious code can be easily done, without consuming many computation resources. Since the analysis model only take a few resources, it can be embedded in several layers. As seen on figure 8, the XSS attack detection will use lexical analysis.

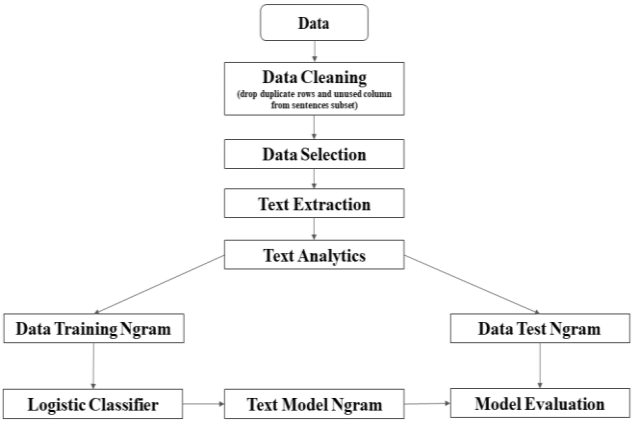

Figure 8. Lexical Analysis for Feature Extraction and Analysis

C. *Multi-Layer Security for Mitigation*

Multi-layer security is a mechanism to comprehensively secure a website or application. This security is called comprehensive because it can handle all websites that are on a web server. This security is built to meet the various characteristics and security needs of each level of website security. This mechanism can also cover various web architectures if it is on the same web server. This mechanism is compiled from various research results on cyber security. Multi-layer security consists of five security layers, they are (1) OWASP ModSecurity; (2) Framework/CMS Default Security Features; (3) HTTP Middleware; (4) Templating Engine; and (5) Data Sanitizer or filter. See figure 9 to get more clearly description.

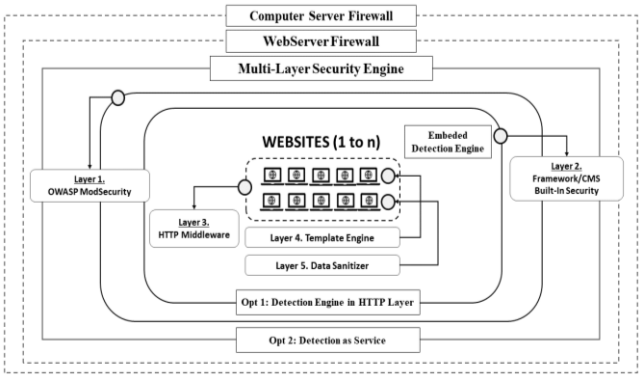

Figure 9. Multi-Layer Security Method to Mitigate Multi-Website

Layer 1 or OWASP ModSecurity or OWASP Web Application Firewall Mod Security is a service, contains a set of rules run on a web server and act as a firewall [20]. This service supports the top-level firewall provided by the web server, computer server, and network gears. OWASP ModSecurity acts based on the rule set by default or customized by the web server administrator. Since it runs on a web server, OWASP ModSecurity can guarantee protection for all websites available on the web server. Not only XSS attack, this ModSecurity provides comprehensive protection against several common attack types, they are:

- SQL Injection
- Local File Inclusion
- Remote File Inclusion
- PHP Code Injection
- PHP Code Injection
- Java Code Injection
- HTTProxy
- Shellshock
- OS Shell Injection
- Session Fixation
- Bot Detection
- Metadata/Error Leakages

Layer 2 or Framework/CMS default security features is a term to refer to the default security features of a web framework or content management system used by web developers. In this case, the common security features provided by web framework or CMS (Content Management System) are filtering and validation, captcha challenges, and CSRF protection. The list of popular and commonly used web framework and CMS can be seen on table 4 and 5.

TABLE 4. TOP-7 COMMON USED WEB FRAMEWORK [21-22]

	Web Framework	Language	Official Website
1	Django	Python	https://www.djangoproject.com/
2	Laravel	PHP	https://laravel.com/
3	Ruby of Rails	Ruby	https://rubyonrails.org/
4	ASP.NET	ASP	https://dotnet.microsoft.com/apps/aspnet
5	CodeIgniter	PHP	https://codeigniter.com/
6	Yii	PHP	https://www.yiiframework.com/
7	Express	JavaScript	https://expressjs.com/

TABLE 5. TOP-5 MOST USED CMS [23]

	Web Framework	Language	Percentage	Domains
1	Wordpress	PHP	77,9%	691,237
2	Drupal	PHP	5,6%	49,834
3	Joomla	PHP	3,7%	33,029
4	Squarespace	PHP	2.6	22,694
5	Moodle	PHP	-	-

HTTP middleware can be defined differently, depend on web framework concept. In Java for example, middleware is called filter or C# calls it delegate handler. Basically, HTTP middleware can be assumed as a function to be used as a controller, watcher, sanitizer, or manipulator in HTTP transportation, such as request and response. See figure 10 to see the concept of HTTP middleware. Templating engine is a parser or converter used to provide readable templating system and to sanitize data output. Before showing data to the user, templating engine sanitize the data. The last layer is data sanitizer. This function is used to sanitize data from or to user. This function is called on form processing, database pre-save, etc.

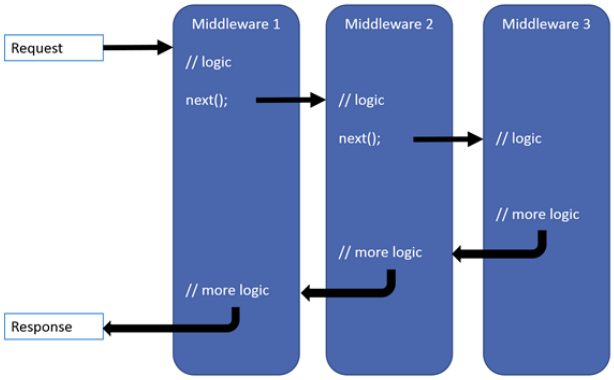

Figure 10. HTTP Middleware Concept in ASP [24]

D. *Method Evaluation and Comparison*

The most appropriate way to measure and evaluate the accuracy of XSS attack detection and the effectiveness of attack mitigation method is by implementing the XSS attack simulation with real attack codes and scenario. In this case, Zap and Arachni is powerful application for simulating and researching the demand of XSS attack. In addition, to get emphasized method, the proposed method should be compared with previous methods used by other researchers.

E. *Complementary Layers in Protecting Multi-Website*

It is important to comprehend that the biggest multi-layer security scope is a web server, and the smallest is web application or even micro service application. In this case, every layer has its' own task to protect web application or components. It also means that to protect a web application, multi-layer security is not always in the form of a complete layer, especially for web application built with very secure web framework or code by experienced programmer. Some of security layers may not need to work, because web application can handle the security problem. In protecting web application, this multi-layer security method has several scenarios, see table 6 below.

TABLE 6. THE SECURITY LAYERS IN PROTECTING MULTI-WEBSITES

	Layers and Web Application Capability	Web/App Security Level	Multi-Layer Actions
1	Web application and server has activated all security layers	high	XSS attack can be handled by all security layers simultaneously.
2	Web application has secured HTTP middleware, data sanitation, and powerful templating engine.	high	XSS attack can be handled by web application itself.
3	Web application has no secured HTTP middleware/data sanitation/powerful templating engine features	medium	XSS attack can be handled by OWASP ModSecurity, data sanitizer, and templating engine
4	Web application does not provide secured HTTP middleware, data sanitation, and templating engine.	low	XSS attack solved by OWASP ModSecurity
5	Web application is not protected by OWASP ModSecurity	low	XSS attack can be handled by web application itself.

V. CONCLUSION

The proposed method is divided into detection and mitigation method. XSS attack patterns and combinations vary widely. This attack can also evolve, along with the attacker's abilities. To overcome the diversity of XSS attacks pattern, the proposed method for detecting XSS attacks involves machine learning model. Model analysis used is lexical analysis or computation that can classify text into several classified. The classified text can be easily identified, so the detection process can be effectively done.

In addition to the use of machine learning with lexical analysis, XSS attack mitigation method is implemented with multi-layer security mechanism. This method utilizes five layers of security so that XSS attacks are not easy to be implemented. This security method is carefully structured, so the probability of a successful XSS attack, both stored, reflected, and DOM, is very difficult to achieve.

Based on considerations mentioned in previous explanation and research, the integration between detection and mitigation method to overcome XSS attack is assumed and believed as effective method. This is reasonable statement because the detection and layer items have been measured and researched. In other word, the detection and mitigation method proposed here have been implemented by some researchers. Related to previous research, this proposed method is to develop previous segmented-existing methods with more reliable and comprehensive configuration and advanced customization. The-refore, these two methods are eligible to be proposed.

VI. REFERENCES

[1] B. B. Gupta, S. Gupta, S. Gangwar, M. Kumar, and P. K. Meena, 'Cross-Site Scripting (XSS) Abuse and Defense: Exploitation on Several Testing Bed Environments and Its Defense', *J. Inf. Priv. Secur.*, vol. 11, no. 2, pp. 118–136, Apr. 2015, doi: 10.1080/15536548.2015.1044865.

[2] S. Gupta and B. B. Gupta, 'Cross-Site Scripting (XSS) attacks and defense mechanisms: classification and state-of-the-art', *Int. J. Syst. Assur. Eng. Manag.*, vol. 8, no. 1, pp. 512–530, Jan. 2017, doi: 10.1007/s13198-015-0376-0.

[3] D. Wichers and J. Williams, 'Owasp top-10 2017', *OWASP Found.*, 2017.

[4] 'OWASP Top-10 2021, statistically calculated proposal.', *Wallarm Blog*. https://lab.wallarm.com/owasp-top-10-2021-proposal-based-on-a-statistical-data/ (accessed Jun. 19, 2021).

[5] 'Rekap Serangan Siber (Januari – April 2020) | bssn.go.id'. https://bssn.go.id/rekap-serangan-siber-januari-april-2020/ (accessed Jul. 19, 2021).

[6] H. M. Søhoel, 'OWASP top ten - What is the state of practice among start-ups?', p. 94.

[7] 'Types of Cyber Attacks | Hacking Attacks & Techniques', *Rapid7*. https://www.rapid7.com/fundamentals/types-of-attacks/ (accessed Oct. 29, 2021).

[8] 'Top 10 Most Common Types of Cyber Attacks', *https://blog.netwrix.com/*. https://blog.netwrix.com/2018/05/15/top-10-most-common-types-of-cyber-attacks/ (accessed Oct. 29, 2021).

[9] D. A. Prasetio, K. Kusrini, and M. R. Arief, 'Cross-site Scripting Attack Detection Using Machine Learning with Hybrid Features', *J. INFOTEL*, vol. 13, no. 1, pp. 1–6, Feb. 2021, doi: 10.20895/infotel.v13i1.606.

[10] F. M. M. Mokbal, W. Dan, A. Imran, L. Jiuchuan, F. Akhtar, and W. Xiaoxi, 'MLPXSS: An Integrated XSS-Based Attack Detection Scheme in Web Applications Using Multilayer Perceptron Technique', *IEEE Access*, vol. 7, pp. 100567–100580, 2019, doi: 10.1109/ACCESS.2019.2927417.

[11] Y. Putra, Y. Yunus, and S. Sumijan, 'Meningkatkan Keamanan Web Menggunakan Algoritma Advanced Encryption Standard (AES) Terhadap Seragan Cross Site Scripting', *J. Sistim Inf. Dan Teknol.*, Sep. 2020, doi: 10.37034/jsisfotek.v3i2.110.

[12] M. F. Kurniawan and W. Setianto, 'OPTIMASI METODE OTOMATISASI PENGHILANGAN KERENTANAN TERHADAP SERANGAN XSS PADA APLIKASI WEB', no. 2, p. 8, 2020.

[13] A. Anggara and R. Somya, 'Pengembangan Sistem Informasi Manajemen Persediaan Barang Dagang Berbasis Web menggunakan Library XSS Filtering', p. 7, 2021.

[14] R. M. Wibowo and A. Sulaksono, 'Web Vulnerability Through Cross Site Scripting (XSS) Detection with OWASP Security Shepherd', *Indones. J. Inf. Syst.*, vol. 3, no. 2, p. 149, Feb. 2021, doi: 10.24002/ijis.v3i2.4192.

[15] M. Shema, *Hacking web apps: detecting and preventing web application security problems*. Amsterdam ; Boston: Syngress, 2012.

[16] 'XSS Attacks Cross Site Scripting Exploits and Defense', p. 482.

[17] *Turi Create*. Apple, 2021. Accessed: Oct. 29, 2021. [Online]. Available: https://github.com/apple/turicreate

[18] A. Kok, I. Ilic Mestric, G. Valiyev, and M. Street, 'Cyber Threat Prediction with Machine Learning', *Inf. Secur. Int. J.*, vol. 47, no. 2, pp. 203–220, 2020, doi: 10.11610/isij.4714.

[19] J. Thanaki, *Python Natural Language Processing*. Packt Publishing Ltd, 2017.

[20] M. Akbar and M. A. F. Ridha, 'SQL Injection and Cross Site Scripting Prevention Using OWASP Web Application Firewall', p. 7.

[21] '8 Framework PHP Terbaik untuk Developer', *Hostinger Tutorial*, Mar. 03, 2019. https://www.hostinger.co.id/tutorial/framework-php (accessed Oct. 30, 2021).

[22] A. C. Nisa, '10 Web Development Framework Terbaik Yang Mesti Kamu Pelajari Di 2021', Feb. 16, 2021. https://www.exabytes.co.id/blog/web-development-framework-terbaik-2021/ (accessed Oct. 30, 2021).

[23] 'CMS Comparison - Most Popular CMS 2021 (Statistic)'. https://www.experte.com/website/cms-software (accessed Oct. 30, 2021).

[24] Rick-Anderson, 'ASP.NET Core Middleware'. https://docs.microsoft.com/en-us/aspnet/core/fundamentals/middleware/ (accessed Oct. 30, 2021).

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Data Visualization of Lecturer of Digital Business Study Program Darmajaya Institute of Informatics and Business

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***Abstract*—Digital Business Study Program is a study program that was born in 2019 from the Faculty of Economics at the Darmajaya Institute of Informatics and Business (IIB Darmajaya). This study program is the most favorite study program at FEB IIB Darmajaya, which of course must be balanced with the many researches carried out by lecturers and students. The efforts of the Darmajaya Institute of Informatics and Business (IIB) to improve the research culture certainly have a very positive impact on the Institute and researchers. Data related to research conducted by lecturers who are currently presented separately on several websites such as Scopus, Web of Science (WOS) and Google Scholar will make it difficult for various parties who want to use data related to these studies for various purposes. . With the development of Digital Business Studies program, the more research done, so there should be a system that can handle them.Data studio is a tool used to create data visualizations. Therefore, it is very important for the digital business study program to have a system that stores data or information about lecturers in the digital business study program which is presented in the form of data visualization so that the information can be understood in a faster and shorter time because the information is packaged in a variety of formats. Diagrams with attractive colors and shapes.**

Keywords-Data Visualization, IIB Darmajaya, Data Processing, Data Analytics.

I. INTRODUCTION

The Darmajaya Institute of Informatics and Business (IIB Darmajaya) is one of the private universities in the city of Bandar Lampung which has a total of 8 study programs. The Digital Business Study Program is a study program that was just born in 2019 from the Faculty of Economics and Business which is expected to be able to answer the challenges of industry 4.0. This Study Program was established based on the Decree of the Minister of Research, Technology and Higher Education of the Republic of Indonesia Number 743/KPT/I/2019. Although this study program is still relatively new, the Digital Business Study Program has now become the favorite study program from the Faculty of Economics and Business, especially after the pandemic era where digital technology is increasingly being used by the public and industry players.

The popularity of this Digital Business study program must of course be balanced with the large number of research conducted by lecturers and students which is in line with efforts to improve the research culture at the Darmajaya Institute of Informatics and Business (IIB), especially in the Digital Business Study Program. Lecturers are required to be able to conduct research that can be published annually by meeting international standards.

Data related to research conducted by existing lecturers is presented separately on several websites such as Scopus, Web of Science (WOS) and Google Scholar which is very difficult for those who want to use the research data for various purposes. Such as individual and institutional interests, academic and non-academic. With the continued development of the Digital Business study program, there will be a lot of research conducted from time to time, especially research conducted by study program lecturers, thus the research data will continue to grow.

Dealing with large volumes of data, often leads to confusion and misinterpretation, so visually grouping a lot of data together will significantly improve the quality of analytics and provide many convenient ways for various parties to utilize the data, viewing the data visually will be very helpful in understanding the data and it will be faster to make decisions [1].

A picture can say a thousand words especially when we are trying to understand and find insights from a data. Data visualization is very helpful when we are trying to find relationships among hundreds or even thousands of variables to find the information we need [2]. Data visualization is the same as communicating, the success or failure of the communication process is determined by how the speaker conveys the information given to the interlocutor, a good data visualization is certainly focused,

provides clear answers and is not too detailed [3]. To create meaningful data visuals, several techniques must be considered. When selecting and summarizing data, its size and composition play an important role. Analytical data requires adequate graphical representation and using temporal data, multidimensional data, 2D area plots and hierarchical representations, can show how data can be visualized [2].

In this study, the process of making data visualizations uses the Google Data Studio application, which is a product from Google that can classify research data based on the date of implementation, study program, type, and status of the research. Details of the research can also be known quickly and easily without manual calculations. The results of data visualization are expected to be a solution to existing problems. With data visualization, the available information can be understood quickly because it uses responsive graphs and tables and supports colors. This will save time and energy in data processing, both from the officer who inputs the data and the parties who will use the data and minimizes the possibility of human error because almost all calculations are carried out by software.

II. THEORY BASIS

A. Dashboard

Dashboard is a collection of informative components that can be in the form of graphs, analytical reports, scorecards or a combination of all of them. Dashboard is a display computer that is rich with indicators, visual reports and announcements mechanisms are combined into a dynamic information display and relevearly and arranged in a layer so that the information can be accessed easily [4].

1) *Benefits of Dashboards*

Dashboards basically monitor the contributions of various departments within the organization. To monitor the performance of the organization as a whole, the dashboard can report and capture certain data points in each department in the organization or provide an overview of previous performance and comparison with performance current. The benefits of dashboards include:

- Visual presentation of performance measures
- Ability to identify and correct trends negative
- Efficiency /measurements inefficiency
- Showing trends new in generating detailed reports
- Accurate in making decisions based on data collection
- Alignment of organizational strategies and objectives
- Total visibility of all systems
- Instant identification outliers and of correlations data
- Save time with comprehensive data visualization display

2) *Types of Dashboards*

According to Utari (2017) dashboards are grouped into three categories, namely strategic dashboards, tactical dashboards and operational dashboards:

- Strategic Dashboards

  On strategic targets, key *Performance Indicators* (KPIs) and related organizational scales Dashboards at the strategic level of the organizational scale are often lowered to the level departmental, while maintaining alignment with company goals. In monitoring and executing strategies for the progress of the managers involved, they often use strategic dashboards, with data usage periods ranging from 5 years to 10 years in advance [5].

- Tactical Dashboard Tactical

  Dashboard to find out trends related to each strategic initiative and monitor results is a function of using tactical dashboards. Tactical dashboards are also used to monitor projects. Strategic initiatives are measured by comparing the goals and current performance that have been previously set (for example, there are problems and goals to be achieved). Manager involved with individual activities to support the achievement of the strategic objectives the organization is baofgiantactical Dashboard.

- Operational Dashboard

  In events complex, technical activities and to control business processes can use a strategic level dashboard. For operational dashboards, it focuses on real time teams on transactional data. The display layer displays a graphic with the current time. To monitor ongoing activities using the operational dashboard. Responsibilities when using operational dashboard narrower ones (service, customer, sales, etc.) that require robust analysis and detailed information.

Based on the description above, it can be seen that the operational dashboard uses real time data to get precise and accurate information in making and using the dashboard.

B. Graph

According to Utari (2007) Diagrams or graphs are pictures that show data visually, based on observed values. The original or from previously created tables. There are several types of graphs or diagrams that can be used to display a clearer picture of information, including [5].

1) *Graphic Diagram*

To determine the trend or trend can use a line chart to show the change in value with time from a series of relative data.

2) *Bar Chart*

To present values relative to the data held, it is more appropriate to use a bar chart.

3) *Bread*

Diagram Bread (pie) diagram is usually used to describe the percentage of data. For example, how many lecturers make journals on Google Scholar? Every year.

C. Key Performance Indicator (KPI)

According to Bernard (2016), key performance indicator (KPI) is an important navigation tool used by managers to understand whether their company is on the way to success or is off the path to success.

The factor that is the key to the success of the organization is that it must have a KPI (Key Performance Indicator) carefully that can reflect important performance for the organization with the company's strategy. To set KPIs and targets to be achieved cannot be carried out by default, but must use systematic and appropriate methods. In determining and setting KPI targets correctly, it will be able to direct the organization with the potential to improve or improve performance so that KPIs are often associated with initiatives related to performance improvement. According to Soemohadiwidjojo, 2015) inappropriate assessment of performance indicators as KPIs can result in inefficient or counterproductive performance measurements. For example, to measure the level of customer satisfaction, the organization sets an indicator in the form of the number of customer complaints received. The fewer customer complaints received, the higher the level of customer satisfaction should be. This is not entirely true because there are very few customer complaints, or customers who will submit complaints cannot access the means of communication provided by the organization.

As one of the main tools of organizational management, the main objectives of determining KPI are as follows:

1) To link the vision-mission-values, higher education strategy and lecturer performance targets with the activities of the Digital Business study program lecturers to achieve the desired performance goals.
2) To measure the trend of lecturer performance based on many journals made in the Digital Business study program. Is there a significant increase or decrease.
3) To compare the performance of lecturers with other lecturers so that the Digital Business study program gets an overview of the performance of the lecturers so that they can easily make decisions and policies.
4) The results of achieving KPIs become the basis for providing rewards and consequences so that KPIs are also useful for encouraging work motivation and good behavior from employees.

D. Google Data Studio

Google studio is one of google's products as a new data visualization platform for enterprises as part of Google Analytics 360 Suits, google data studio enables users [6]:

1) *Connect to data sources*
2) *Create dashboards, custom reports and calculations*
3) *Collaborate and share with another*

E. Definition of Data Visualization Data

Visualization is seen by society as modern visual communication. Michael Friendly states that data visualization is the science of visual representation of data. It is defined as information that has been abstracted in some schematic form, including characteristics or variables for units of information. This process involves the creation and study of visual representations of data [7]. The main purpose of data visualization is to communicate information clearly and efficiently through statistical graphs, plots, and information graphs. Numerical data can be visualized using dots, lines, or bars, to visually describe quantitative messages [8].

Indeed, Fernanda Viegas and Martin M. Wattenberg have recommended that good visualization should not only communicate explicitly but also increase audience engagement and attention. Data visualization is closely related to graphic information, information visualization, scientific visualization, exploratory data analysis, and statistical graphs. In today's new era, data visualization has become an area of intense research, teaching and development. According to Post, Nielsen, and Bonneau, designers should be able to unify information and scientific visualization [9].

The main purpose of visualization is to facilitate effective and clear communication in a graphical way, so that data visualization is not boring and looks interesting to people who read it.

Meanwhile, data visualization is defined in various ways to create diagrams, images or animations with the aim of communicating information. In general, large amounts of data visualization are then designed with various models to be presented.

F. Design of Information System

- Systems

System is a collection of several elements that are interconnected with one another to form a single unit to carry out a main purpose of the system. To distinguish a system or not, it can be seen from its characteristics that the system is basically complementary, has boundaries, aims, is composed of subsystems, is open and related and depends on forming a systematic unity [10].

- Information

Information is data that has been processed into a form that has meaning for the recipient (Jogiyanto, 2005)". Data is an event or fact that has no meaning. Information is generated from data that is processed into a modal. The quality of information depends on three things, namely: accurate, timely and relevant [11].

- Information System Information

System is an organization in which there is a system within an organization that brings together management and daily transaction needs that support the organization's operational functions with strategic and managerial activities to be able to make reports needed by certain outside parties [12].

G. Characteristics of Big Data

Big data has 2 special characteristics, namely structured, semi-structured, or unstructured data, for example, data in relational databases, bulletin board discussions, and videos

on their respective websites; another trait is data that is internal or external to the organization, for example, messages to after-sales service in one hand. Big data that is managed well will be able to help work towards a better [13].

III. RESEARCH METHODOLOGY

The research method was carried out using several methods according to the design and research tools. The research was conducted in a logical sequence of processes. To determine and achieve goals in solving problems used to visualize data assisted by research methods. The process can be described in the form of a flow that aims to provide a precise, systematic and orderly explanation [14]. The stages of this research can be seen in Figure 1.1

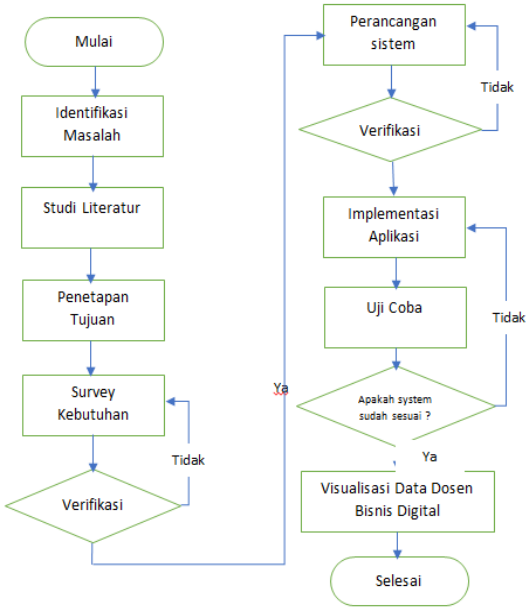

Figure 1 Research Stages The

Following is an explanation of the research methodology:

A. *Problem Identification*

The initial stage of the research is to conduct a process of assessing problems and understanding problems related to the performance of IIB Darmajaya lecturers. Lecturer performance is related to lecturer biodata which includes education that has been taken by lecturers, graduates from and regional colleges of lecturers and journals that have been made by lecturers to journals that have been made whether they have been published on several media platforms for journal publications such as Google Scholar, Scopus and WOS. As material for could see problems existing in determining dan making the technology into an appropriate application for today's digital era.

B. *Literature Study*

To support research writing, literature study is needed by collecting information according to related research topics. Sources of information can be taken from presentation documents, books, research journals and other sources obtained from several sources that can be offline or online [15]. The literature study stage is a series of learning processes related to all the methods used in making assignments. Learning is done by looking for a reference source and references that are relevant to the case study [16]. Literature can be used and obtained from a number of accredited papers and journals, e-books, and theses, as well as reading sources on the internet. The important thing to do at this stage is to learn mapping visualization technology. Mapping visualization is a state of mapping and analysis of everything that is an attribute of the performance of IIB Darmajaya lecturers. Many things that must be learned from visualization can be used to open data, store data, process graphical data into information that is easy to understand [17].

C. *Setting Goals*

At this stage how to set the goals of the application to be made by looking at the identification of the problems contained in the previous step. By setting the right goals, it can help direct the benefits that will be obtained from making a data visualization application for the performance of lecturers of IIB Darmajaya Digital Business Study Program.

D. *Needs Survey (data obtained)*

This stage takes data about Lecturers of IIB Darmajaya Digital Business Study Program which will be developed in the process of making applications in the form sheets of lecturer data covering education level, place of education, geography and journal searches made by lecturers from various platforms including No google scholar,Scopus and WOS.

E. *Verification*

This stage is an examination stage that is carried out carefully whether the data obtained is correct and appropriate to be used as an application for visualizing the performance data of the lecturers of IIB Darmajaya Digital Business Study Program.

F. *System Design The*

Next stage of system design is divided into several stages carried out during the design process system:

1) *Creating SystemAn*

Architecture Architecture that will be made to describe the business process design regarding the Lecturer Performance Visualization workflow that will be designed before heading to the application implementation stage.

2) *Creating aGUI design Storyboard*

GUI Storyboard describes the appearance of the design of the system to meet user requirements.

G. *Validation*

The validation process is carried out to check the results of the designs compiled based on the data obtained which are useful for the implementation of the performance visualization application for the lecturers of IIB Darmajaya Digital Business Study Program.

H. Application Implementation

The stage implementation applications will begin when the requirements have been met. This process will use digital business lecturer datasheets to build digital business lecturer data visualizations using google studio as an application used to create digital business lecturer data visualizations.

I. Trial

Testing is carried out on a functional and non-functional basis to find out the whole system based on if something goes wrong in the application it will return to the stage development and then a trial will be carried out again.

IV. IMPLEMENTATION

At this stage is the implementation of digital business study program data that has been made in excel form which is stored in the spreadsheets application. Then the data is imported into the data studio application to be presented in the form of a visualization. The following is a visualization display of digital business study programs using data studio.

A. Digital Business Study Program menu dashboard

In the picture above, the digital business study program menu dashboard is presented in the form of visualization, we can see information on the number of lecturers, educational history, and number of papers, number of lecturer papers, and a button to see the number of each paper per year, the title of the paper.

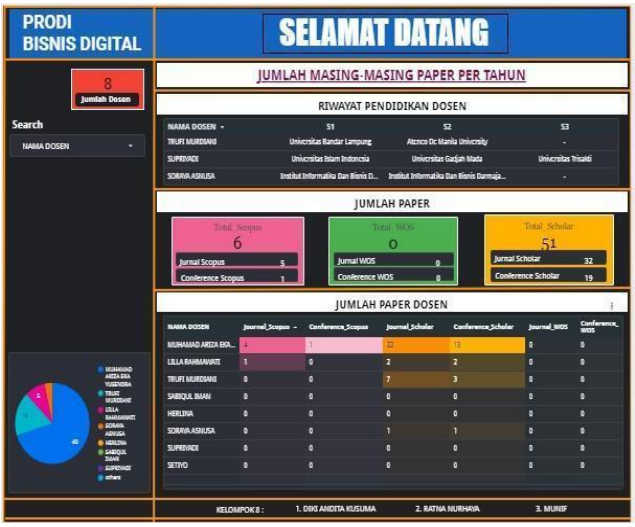

Figure 2 digital study program dashboard menu

1) *Dropdown list of lecturer names the*

Drop-down list of lecturer names is used to display the names of digital business study program lecturers. The field taken is the lecturer's name field, and through this button we can see the details of the lecturers one by one about their educational history, the number of Scopus indexed papers, WOS and Scholars.

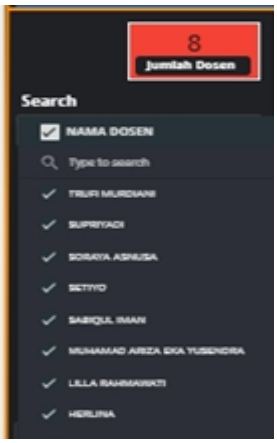

Figure 3 Dropdown list of lecturers' names Lecturer

2) History lecturer history

The Chart is used to view the education history of the lecturers starting from the history of undergraduate education, master's education, and doctoral education.

Figure 4 Chart table of lecturers' history

3) *Scorecard number of papers*

Scorecard number of papers is used to see the total papers indexed by Scopus, WOS, and Scholar. And each also presented the number of types of paper categorized as journals or categorized as conferences.

Figure 5 Scorecard number of papers

4) *Chart table number of lecturer papers*

Chart table number of papers is used to see the number of types of paper categorized as journals or categorized as conference based on the name of the lecturer.

Figure 6 Chart table for the number of lecturers' papers.

5) *Pie chart the pie*

A chart is used to display the total number of papers from each lecturer and the most dominant color is the largest number of papers.

Figure 7 PieChart

6) *Paper Per year*

Used to display Scopus, WOS, and Scholar indexed papers, and the type of paper included in the journal or entered into the conference based on the year and the name of the lecturer.

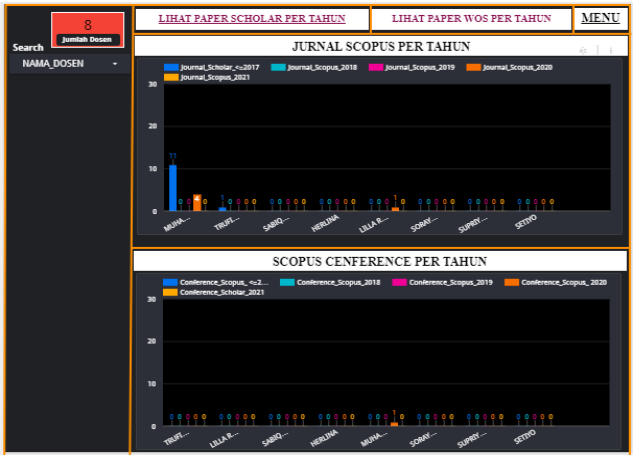

Figure 8 the number of papers per year indexed by Scopus

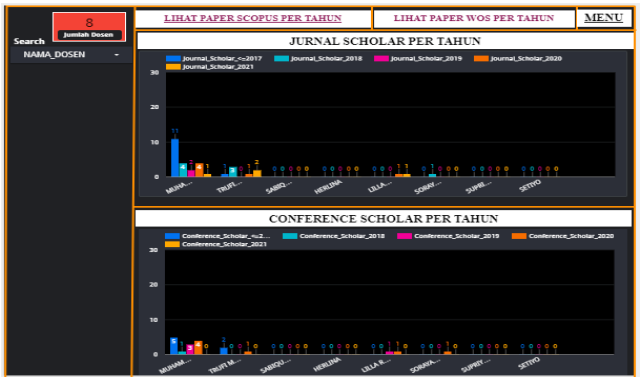

Figure 9 the number of papers per year indexed by scholar

Figure 10 the number of papers per year indexed scholar

7) *Paper title*

Used to display the paper title of each lecturer which we can filter using the year of paper, paper (Scopus/WOS/Scholar), type of paper, and author's name.

Figure 11 Scopus indexed paper titles, WOS, scholar

V. CONCLUSIONS AND SUGGESTIONS

A. Conclusion

Digital business study program is one of the study programs in the business economics faculty at the Darmajaya Institute of Informatics and Business (IIB). The digital business study program is a study program that studies several sciences ranging from management science, business and information technology 4.0 where the development of business models is carried out online. Data or information about lecturers who teach in digital business study programs is very important as monitoring material.

In this study, data visualization of digital business study program lecturers at the Darmajaya Institute of Informatics and Business which includes the number of lecturers, the names of the lecturers, the educational history of the lecturers (S1, S2, and S3), the number of Scopus indexed papers, WOS, and scholars, and we can looking for the title of each lecturer's paper in the last five years, so that by presenting the data visually, the information can be understood in a faster and shorter time because the information is packaged in various diagrams with attractive colors and shapes.

B. Suggestion

1) Visualization of digital business study study data only displays papers of the last 5 years, so data for digital business study study lecturers who are under 5 years old are not available.

2) The data visualization that the researchers did was limited to digital business study programs, so that data visualization of various study programs at the Darmajaya Institute of Informatics and Business could be developed.

REFERENCES

[1] AS Syed Fiaz, N. Asha, D. Sumathi, and AS Syed Navaz, "Visualization: Enhancing big data more adaptable and valuable," *Int. J. Appl. eng. res.*, vol. 11, no. 4, pp. 2801–2804, 2016.

[2] R. Toasa, M. Maximiano, C. Reis, and D. Guevara, "Data visualization techniques for real-time information - A custom and dynamic dashboard for analyzing surveys' results," *Iber. conf. inf. syst. Technol. cist.*, vol. 2018-June, pp. 1–7, 2018, doi:10.23919/CISTI.2018.8398641.

[3] N. Ahmad Syaripul and A. Mukharil Bachtiar, "Interactive Data Visualization of Open Data for DKI Jakarta Provincial Government: Topics of Regional Economy and Finance," *J. Sist. inf.*, vol. 12, pp. 15–29, 2016.

[4] FM Aditya, "Designing Dashboards as Decision Support Based on Queue Data in Antribos Applications (Case Study: Its Medical Center)," p. 111, 2018.

[5] 127-133. Arciniegas Paspuel, OG, lvarez Hernández, SR, Castro Morales, LG, & Maldonado Gudiño, CW (2021). Emotional intelligence en estudiantes de la Universidad Autónoma de Los Andes. Revista Conrado, 17(78), "No 主観的健康感を中心とした在宅高齢者における 健康関連指標に関するTitle, "p. 6, 2021.

[6] D. Fernando, "Data Visualization Using Google Data Studio," *Natl. Semin. inf. Technol. eng.*, vol. 1, no. November, pp. 71–77, 2018, [Online]. Available: https://e-jurnal.lppmunsera.org/index.php/snartisi/issue/view/100.

[7] M. Friendly and DJ Denis, "Milestones in the History of Thematic Cartography, Data Visualization," no. January 2001, 2009, [Online]. Available: http://www.math.yorku.ca/SCS/Gallery/milestone/%0Ahttp://datavis.ca/milestones/.

[8] S. Few, "Selecting the Right Graph for Your Message," *Intell. Percept. Edge*, vol. 7, no. 14, p. 35, 2004, [Online]. Available: http://www.perceptualedge.com/articles/ie/the_right_graph.pdf.

[9] GM Nielson, "DATA VISUALIZATION: THE STATE OF THE ART Proceedings of the 4th Dagstuhl Seminar on Scientific Visualization CD-ROM," *Art Springer*, no. February, 2002.

[10] H. Nopriandi, "Student Registration Information System Design," *J. Teknol. Dan Open Source*, vol. 1, no. 1, pp. 73–79, 2018, doi:10.36378/jtos.v1i1.1.

[11] M. Susanti, "Web-Based Academics," *J. Inform.*, vol. 3, no. 1, pp. 91–99, 2016, [Online]. Available: http://lppm3.bsi.ac.id/jurnal%0ASistem.

[12] Y. Eka and E. Arviana, "Information System of Service Revenue at PDAM Tirta Patriot Bekasi Cooperative," *J. Tek. computer. AMIK BSI*, vol. 4, no. 1, pp. 1–8, 2018, [Online]. Available: https://ejournal.bsi.ac.id/ejurnal/index.php/jtk/article/view/2377.

[13] B. Tutorial and D. Brookshier, "About the Tutorial," pp. 327–328, 2000.

[14] A. & N. Achmadi, "Theory of Research Methodology," vol. pp. 1–21, 2011.

[15] S. Pomalingo, B. Sugiantoro, and Y. Prayudi, "Data Visualization as Support for Social Media Investigations," *Ilk. J. Ilm.*, vol. 11, no. 2, pp. 143–151, 2019, doi:10.33096/ilkom.v11i2.443.143-151.

[16] P. Compilation and S. Literatur, "MANUAL FOR THE STUDY OF LITERATURE COMPLETED BY: Wala Erpurini." .

[17] Y. Afiyanti, "Use of Literature in Qualitative Research," *J. Nursing Indonesia.*, vol. 9, no. 1, pp. 2003–2006, 2014, doi:10.7454/jki.v9i1.157.

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Visualization of Lecturer Education and Research Data (case study of Informatics Engineering Lecturer IIB Darmajaya)

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Abstract— Lecturers who are qualified and competent in their fields are needed to encourage the quality of higher education. One way that can be done is by conducting research. Research in higher education is directed at developing science and technology, as well as improving the welfare of the community and the competitiveness of the nation. As time goes by, the research conducted by lecturers of the informatics engineering study program is increasing. This causes the processing and retrieval of certain information takes a long time. Currently data processing only uses Microsoft Excel so that the available information is more difficult to understand. The information to be processed is data visualization of education and research data by lecturers of the informatics engineering study program at The Institute Informatics and Business Darmajaya. Therefore, visualization using Google Data Studio is needed to make it easier for someone to understand the existing data and information. based on trials of making educational data visualization and lecturer research using Google Data Studio, it produces data in attractive graphic form so that the data and information displayed are easily understood by readers.

Keywords—visualization, Research data, Google Data Studio.

I. INTRODUCTION

Universities have lecturers whose job is to guide students in various majors. To encourage the quality of higher education, qualified and competent lecturers are needed in their fields. There are many ways that can be done to improve the competence of lecturers, one of which is by conducting research. Research is one of the lecturers' efforts to remain relevant and develop in their field of competence. This is regulated in the law of the republic of indonesia number 12 of 2012 article 45 concerning higher education. Paragraph 1 of the article states that research in higher education is directed at developing science and technology, as well as improving the welfare of the community and the competitiveness of the nation.

Research conducted by lecturers of the study program informatics engineering IBI Darmajaya now increasing continuously, making it difficult to process data. A lot of existing data and increasing complexity make the processing and retrieval of certain information takes a long time.. Currently, lecturer research data processing is only using Microsoft Excel. However, due to the limited features of Microsoft Excel and the increasing number of data, and the increasing number of data makes the information more difficult to understand. Based on the existing problems, it is very necessary to visualize the education and research data of lecturers, especially the study program informatics engineering using Google Data Studio. Google Data Studio is a cloud-based program designed as an easy-to-use tool to represent complex data sets in an attractive and clear way (Fernando, 2018). The core function of Google Data Studio is to display visuals such as dashboards from social media and web analytics such as Google AdWords and YouTube analytics, but with the support of MySQL and Google Sheets it shows that the program can be used by researchers to interpret their own data in an equally attractive and interesting format. user friendly (Snipes, G. 2018). The ability of Data Studio researchers to monitor and visually represent mdata can be useful for businesses and communications or anyone working with data. In addition, users look for dynamic ways to present data or deal with data. a. Data visualization can help people to understand the significance of data by placing data in a visual context. The

results of data visualization are expected to make it easier for someone to understand the existing data and information.

In a previous research entitled Designing and Making Data Visualization of Internal Research Funds and LPPM Dikti Grants, Multimedia Nusantara University, it was found that with data visualization, the existing information can be understood in a shorter and easier time because the information is packaged in various colored diagrams. and attractive shapes. Easy-to-see information makes the decision-making process easier (Loka and Natalia, 2019).

I. METHOD

A. *lecturer*

Government Regulation of the Republic of Indonesia number 37 article 1 concerning lecturers states that: lecturers are professional educators and scientists with the main task of transforming, developing and disseminating science, technology and art through education, research, and community service.

Lecturer performance is something produced by lecturers in achieving responsible and quality performance (Suryaman and Hamdan, 2016)

B. *Research*

Research is an effort to develop knowledge, develop and test theories. In relation to knowledge development efforts, there are five steps for developing knowledge through research, namely: (1) identifying research problems, (2) conducting empirical studies, (3) replicating or repeating, (4) integrating (synthesising) and reviewing, and (5) using and evaluating (Dan and Abu Achmadi, 2016).

C. *Visualization*

Data visualization is the same as communicating, the success or failure of communication is determined by how the speaker conveys the information given to the communication partner. Good visualization is certainly focused, provides clear answers, and is not too detailed. To achieve good visualization, a data visualization process is carried out (Ahmad Syaripul and Mukharil Bachtiar, 2016).

D. *Cloud Computing*

Cloud Computing is a promising new computing paradigm and is a future technology that provides many computing services that have never been experienced before. A Cloud Computing model infrastructure setup is usually known as a Cloud. Here are some of the categories of services available from a Cloud.

SaaS is a service for using a provided application – the service provider manages the platform and infrastructure that runs the application.

PaaS is a service for using the provided platform – developers focus on the applications they build without thinking about maintaining the platform.

IaaS is a service to use the infrastructure that has been provided (May Lenawati and Hani Atun Mumtahana, 2018)

E. *Google Cloud Storage*

Google Cloud Storage is a service product from Google that allows you to easily store, access, and protect data. With Google Cloud Storage, users can store and manage access to any amount of data, whether for individuals or groups.

Google Cloud Storage allows users to store, retrieve, share, and analyze data without worrying about maintenance, upgrading or downgrading, or upgrading hardware and firmware.

Google Cloud Storage is a service product that is devoted to developers as a medium for storing very large data. This service allows you to create a file sharing service, video sharing or photo sharing very easily without thinking about how to build a server infrastructure.

F. *Research Stages*

The research stages describe the flow of the research from the beginning to the end of the research. This research was carried out in several stages which can be seen in Figure 1.

Fig. 1. Stages of Data Visualization Research

F. *Research Data*

TABLE I. The data sources used in this study were obtained from data published on the SINTA website (https://sinta.ristekbrin.go.id) for the last five years. The data can be seen in table 1.

TABLE I. RESEARCH DATA

Data Dosen S1 Teknik Infomatika IBI Darmajaya				
No	***Nama Dosen***	***Pendididikan***	***Scoopus***	***Google Schoolar***
1	Suhendro Yusuf Irianto	S3	4	49
2	Sri Lestari	S3	4	119
3	Joko Triloka	S3	3	35
4	Chairani	S3	6	22
5	Isnandar Agus	S2	0	60
6	Amnah	S2	0	3
7	Nisar	S2	0	3
8	Riko Herwanto	S2	0	11
10	Septilia Arfida	S2	0	16
11	Yuni Arkhiansyah	S2	0	3
12	Fitria	S2	18	120
13	Hariyanto Wibowo	S2	0	12
14	Yulmaini	S2	3	48
15	Sulyono	S2	0	12
16	Rionaldi Ali	S2	2	10
17	Rahmalia Syahputri	S2	0	7
18	Tri Wahyuni	S2	0	0
19	Hary Sabita	S2	0	0
20	Yuni Puspita Sari	S2	0	16
21	Rio Kurniawan	S2	1	41
22	Ketut Artaye	S2	0	5
23	Triowali Rosandy	S2	0	30
24	Suci Mutiara	S2	0	0
25	Muhammad Fauzan Azima	S2	2	27
26	Siti Nur Laila	S2	1	4

a.

G. *Data Analysis Method*

The data analysis method in this research is to design visualization using Google Data Studio. The stages of data analysis using Google Data Studio are as follows:

- Sign up for a Google Data Studio account
- Sign in using a previously used E-mail
- Prepare data to be visualized
- Change data format in Google Sheet form
- Visualize the data that will be displayed using several features available in Google Data Studio.

III. RESULTS

A. *Results*

Based on the design that has been done, the making of data visualization of lecturers' education and research using Google Data Studio produces data in the form of attractive graphics so that the data and information displayed are easily understood by readers.

B. *Making Data Visualization*

- Data on the number of lecturers, and Lecturer Education for Undergraduate Informatics Engineering IBI Darmajaya Study Program using the chart score card feature

Fig. 2. Data on the number of lectturers

- Using the table feature in displaying data on lecturers' names and lecturers' education, for Data Visualization Research Stages to find out lecturer information.

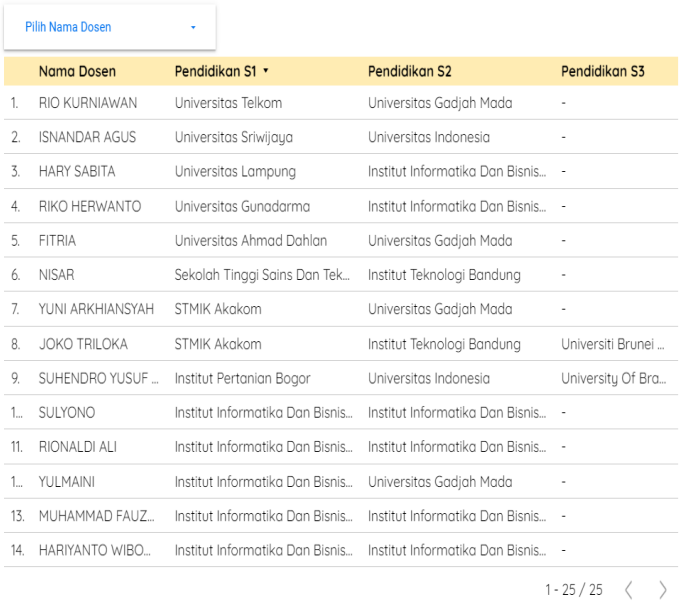

Fig. 3. Lecturer Education Data

- Using the google maps chart feature in displaying the location of lecturers' education in pursuing undergraduate, postgraduate, and doctoral education.

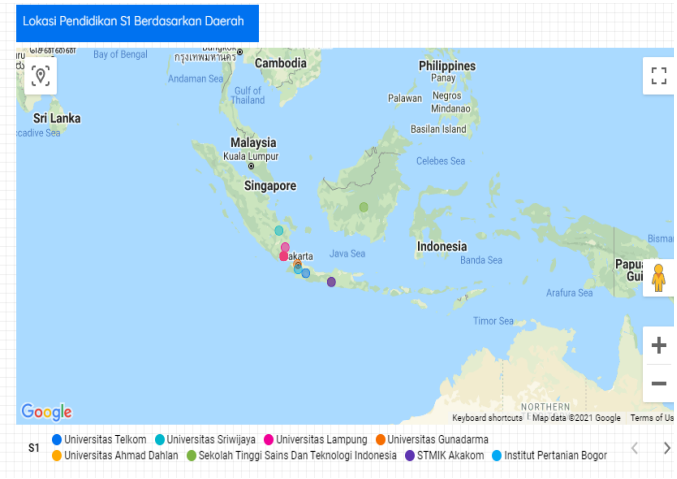

Fig. 4. Location Map of Lecturer S1 Education

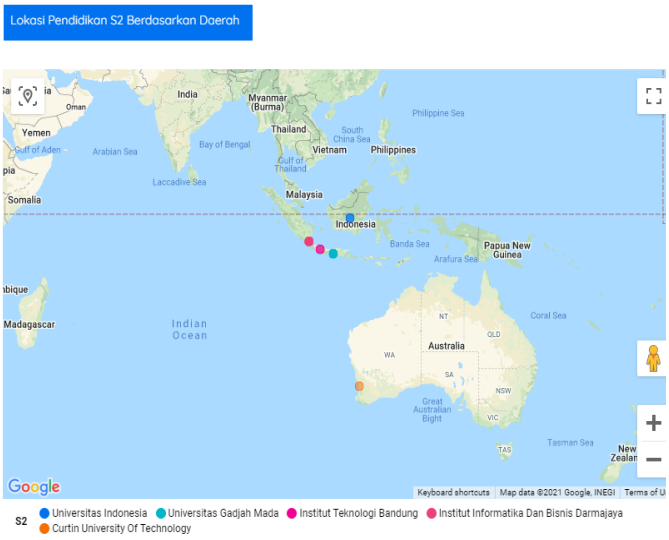

Fig. 5. Location Map of Lecturer S2 Education

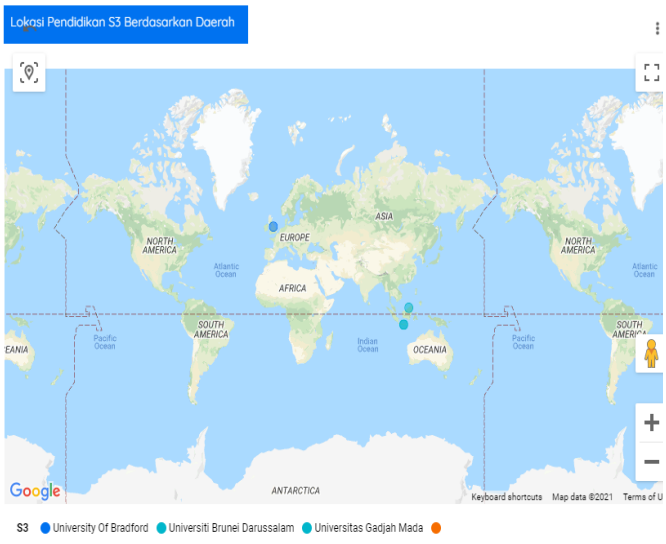

Fig. 6. Location Map of Lecturer S3 Education

- Displays data on lecturers in Informatics Engineering, the number of lecturer data, the number of Scopus data, the number of WOS data, and the amount of schoolar data using the chart score card feature.

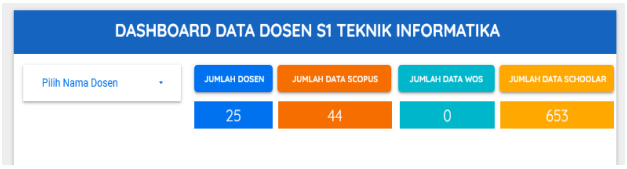

Fig. 7. Research Data for Undergraduate Informatics Engineering Lecturers

- Displays data on lecturers' names and Scopus data as a whole using the chart line feature

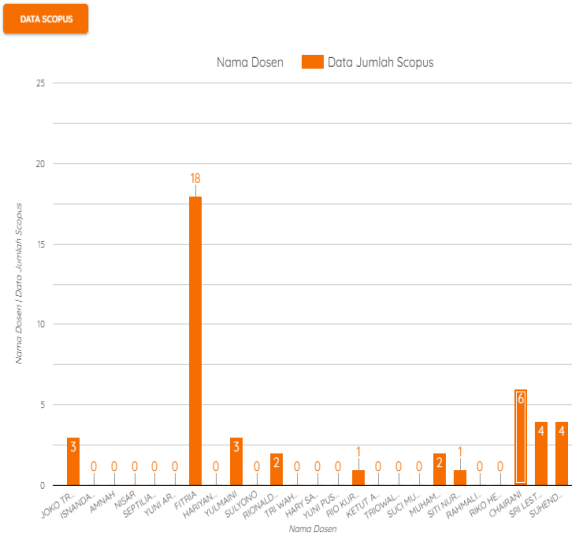

Fig. 8. Diagram of Total Data Scopus Lecturer of Informatics Engineering

- Displaying data on lecturers' names and Scopus data as a whole starting from 2017 to 2021 using the chart line feature.

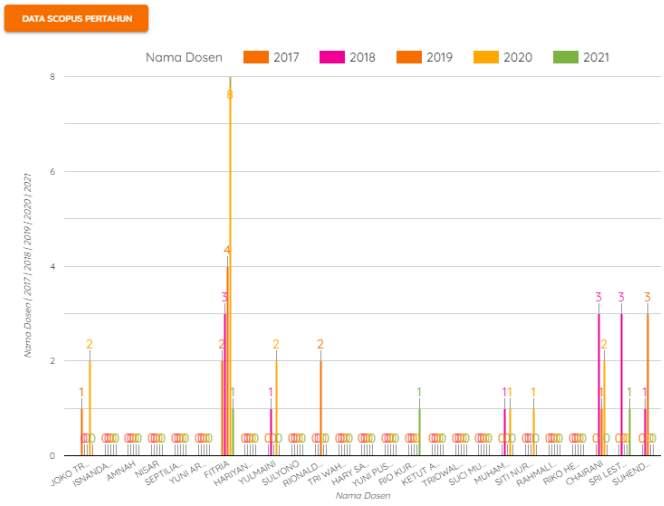

Fig. 9. Annual Scoopus Data Diagram for Informatics Engineering Lecturer

- Displays data on lecturers' names and overall Google Scholar data using the chart line feature.

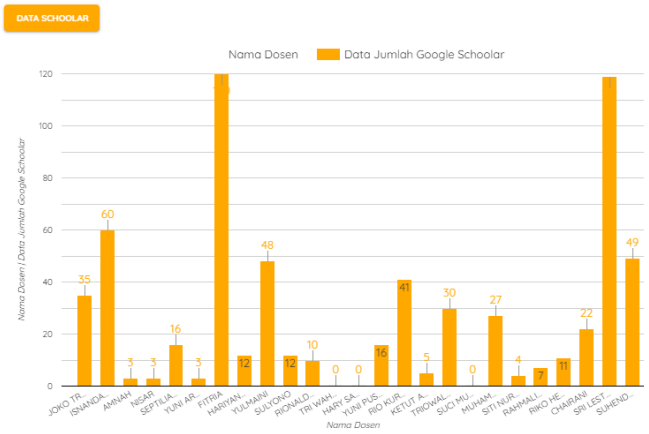

Fig. 10. Total Data Diagram of Google Scholar Informatics Engineering Lecturer

- Displaying lecturer name data and google scholar data as a whole starting from 2017 to 2021 using the chart line feature.

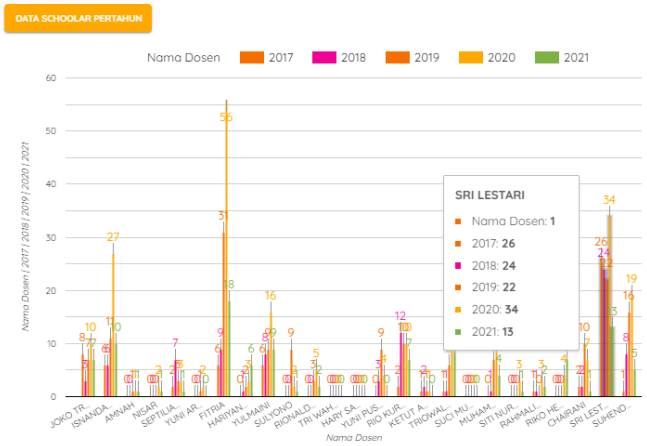

Fig. 11. Data Diagram of the Informatics Engineering Lecturer Annual Google Scholar

IV. CONCLUSION

The data used is obtained from the SINTA website with 25 lecturers, 44 Scoopus researches, 653 Google Scoolars. Lecturers of the informatics engineering study program are dominated at the postgraduate education level. Based on the data visualization design created using Google Data Studio, it produces data in the form of attractive graphics so that the data and information displayed are easily understood by readers. However, this research still has many limitations, namely the data used is not real-time (static). Suggestions for further research are to use real-time data so that the data displayed is the updated (latest) data.

THANK-YOU NOTE

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REFERENCE

[1] Ahmad Syaripul, N. and Mukharil Bachtiar, A. (2016) 'Visualisasi Data Interaktif Data Terbuka Pemerintah Provinsi Dki Jakarta: Topik Ekonomi Dan Keuangan Daerah', *Jurnal Sistem Informasi*, 12, pp. 15–29.

[2] Dan, C. N. and Abu Achmadi (2016) *Metodologi Penelitian, Teori Metodologi Penelitian*.

[3] Fernando, D. (2018) 'Visualisasi Data Menggunakan Google Data Studio', *Prosiding Seminar Nasional Rekayasa Teknologi Informasi | SNARTISI*.

[4] Snipes, G. (2018) 'Google Data Studio Product Review'. *Journal of Librarianship and Scholarly Communication, 6 (General Issue), eP2214.*

[5] Mei Lenawati, Hani Atun Mumtahana (2018) 'PENERAPAN CLOUD STORAGE DALAM PERKULIAHAN FAKULTAS TEKNIK UNIVERSITAS PGRI MADIUN', *Journal of Computer, information system, & technology management Online ISSN: 2615-7357 Vol. 1, No. 2.*

[6] Google Cloud Storage https://cloud.google.com/storage

[7] https://sinta.ristekbrin.go.id

[8] Loka, W. I. and Natalia, F. (2019) 'Perancangan dan Pembuatan Visualisasi Data Dana Penelitian Internal dan Hibah Dikti LPPM Universitas Multimedia Nusantara', *Ultima InfoSys : Jurnal Ilmu Sistem Informasi*. doi: 10.31937/si.v10i1.867.

[9] Suryaman, S. and Hamdan, H. (2016) 'PENGUKURAN KINERJA DOSEN UNSERA DENGAN PENDEKATAN BALANCED SCORECARD', *CENDEKIA: Journal of Education and Teaching*. doi: 10.30957/cendekia.v10i2.190.

[10] Undang-Undang Dasar Repblik Indonesia 1945

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A Comparative Analysis Of Vikor And Topsis For Scholarship Selection

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***Abstract*— Scholarships can be interpreted as financial assistance given to students who have achievements and economic limitations. Selection of scholarship recipients at STMIK Pringsewu still uses manual selection. Manual selection has a weakness in making selections using many criteria, so that it can lead to errors and inconsistent assessments. This study uses the VIKOR method as a ranking method for determining scholarship recipients with criteria set by the leadership, namely: Achievement Index, semester, electric power and home electricity bills. The VIKOR method is a Multi-Criteria Decision Making (MCDM) method that can be used to select more than one criteria. The VIKOR method focuses on ranking by compromising on alternative outcomes and conflicting criteria. The results showed that the VIKOR method can assist the selection process and determine the right scholarship recipient. In addition, the VIKOR method can create a ranking of alternative compromises from a number of existing alternatives**

***Keywords*— Scholarship, VIKOR, MADM, MCDM**

I. INTRODUCTION

Scholarship assistance for students with economic limitations is a form of concern for educational institutions or universities for students who have financial deficiencies, so that these students can continue and complete their education with scholarship assistance for students with economic limitations.

STMIK Pringsewu is one of the universities that has more than 500 students in each class and more and more students are registering as applicants for scholarships. Meanwhile, the system for determining student scholarship receipts is still done conventionally by employees or decision makers in this case the Head of the University Education Bureau which is strongly influenced by factors such as the condition of employees at that time, limited time and many employees who concurrently work with other jobs so that factors Subjectivity in decision making is very large

Based on these problems, it is necessary to build a decision support system to support the process of selecting poor scholarship recipients at STMIK Pringsewu. Decision Support System (DSS) is a computer-based system that presents and processes information that enables decision making to be more productive, dynamic, and innovative [1] . Multiple Criteria Decision Making (MCDM) is the selection of the best alternative from several mutually beneficial exclusive alternatives on the basis of general performance in various criteria or attributes determined by decision makers [2]. MCDM has various methods used to solve problems in the fields of science, business, and government. One of the MCDM methods is the Analytical Hierarchy Process (AHP)[1][2]. This decision support system will be built using the Analytical Hierarchy Process (AHP) method for weighting the criteria, as well as the VlseKriterijumska Optimizacija I Kompromisno Resenje (VIKOR) method and the Technique for Order Preferences by Similarity to an Ideal Solution (TOPSIS) for alternative rankings. The AHP method has advantages in determining the weights and hierarchy of criteria, and can guarantee consistency when determining the weights of the criteria [3]. The VIKOR method has the advantage of compromising existing alternatives, and can complete discrete decision making on conflicting and noncommensurable criteria, namely the difference in units between criteria [4]. The TOPSIS method has several advantages, including the concept is simple and easy to understand, computationally efficient, and has the ability to measure the relative performance of alternative decisions in a simple mathematical form. The compromise solution can be considered as the selection of a solution with the closest Euclidean distance from the positive ideal solution and the farthest Euclidean distance from the negative ideal solution [5]. With the application of this method, it is hoped that the process of selecting students who receive scholarship assistance for underprivileged students can be more objective, accurate, and faster

II. METHOD

The research method used is descriptive analysis method with a quantitative approach, meaning that the research carried out is to emphasize the analysis on numerical data (numbers), which aims to get a clear picture of a situation based on the data obtained by presenting, collecting and analyzing the data. so that it becomes new information that can be used to analyze the problem being studied. Sampling is a process of selecting a portion of the population to be able to represent the population [1]. The research method is a set of rules, activities, and procedures used to organize this research

A. Data Collection

Data collection methods used in this research to obtain data are interview, observation, and documentation.

B. Criteria

The criteria used in this study are:

- GPA
- Semester
- Number of dependents of parents
- Academic and Non-Academic Achievement Data
- Last month's electricity bill
- Land and building tax value last year
- Membership in Campus organizations

C. Vikor Method

- Determine the criteria that will be used as a reference in making decisions, namely the value of report cards, activity values, achievement values, and attitude values.
- Weighting the criteria to distinguish the level of importance between criteria
- Determine positive and negative values as the ideal solution for each criterion
- Calculate the utility measure of each alternative.
- Calculating VIKOR indeks index value
- Alternate Ranking

D. Topsis Method

- Determine the criteria that will be used as a reference in making decisions.
- Doing weighting criteria to distinguish the level of importance between criteria.
- Normalize the decision matrix. The normalization used is vector normalization.
- Perform normalization weighting by multiplying the results of normalization of the decision matrix by the weight of the criteria
- Determine the positive ideal solution and the negative ideal solution for each criterion.
- Calculating the value of relative closeness and sorting alternatives starting from the largest value as a result of ranking students with achievements.
- Calculating the value of relative proximity and sorting alternatives starting from the largest value as a result of ranking students with achievements

III. RESULTS AND DISCUSSION

Document analysis is used to obtain factors that influence the determination of the award of scholarships for economic limitations. In this study there are 7 assessment criteria used, namely: Number of Parent Dependents (C01), Number of Semesters (C02), Student GPA (C03), Academic and Non-Academic Achievement Data (C04), Last Month's Electricity Bill (C05), Value Land and Building Tax last year (C06), Membership in Campus organization (C07). These seven criteria will be analyzed and used as variables to determine the evaluation of scholarships for underprivileged students at STMIK Pringsewu, then these variables are calculated using the prototype that has been designed using the TOPSIS and VIKOR methods. The data inputted into the system is data on scholarship applicants for underprivileged students at STMIK Pringsewu as many as 10 students from all majors which will be used as an alternative for selecting the best students based on the highest calculation value.

TABLE I CRITERIA TABLE

No.	Criteria	Kode
1	Number of Parent Dependents	C01
2	semester	C02
3	GPA	C03
4	Academic and Non-Academic Achievement Data	C04
5	Last Month's Electricity Bill	C05
6	Value Land and Building Tax last year	C06
7	Membership in Campus organization	C07

A. Pairwise Comparison Matrix (PCM)

For each criterion used, a value of X is given which represents the comparison between one criterion and another. So that after a comparison is made between all existing criteria, a pairwise comparison matrix is obtained. Intensity data of the importance of pairwise comparisons between criteria are shown in Table 2

TABLE II PAIRWISE COMPARISON MATRIX

X	C01	C02	C03	C04	C05	C06	C07
C01	1	3	2	1	1	2	1
C02	0.3333	1	2	3	1	1	1
C03	0.5	0.5	1	2	2	1	1
C04	1	0.3333	0.5	1	1	2	1
C05	1	1	0.5	1	1	1	2
C06	0.5	1	1	0.5	1	1	1
C07	1	1	1	1	0.5	1	1

B. Weight normalization matrix

calculate the results by multiplying the pairwise comparison matrix with the priority weight value. The result of the row sum is divided by the corresponding relative priority element then add up the quotient by the number of elements, the result is called λ max. The results can be shown in table 3

TABLE III WEIGHT, CI, CR

Criteria	W	Local W	CI	IR	CR
C01	1.000	0.179	0.1468	1.3	0.111
C02	0.895	0.160			
C03	0.822	0.147			
C04	0.679	0.121			
C05	0.779	0.139			
C06	0.710	0.127			
C07	0.710	0.127			

The CR value obtained is 0.111. This CR value <= 0.20 then the assessment is acceptable, meaning that the preferences given are consistent from the above calculations so that the criteria weights are obtained as shown in Table 4.

TABLE IV W CRITERIA

No.	Criteria	Kode	Weight
1	Number of Parent Dependents	C01	0.179
2	semester	C02	0.160
3	GPA	C03	0.147
4	Academic and Non-Academic Achievement Data	C04	0.121
5	Last Month's Electricity Bill	C05	0.139
6	Value Land and Building Tax last year	C06	0.127
7	Membership in Campus organization	C07	0.127

C. Alternative ranking with TOPSIS

The TOPSIS method is used for the alternative ranking process of each criterion by calculating the closeness between the solution and each alternative using the weighted criteria that have been calculated using AHP.

From the normalized weight matrix, the positive ideal solution value and the ideal solution value will be obtained. Then the distance between the alternative candidate and the ideal solution is positive, while the distance between the alternative candidate and the ideal solution is negative. By comparing the distance with the positive and negative ideal solutions, the preference value for each alternative candidate is obtained.

TABLE V TOPSIS RANKING PREFERENCE VALUE

Alternatif	Positif	Negatif	Pref	Rank
A01	0.052	0.073	0.582	4
A02	0.050	0.094	0.651	1
A03	0.052	0.030	0.606	3
A04	0.053	0.087	0.620	2
A05	0.058	0.078	0.574	5
A06	0.064	0.059	0.479	7
A07	0.084	0.070	0.454	9
A08	0.074	0.064	0.463	8
A09	0.061	0.071	0.539	6
A10	0.085	0.058	0.405	10

D. Alternative ranking with VIKOR

The next step is to determine the final value which can then be ranked based on the highest final score. VIKOR method ranking results can be seen in the table below

TABLE VI VIKOR RANKING PREFERENCE VALUE

Alternatif	Result Value (Q)	Rangking
A01	0.806717	5
A02	0.919970	1
A03	0.889330	3
A04	0.910903	2
A05	0.758372	8
A06	0.775796	6
A07	0.775256	7
A08	0.600119	10
A09	0.815990	4
A10	0.676881	9

E. Comparison of VIKOR and TOPSIS Rankings

The results of TOPSIS and VIKOR rankings for decision-making on granting scholarships to students with economic limitations at STMIK Pringsewu which were tested for accuracy resulted in a comparison of the accuracy values for each method. The TOPSIS algorithm gets the highest accuracy, which is 85.00%. While the VIKOR algorithm gets an accuracy of 80.67%.

TABLE VII DATA SAMPLE

No.	Alternatif	Data	
		Value	Rangking
1.	A01	48,5714	4
2.	A02	52,1429	1
3.	A03	49,2857	3
4.	A04	50,7143	2
5.	A05	45,7143	6
6.	A06	45,0000	7
7.	A07	42,1429	9
8.	ADB	44,2857	8
9.	A09	46,4286	5
10.	A10	41,4286	10

TABLE VIII TOPSIS DATA

TOPSIS DATA		
VALUE	**Rangking**	**Matching**
0,5820	4	Match
0,6510	1	Match
0,6060	3	Match
0,6200	2	Match
0,5740	5	Not Match
0,4790	7	Match
0,4540	9	Match
0,4630	8	Match
0,5390	6	Not Match
0,4050	10	Match

TABLE IX VIKOR DATA

VIKOR DATA		
VALUE	**Rangking**	**Matching**
0,806717	5	Not Match
0,91997	1	Match
0,88933	3	Match
0,910903	2	Match
0,758372	8	Not Match
0,775796	6	Not Match
0,775256	7	Not Match
0,600119	10	Not Match
0,81599	4	Not Match
0,676881	9	Not Match

To calculate the level of accuracy of the performance of the TOPSIS and VIKOR methods, it takes the appropriate amount of data between the results of the ranking system with the two methods, namely the TOPSIS method and the VIKOR method, then will be compared with the amount of existing data. The level of accuracy of system performance will be expressed as a percentage (%).

- The TOPSIS method produces the number of matching data is 8 data from 10 existing data, so the level of accuracy is:

$$Accuracy = \frac{Number\ of\ matching\ data}{Amount\ of\ data}\ x\ 100\%$$

$$Accuracy = \frac{8}{10}\ x\ 100\% = 80\%$$

- The VIKOR method produces the number of matching data is 3 data out of 10 available data, so the level of accuracy is

$$Accuracy = \frac{3}{10}\ x\ 100\% = 30\%$$

Based on the results obtained from manual calculations of sample data, it is proven that the TOPSIS method has a much better level of accuracy than the VIKOR method, which is 50% better, so the TOPSIS method is very appropriate to be used for evaluating the awarding of scholarships.

F. System Design

This application is made using a web-based program with Laravel Framework and Mysql. Based on the results of the analysis of the functional needs of the decision support system for providing scholarship assistance to underprivileged students at STMIK Pringsewu, it can be described in a use case diagram as follows:

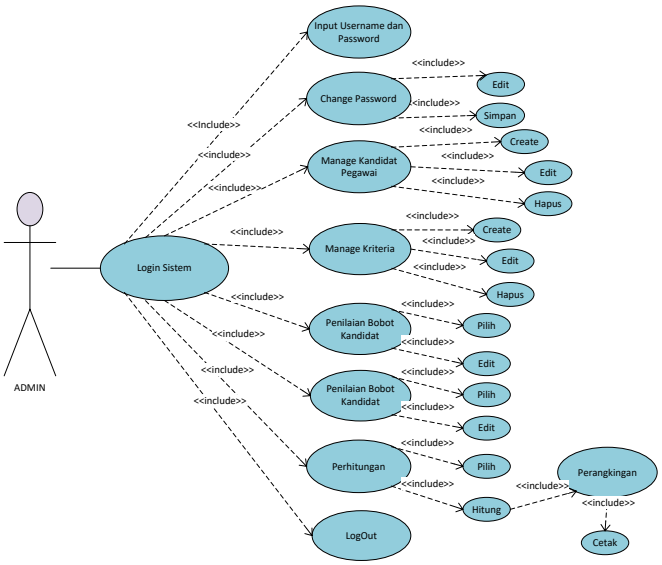

Fig. 1. Usecase Diagram

There are needs for a decision support system for providing scholarships for students with economic limitations at STMIK Pringsewu. All of these needs are described in one initial use case, namely login for the User actor and 8 module use cases which are included with the login. In this use case, there is a requirement to do the login process first. The Administrator actor plays more of a role as a user administration manager and existing knowledge on the system

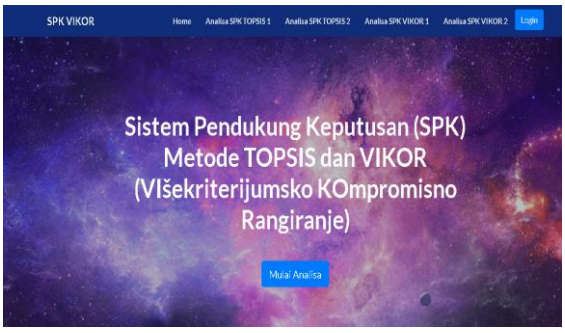

Fig. 2. App Interface

This application is made based on Web-based services intended to make it easier for users to use this application, so that it can be used anywhere and anytime. In the program, a form is given to choose a comparison value between one criterion and another, and a form is also given

to choose the level of criteria for evaluating all available alternative candidates.

G. Accuracy Testing, Analysis, and Validation

The level of accuracy is obtained from the comparison between the results of the TOPSIS and VIKOR ranking methods, the ranking of students receiving scholarship assistance for economic limitations is carried out by the Head of the Academic Section of STMIK Pringsewu. The student data used in this evaluation is student data for the period 2020/2021 semester 1 to semester 7.

Testing the consistency of the degree of importance of the criteria with the AHP method is carried out before this evaluation. The consistency test of the degree of importance of the criteria was carried out 20 times. 12) consistent trials, namely experiments 1, 5, 7, 8, 9, 11, 12, 13, 16, 17, 19, and 20. Experiments that have inconsistent degrees of importance are caused by the resulting Consistency Ratio (CR) value. greater than 0.1 so it cannot be used

TABLE X COMPARISON OF ACCURACY LEVELS

Number Of Trials	Accuracy	
	Topsis	VIKOR
1	0%	10%
2	10%	10%
3	0%	10%
4	50%	10%
5	10%	20%
6	80%	10%
7	70%	40%
8	50%	10%
9	0%	10%
10	80%	20%
11	50%	50%
12	50%	10%
13	40%	10%
14	50%	10%
15	40%	10%
16	40%	10%
17	50%	50%
18	40%	60%
19	50%	10%
20	40%	10%

Based on the table above, it can be seen that the TOPSIS method has the highest accuracy rate of 80% in experiment 12, while the VIKOR method only has the highest accuracy rate of 60% in experiment 17. Based on these results, it can be concluded that the TOPSIS method can be used in the case of student selection. scholarship recipients with economic limitations at STMIK Pringsewu with a degree of importance between criteria adjusted for experiment 12, because the accuracy rate produced is closest to 100%.

The degree of importance between the criteria in experiment 12 is that the criteria for parental dependents are slightly more important than the GPA value, the number of semesters is more important than the GPA value, the electricity account criteria are as important as the PBB, the criteria for organizational activity are slightly more important than the GPA value, the criteria for organizational activity are as important as many academic and non-academic achievements

IV. CONCLUSION

Based on the problems, literature study, research review, research object review and research methodology in decision making using TOPSIS and VIKOR methods, the results of the research that has been carried out can be concluded that VIKOR and TOPSIS methods produce an assessment calculation of effective economic limitations scholarships by entering 7 input criteria and 10 alternatives that have been tested 20 times. From previous studies by comparing the same two methods, the accuracy value in this study is better than theirs, because in the same experiment the accuracy level was 50% better when using the TOPSIS method than the VIKOR method, while the previous study the difference was only 30%.TOPSIS has the highest accuracy rate of 80% in 12 trials, while the VIKOR method only has the highest accuracy rate of 60%. between the adjusted criteria because the resulting accuracy level is closest to 100%. The degree of importance between these criteria is that the criteria for parental dependents are slightly more important than the GPA value, the number of semesters is more important than the GPA value, the electricity account criteria are as important as the PBB, the criteria for organizational activity are slightly more important than the GPA value, the criteria for organizational activity are as important as many academic and non-academic achievements

REFERENCES

[1] [1] E. Setiawan, "PENERAPAN METODE FUZZY AHP DAN ANALYTIC RUBRIC DALAM PENILAIAN KINERJA KARYAWAN (Studi Kasus Pada PT. XYZ)," Jurnal Manajemen Maranatha, vol. 16 (1), pp. 197- 201, 2016.

[2] [2] L. X. Y. Y. C.-H. L. Y. &. z. D. Zhang, "City Sustainability Evaluation Using MCDM with Objective Weights of Interdependent Criteria," Journal of Cleaner Production, pp. 1-27, 2016.

[3] [3] R. d. D. R. Ilhami, "Penilaian Kinerja Karyawan Dengan Metode AHP dan Rating Scale," Jurnal Optimasi Sistem Industri, vol. 16 (2), p. 150 – 157, 2017.

[4] [4] T. e. Hotmoko, "Penerapan Metode VIKOR Dalam Penentuan Penerima Dana Bantuan Rumah Tidak Layak Huni," Jurnal Riset Komputer (JURIKOM), vol. 5 (1), no. ISSN 2407-389, pp. 71-78, 2018.

[5] [5] Amroni, "Analisis Sistem Pendukung Keputusan Untuk Menentukan Penerima Beasiswa Yayasan Dinamika Bangsa Jambi Dengan Menggunakan Metode Topsis (Studi Kasus : STIKOM Dinamika Bangsa)," Jurnal Media Sisfo , vol. 11(2), no. ISSN : 1978 – 8126, eISSN : 2527-7340, 2017.

[6] [6] J. S. P. Tyoso, Sistem Informasi Manajemen. Ed.1, Cet.1., Yogyakarta: Deepublish, 2016.

[7] [7] B. H. Hayadi, Sistem Pakar. Ed.1, Cet.1., Yogyakarta : : Deepublish, 2016.

[8] [8] J. A. a. G. M.Marakas, Analisis Sistem Informasi / Tata Sutabri Ed. I, Yogyakarta: Andi, 2016.

[9] [9] e. Rachman Jaya, "IMPLEMENTASI MULTI CRITERIA DECISION MAKING (MCDM) PADA AGROINDUSTRI: SUATU TELAAH LITERATUR," Jurnal Teknologi Industri Pertanian, vol. 30 (2), no. ISSN: 0216-3160 EISSN: 2252-390, pp. 234-243, 2020.

[10] [10] C. E. d. S. M. Asadabadi MR, "Are MCDM methods useful? A critical review of Analytic Hierarchy Process (AHP) and Analytic Network Process (ANP)," Cogent Engineering, vol. 6(1), pp. 1-11, 2019.

[11] [11] I. H. A. G. &. R. F. Firdaus, " Sistem Pendukung Keputusan Penentuan Karyawan Terbaik menggunakan Metode AHP dan TOPSIS," SENTIKA, pp. 440-445, 2016.

[12] [12] A. A. I. F. &. M. S. Sasongko, “Pemilihan Karyawan Baru Dengan menggunakan Metode AHP (Analytic Hierarchy Process) pada PT Noreen Surya Perdana,” Jurnal Informatika Mulawarman, pp. 88-93, 2017.

[13] [13] Zamhari, “Apa itu Mahasiswa ? Inilah Pengertian Mahasiswa yang Jarang Anda Ketahui Hingga Saat Ini,” Retrieved from academicindonesia.com, 2016.

[14] [14] H. SARAH, “FAKTOR-FAKTOR PENGHAMBAT MAHASISWA UNTUK BERWIRAUSAHA (STUDI KASUS MAHASISWA NON-REKAYASA POLITEKNIK NEGERI SRIWIJAYA PALEMBANG),” POLITEKNIK NEGERI SRIWIJAYA, 2018.

[15] [15] A. Ahira, “Beasiswa Arti Tujuan dan Syaratnya,” http://www.anneahira.com/beasiswa.htm, 2017.

[16] [16] D. e. Apriliani, “Penerapan Metode Weighted Product Untuk Sistem Pendukung Keputusan Penerima Beasiswa Politeknik Harapan Bersama Tegal,” J. Inform. J. Pengemb. IT (JPIT), vol. 3(2), no. ISSN: 2477-5126 e-ISSN: 2548-9356, p. 136–142, 2018.

[17] [17] F. N. K. d. S. Rofiah, “Sistem Seleksi Penerimaan Beasiswa Menggunakan Metode Pendukung Keputusan Simple Additive Weighting,” Seminar Nasional APTIKOM (SEMNASTIK), pp. 118 - 125, 2019.

[18] [18] KBBI, Kamus Besar Bahasa Indonesia (KBBI), Tersedia di http://kbbi.web.id/pusat, 2016.

[19] [19] T. L. Saaty, The Analytic Hierarchy Process, New York: McGraw- Hill, 1980.

[20] [20] K. a. C. L. H. Yoon, TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) - A Multiple Attribute Decision Making, 1980.

[21] [21] R. e. Autia, “Implementasi Metode VIKOR,” Jurnal Komputer dan Aplikasi untuk Rekomendasi Panti Asuhan Penerima Dana APBD Berbasis Website (Studi Kasus: Dinas Sosial Kota Pontianak), no. Tersedia di : http://jurnal.untan.ac.id/index.php/jcskommipa/article/download/39196/756 76585074 [Diakses 12 Feb. 2020], 2020.

[22] [22] e. Alika Ramadhani, “PEMILIHAN PERUMAHAN TERFAVORIT MENGGUNAKAN METODE VIKOR DAN TOPSIS DENGAN GUI MATLAB (Studi Kasus: Perumahan Mijen Semarang),” JURNAL GAUSSIAN, vol. 8 (3), no. ISSN: 2339-2541, pp. 330-342, 2019.

[23] [23] D. Purnomo, “Model Prototyping Pada Pengembangan Sistem Informasi,” JIMP - Jurnal Informatika Merdeka Pasuruan, vol. 2 (2), no. ISSN 2503-1945, pp. 54-61, 2017.

[24] [24] R. Pressman, Software Engineering : a practitioner’s approach,, New York: McGraw-Hill, 2010.

[25] [25] D. Setiawan, START UP. Buku Sakti Pemrograman Web, Yogyakarta, 2017.

[26] [26] P. C.A., Pengantar Dan Implementasi Basis Data, Yogyakarta: Deepublish, 2017.

[27] [27] A. N. D., “Aplikasi Pengolahan Data Anggaran Pendapatan dan Belanja Desa (APBDES) Pada Kantor Desa Bakau Kecamatan Jawai Berbasis Web,” vol. 01(02), no. Tersedia di: http://openjurnal.unmuhpnk.ac.id/index.php/CN/article/view/745, p. 105–119, 2017.

[28] [28] M. M and Oktafianto, Analisis dan Perancangan Sistem Informasi Menggunakan Model Terstruktur dan UML, Yogyakarta: ANDI, 2016.

[29] [29] R. &. B. M. Djouab, “An ISO 9126 Based Quality Model for the e Learning Systems,” IJIET, vol. 6(5), no. Tersedia di: https://doi.org/10.7763/IJIET.2016.V6.716, 2016.

[30] W. d. P. Pratama, “Sistem Pendukung Keputusan Pemilihan Siswa Berprestasi di Sekolah Menengah Pertama dengan Metode VIKOR dan TOPSIS,” Journal of Information Systems Engineering and Business Intelligence, vol. 3 (2), no. e-ISSN 2443-2555, pp. 113 - 121, 2017.

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Data Visualization of Research Publications of IIB Darmajaya Lecturers

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***Abstract*—Data visualization is now very important to understand data and can be used for decision making. Effective visualization assists users in analyzing and reasoning about data and makes complex data accessible, understandable and useful. Users can perform analysis, such as making comparisons or understanding causality. The Indonesian government has upgraded the status of the IIB Darmajaya Research Institute so that it must increase its publications. IIB Darmajaya currently requires a system to determine the achievements of lecturers' research publications in data visualization. Visualization tools are increasingly being used, such as Microsoft Power BI, Google Chart, Tableau, Zoho Analytics, Datawrapper, Infogram, Google Data Studio, and others. Currently, Google Data Studio is increasingly being used since its release in 2016. Google Data Studio allows developers to easily visualize data without having to be a data scientist. IIB Darmajaya currently does not have a system to visualize published research publication data. This study uses Google Data Studio in developing a data visualization system for lecturer research publications that have been published on Scopus, Google Scholar, and Web of Science (WOS). The steps taken in this research are requirements analysis, collecting data, preparing data, and implementation. This study succeeded in developing a data visualization system for lecturer research publications for IIB Darmajaya and is expected to be a source of information on current achievements and a reference for future decision making.**

Keywords— data visualization, google data studio, research publications

I. INTRODUCTION

Institut Informatika dan Bisnis (IIB) Darmajaya is a private university in Lampung Province, Indonesia, founded in 1995 under the Alfian Husin Education Foundation. Currently IIB Darmajaya has two faculties, Computer Science and Business Economics, with nine departments.

Research publication is very important for a university. Until now, all lecturers and students of IIB Darmajaya have been encouraged to increase research publications. Moreover, with the increase in the status of LP4M IIB Darmajaya as the first in the middle cluster region II in 2015, of course it must be balanced with an increase in research activities.

Currently, data is needed to be processed into information so that it can be used for decision making. Data visualization can help to understand the data and gain insight from the data[1]. Visualization tools are increasingly being used, such as Microsoft Power BI, Google Chart, Tableau, Zoho Analytics, Datawrapper, Infogram, Google Data Studio, and others. Currently, Google Data Studio is increasingly being used since its release in 2016. Google Data Studio allows developers to easily visualize data without having to be a data scientist. IIB Darmajaya currently does not have a place to visualize published lecturer research publication data. In this study, it is proposed to design a data visualization system for lecturer research publications, so that it is expected to be a reference by IIB Darmajaya. The data visualization used in this study must be used interactively, making it easier for readers to understand the visualization and obtain new information from the data visualization [2]. Lecturer research publication data collected is lecturer research publication data published on Scopus, Google Scholar, and Web of Science (WOS).

II. METHODOLOGY

The methodology in this study is as follows:

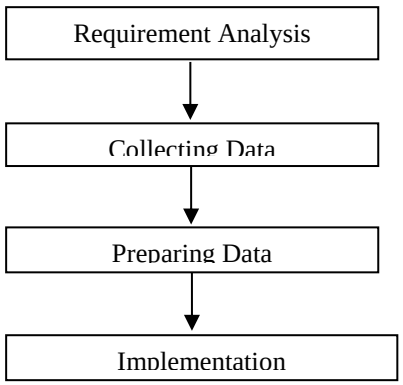

Fig. 1 Research methodology

A. *Requirement Analysis*

The first stage in this research is to analyze the needs of IIB Darmajaya for the data visualization system that will be created. At this stage, a review of some of the literature is also carried out to support the research.

B. *Collecting Data*

At this stage, data collection can be carried out from several sources, from Scopus Author searches, Google Scholar profiles, and Author searches on the Sinta RISTEK-BRIN website [3]. However, in this study, data was collected from the Sinta portal only, because this portal became a reference for the achievement of lecturer publications. The data collected is the number of research publications by IIB Darmajaya lecturers in the last 5 years at Scopus, Google Scholar, and Web of Science (WOS).

Then data was collected on the educational history of IIB Darmajaya lecturers from the university database website of the Indonesian Ministry of Education and Culture. The educational history of IIB Darmajaya lecturers collected is Bachelor, Master, and Doctor Education.

C. *Preparing Data*

Data preparation is carried out to facilitate the implementation of the data source needed for the development of data visualization reports on Google Data Studio. Many data sources are supported by Google Data Studio, CSV files, Google Sheets, and from other data sources with connector support. In this study, the data that has been obtained is immediately recorded in Google Sheets.

D. *Implementation*

After the data has been prepared in Google Sheets, it is then retrieved as a data source in Google Data Studio. At this stage, a dashboard is developed that contains reports on data visualization of lecturers' research publications and educational history of IIB Darmajaya lecturers. The dashboard is developed with the appropriate selection of graphs and also features filters to make reports more interactive.

III. RESULTS

The results of this study are several visualizations with Google Data Studio from the research publication data of IIB Darmajaya lecturers. Several types of charts used in Google Data Studio are scorecards, pie charts, bar charts, bubble maps, and tables, plus filter controls.

A. *Dashboard Page*

The dashboard page first displays filters and a scorecard that displays documents indexed by Scopus, Google Scholar, and Web of Science (Fig. 2). In data visualization published online, it should be used interactively, so that users can explore a lot of data visualization data information[2].

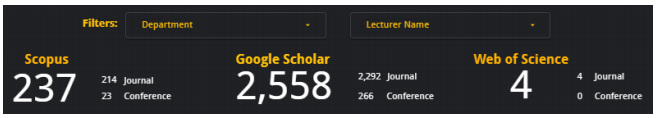

Fig. 2. Scorecard Scopus, Google Scholar, and Web of Science

The scorecard displays the total number of documents indexed by Scopus, Google Scholar, and Web of Science. The scorecard also displays a breakdown based on the number of journals and conferences indexed.

Furthermore, the dashboard page displays a donut chart of publications by lecturers after the scorecard. Pie charts are used to make it easier for users to compare data in each cluster [4]. Donut chart is a modern form of pie chart that is used to display comparisons [5]. On this page the donut chart is used to display a comparison of total publications.

The first donut chart only shows 9 lecturers and 1 combination of other lecturers, so there are 10 slices on this donut chart. The second donut chart shows a comparison of publications per department.

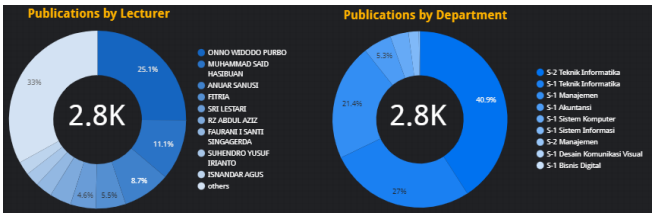

Fig. 3 Publication by Lecturer

In the donut chart above, a sequential color palette is applied. This sequential color palette is suitable for describing the range of sequential data from low to high or vice versa, by applying bright colors for low values and dark ones for high values [6].

The dashboard also displays a bar chart with a column chart type in Google Data Studio. This bar chart displays data on 10 lecturers with the number of publications with details of journals and conferences. The following is a data visualization for documents indexed by Scopus, Google Scholar, and Web of Science in Fig. 4 with a horizontal bar chart.

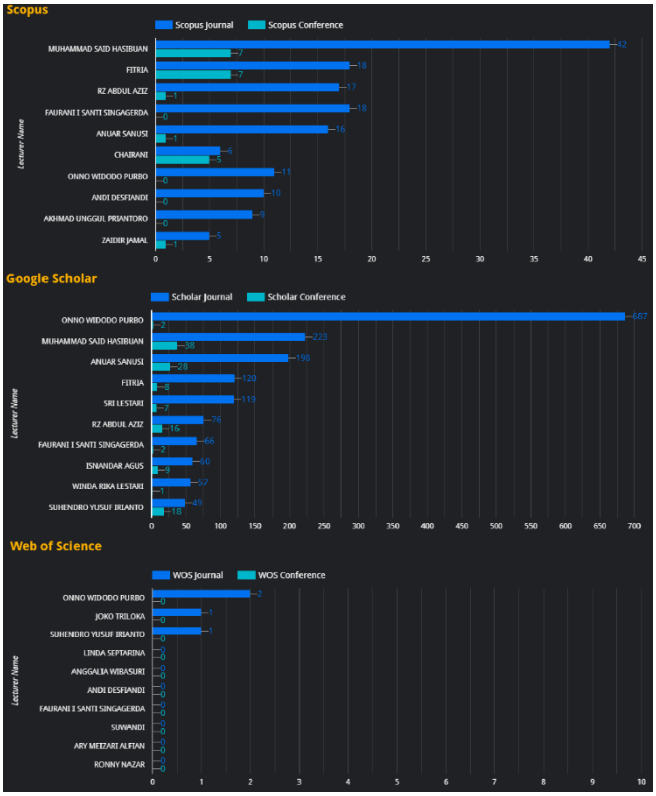

Fig. 4 Scopus, Google Scholar, and Web of Science (Horizontal Bar Chart)

The three bar charts above visualize the comparison between journal documents and conference documents for each lecturer. Vertical bar charts are usually used to display distribution by category[7]. In this study, a comparison was made with the vertical bar chart in Fig. 5 below.

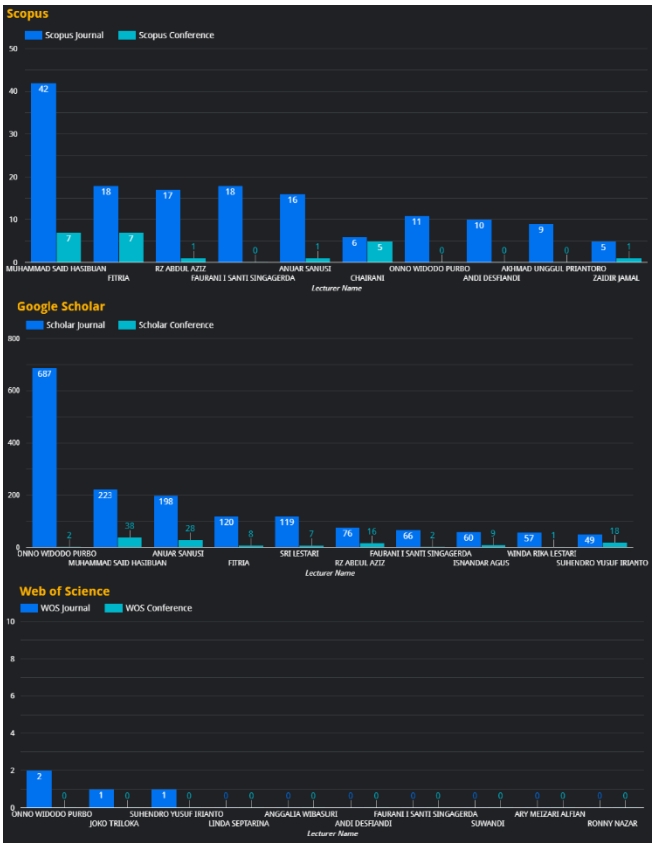

Fig. 5. Scopus, Google Scholar, and Web of Science (Vertical Bar Chart)

In this study finally implemented a vertical bar chart, because vertical bar charts look easy to understand when showing comparisons, while horizontal bar charts are more difficult to understand in displaying comparisons, because the bars look small.

The last part of the dashboard page displays a table that displays detailed data by type, journal and conference, for each document.

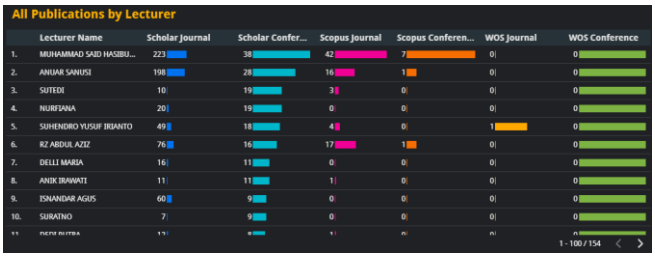

Fig. 6. Publication type by lecturer

Unlike the bar chart used previously, this table is combined with a bar chart so that all data can be displayed. To summarize the view, pagination and scrollbars can be applied.

B. Scopus Page

On the Scopus page, it begins by displaying filters and bar charts for distribution of the top 10 lecturers' publications, detailed for journals and conferences.

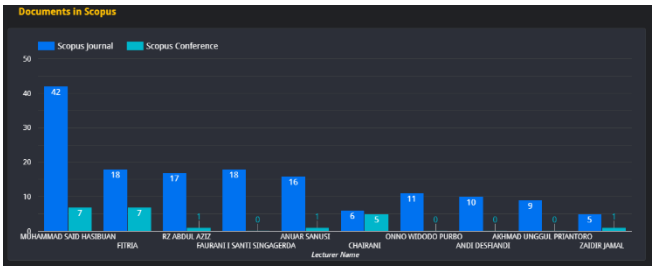

Fig. 7. Document by Scopus

Then display document publications per year: <= 2017, 2018, 2019, 2020, and 2021, using a bar chart.

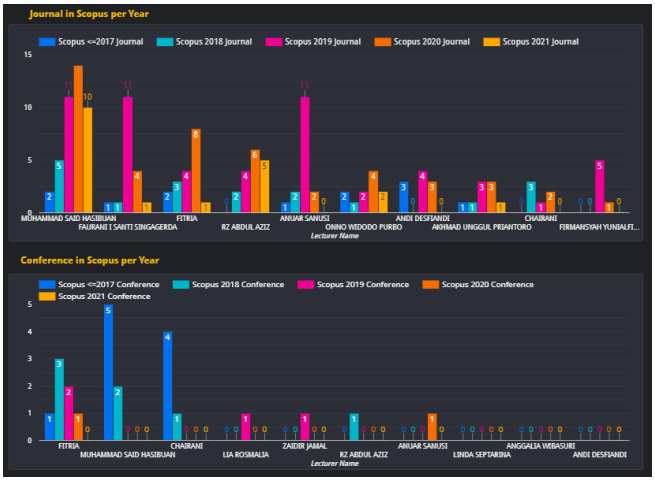

Fig. 8. Scopus per year

Then the last part of the Scopus page displays a table for the total number of Scopus documents by department and lecturer.

Fig. 9. Scopus by department and lecturer

In this section, we do not use a horizontal bar chart, because this table can display all data with the pagination feature, while the bar chart does not have a pagination feature.

C. Google Scholar Page

On the Google Scholar page, it is the same as on the Scopus page, which begins with a filter and a bar chart of the total documents published on Google Scholar. The filters on this page are filters based on department and lecturer name.

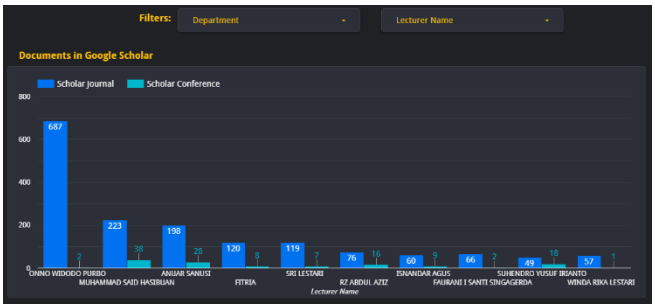

Fig. 10. Documents in Google Scholar

Furthermore, the publication of documents on Google Scholar per year is displayed.

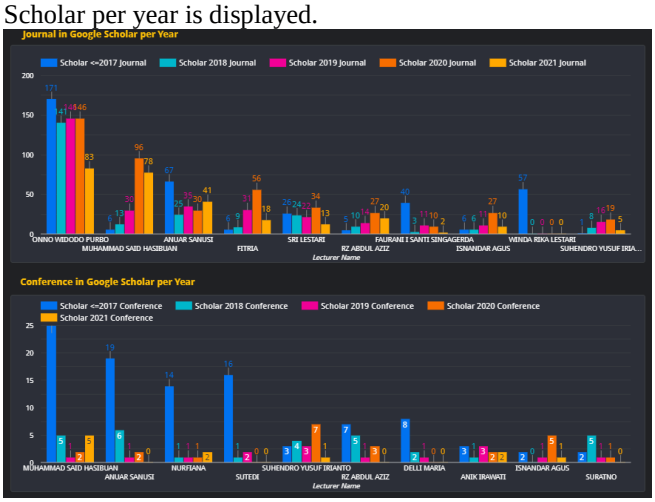

Fig. 11. Google Scholar per year

The final section of the Google Scholar page displays a table with a bar chart to display total Google Scholar documents by department and faculty.

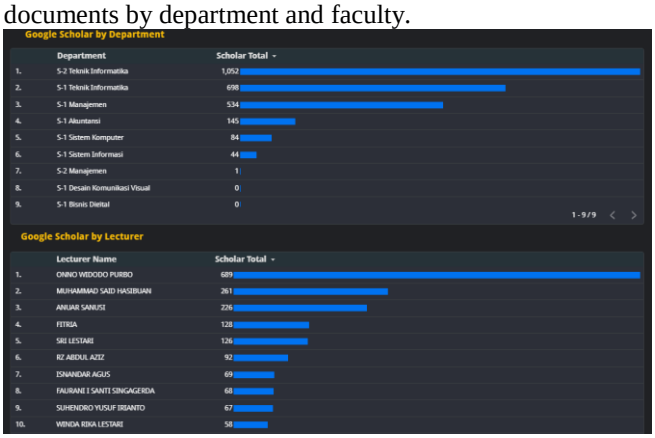

Fig. 12. Google Scholar by department and lecturer

D. *Web of Science Page*

The Web of Science page displays the same visualization as on the Scopus page and the Google Scholar page. However, in this study only 4 documents were found, so there is no need to display further.

E. *Education History*

On the education history page, it begins with the filter and scorecard features displayed. The filter features applied to this page are department, bachelor, master, and doctoral. The scorecard displays the number of lecturers and departments displayed on this page.

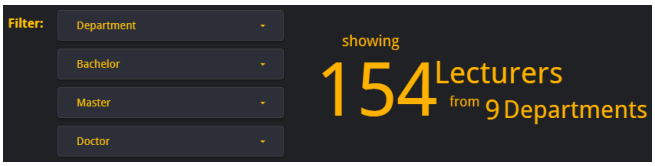

Fig. 13. Filters on Education History Page

Then below it displays the names of lecturers along with the name of the bachelor level university and can be scrolled to see other lecturer data.

Fig. 14. Bachelor table

Then below it displays a bubble map and a bar chart table below it.

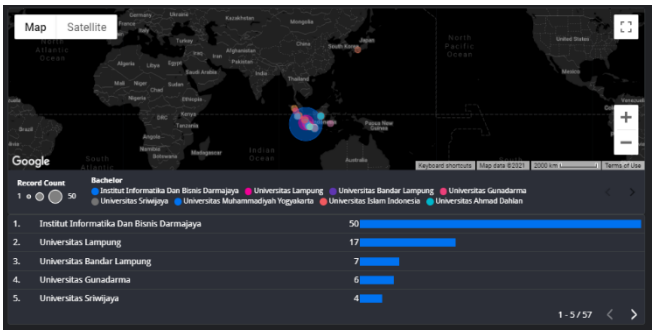

Fig. 15. Bubble map bachelor

Then below it is continued by displaying the same visualization for Master and Doctor as in Bachelor.

IV. Conclusions

In this study, a data visualization system for research publications by IIB Darmajaya lecturers has been successfully designed using Google Data Studio. This data visualization system with Google Data Studio uses data sources stored in Google Sheets. Data is collected from SINTA, Scopus, and Google Scholar sites.

A visualization system has been successfully designed using filters with dropdown list and chart controls, namely tables, bar chart tables, bar charts, pie charts, and bubble maps. Tables and table bar charts to display data and add the number of document data, bar charts to display the distribution of document data, pie charts to display comparisons of total documents, and bubble maps to display university locations.

However, in this study there are still some shortcomings that are expected to be considered in future research. In this study, we have not used other types of visualization, either other visualizations from Google or visualizations made by the community. This research also does not include data visualization for document citation. Visualization with a bubble map found deficiencies in determining geo location, namely the name of the university is used as the geolocation specified as the address, some do not show the appropriate location. So it is necessary to consider adding the name of the city or coordinates.

ACKNOWLEDGMENT

We would like to thank the members of 3MTI-A class who have worked according to their group assignments to collect this data so that this research can be carried out.

REFERENCES

[1] G. Kemp and G. White, *Google Data Studio for Beginners*. Apress, 2021. doi: 10.1007/978-1-4842-5156-0.

[2] "ILLUSTRATION BY THE PROJECT TWINS."

[3] "SINTA - Science and Technology Index." https://sinta.ristekbrin.go.id/ (accessed Oct. 30, 2021).

[4] N. A. Syaripul and A. M. Bachtiar, "VISUALISASI DATA INTERAKTIF DATA TERBUKA PEMERINTAH PROVINSI DKI JAKARTA: TOPIK EKONOMI DAN KEUANGAN DAERAH," *Jurnal Sistem Informasi*, vol. 12, no. 2, p. 82, Nov. 2016, doi: 10.21609/jsi.v12i2.481.

[5] P. photo, "Title Data Visualization Techniques From Basics to Big Data With SAS ® Visual Analytics."

[6] Mario. Döbler and Tim. Großmann, *The DATA VISUALIZATION WORKSHOP a self-paced, practical approach to transforming your complex data into compelling, captivating graphics.* PACKT PUBLISHING LIMITED, 2020.

[7] F. Windhager *et al.*, "Visualization of Cultural Heritage Collection Data: State of the Art and Future Challenges," *IEEE Transactions on Visualization and Computer Graphics*, vol. 25, no. 6, pp. 2311–2330, Jun. 2019, doi: 10.1109/TVCG.2018.2830759.

An Enterprise Architecture Plan For The Regional Office Of Kementerian Agama Lampung Province Using Feaf

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Abstract—Abstract—The Regional Office of Kementerian Agama Lampung Province does not yet have a specific system and has not been integrated between sections or work units. In addition, documents and data in each work unit have so far been stored on personal computers (PCs) used by each staff in each work unit, and not all staff have backed up data periodically to offline media (external hard disk). This is of course a high risk of data damage/loss and allows for irregularities to occur in the services provided. This research aims to design enterprise architecture (EA) using FEAF framework to solve the problem. The process carried out from identification of internal and external conditions, identification of current and future business needs, creating and clarifying architectural models based on metrics and identification of business architecture, data or information, applications and technologies from the collected data. The results of this research to designing new models by using FEAF EA.
Keywords : FEAF, Enterprise Architecture, Kementerian Agama Lampung Province

I. INTRODUCTION

In carrying out its duties, the Kementerian Agama has regional office representatives in each province, one of which is the Regional Office of the Kementerian Agama (Kanwil Kemenag) Lampung Province. The Regional Office is in charge of many fields, including: Madrasah Education, Religious Education and Islamic Religious Education, Hajj and Umrah Organization, Islamic Religious Affairs, Islamic Information and Zakat and Waqf Empowerment, and Hindu Community Guidance. In order for the implementation of tasks in each of these fields to run optimally, there is a need for system integration between these fields. Therefore, it is necessary to design an Enterprise Architecture (EA) which can be used as a direction for the development of information technology at the regional office.

The use of the framework in modeling enterprise architecture is also carried out in several government agencies which aims to answer the needs and changes in the organization that continues to grow. The Kementerian Agama has a vision to become a professional and reliable Kementerian Agama in building a pious, moderate, intelligent and superior society to realize an advanced Indonesia that is sovereign, independent, and has a personality based on mutual cooperation. To realize the vision and mission, the Kementerian Agama must have adequate facilities in order to carry out its business processes, while in the current business process, the Kementerian Agama of Lampung Province does not yet have automation and integration of business processes between sections or work units.

The Provincial Office of the Kementerian Agama uses computer equipment in their daily activities in each work unit, but it has not been systemized specifically where all activities have not been connected or integrated between sections or work units. In addition, documents and data in each work unit have so far been stored on personal computers (PCs) used by each staff in each work unit, and not all staff have backed up data periodically to offline media (external hard disk). This is of course a high risk of data damage/loss and allows for irregularities to occur in the services provided. Given the importance of optimal service and good data security at the Provincial Office of the Kementerian Agama. From the problems faced by the Provincial Office of the Kementerian Agama, it can be concluded that there is a need for a solution in the form of enterprise architecture modeling that views the different elements in an organization/company as a whole as a whole. To develop and manage enterprise architecture, it is necessary to adopt or develop the framework and methodology for enterprise architecture. FEAF has several advantages when compared to several frameworks such as Zachman, Wards & Peppard and TOGAF. FEAF is more flexible because it combines the three frameworks at each level and also the reference model for each sub-architecture already exists and is good enough to guide users of the framework to build strategic plans. FEAF also has a life cycle that can be used to develop an architecture that is better than the three frameworks. FEAF has planning, analysis, design, implementation and monitoring phases where

Zachman, Wards & Peppard and TOGAF do not have these five phases.

II. LITERATURE REVIEW

The Federal Enterprise Architecture Framework or abbreviated as FEAF is a conceptual model that formulates organizational goals and visions in a documented manner and has a coordinated structure between business lines between departments. Business, information needed to support business, technology to support business operations, and the process of moving from old technology to new technology can be done with this framework.

FEAF also supports enterprise architecture components, namely business, data, application, and technology architectures. In addition, FEAF has adopted three main columns from the Zachman framework, which consist of data description, function description, and network description. In FEAF there are 6 parts of the architecture, each part has a reference model that can be used as an architectural model, namely:

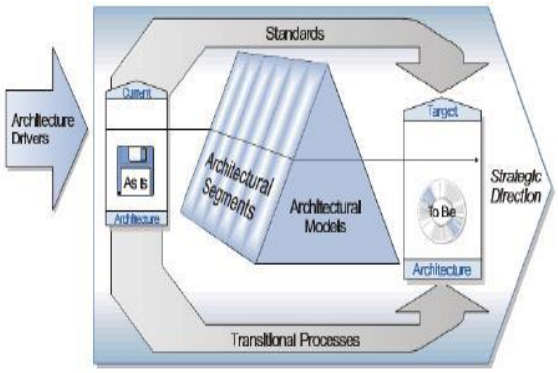
1) Strategy
2) Business
3) Data
4) Application
5) Infrastructure
6) Security

FEAF has several advantages when compared to several frameworks such as Zachman, Wards & Peppard and TOGAF. FEAF is more flexible because it combines the three frameworks at each level and also the reference model for each sub-architecture already exists and is good enough to guide users of the framework to build strategic plans. FEAF also has a life cycle that can be used to develop an architecture that is better than the three frameworks. FEAF has planning, analysis, design, implementation and monitoring phases where Zachman, Wards & Peppard and TOGAF do not have these five phases.

FEAF provides standards for developing and documenting architectural descriptions of areas of high priority. FEAF is suitable to describe the architecture for the Federal government. The process trace yields four levels of the Federal Enterprise Architecture Framework. Each level provides an understanding or frame of reference for the following year. Level three, describing the development of the eight components is increasingly detailed that leads to a logical structure for classifying and organizing a descriptive description of Federal companies at level IV [2].

Level I

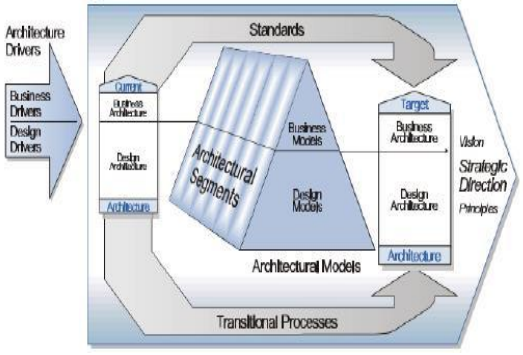
Level I is the highest level of the FEAF and introduces the eight components required to develop and maintain the Federal enterprise architecture. One external component framework, driver architecture, the other seven internal. As shown in the figure below, the flow of the framework is from left to right and represents the continuous process of Federal enterprise architecture.



Federal Enterprise Architecture Framework Level I

Level II

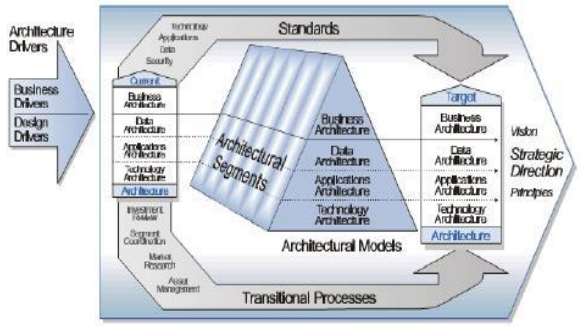
Level II shows at a greater level of detail, the business and design elements of the Federal enterprise architecture and how they relate to each other. Viewed horizontally, the top half of the framework deals with the company's business, while the bottom half deals with the architectural design used to support the business. The business and design relationship is a pull/pull in which the business pushes design and design (i.e., new developments in data, applications, and technology) pulls the business to a new level of service delivery in support of business operations. Examples of design drivers are the Internet and electronic access to public services, creating challenges for design to support business missions.



Federal Enterprise Architecture Framework Level II

Level III

Level III extends parts of the design framework to represent three architectural designs: data, application, and technology.



Federal Enterprise Architecture Framework Level III

Level IV

Level IV identifies the type of model that describes the business architecture and three architectural designs: data, application, and technology. This constitution also stipulates architectural planning companies. At level IV, how this business architecture is supported by three architectural designs begins to develop and is made explicit.

Enterprise architects and engineers have historically used models as their primary descriptive method. John Zachman and Steven Spewak are two of the many recognized leaders in architectural conceptualization and architectural planning firms. This is key at level IV in that it presents the transition from a general to a more specific set of methods and approaches.

The image below describes, with minor changes, how the Federal Enterprise Architecture Framework combines the five-line perspective (i.e., views) and three architectural artifact or column abstraction products of the Zachman Framework. Level IV shows the architectural design as the column head. Planners and line owners focus on business architecture definitions and documentation. When finished, this line makes explicit what the company is in business and what information is used to do that (i.e., the business model).

Perspectives	Data Architecture (entities = what)	Applications Architecture (activities = how)	Technolog Architectu (locations = w
Planner's View Objectives/Scope	List of Business Objects	List of Business Processes	List of Busin Locations
Owner's View Enterprise Model	Semantic Model	Business Process Model	Business Logi System
Designer's View Information Systems Model	Logical Data Model	Application Architecture	System Geogr Deploymer Architectur
Builder's View Technology Model	Physical Data Model	System Design	Technolog Architectur
Subcontractor's View Detailed Specifications	Data Definition "Library or Encyclopedia"	Programs "Supporting Software Components (i.e., operating systems)"	Network Archit

Federal Enterprise Architecture Framework Level IV

The figure above explains, with minor changes, how the Federal enterprise architecture framework incorporates the five-line perspective (i.e., views) and the three-architecture artifact or column abstraction product of the Zachman framework. Level IV shows the architectural design as the column head. Planners and lines focus on business architecture definitions and documentation. When finished, this line makes explicit what the company's business is and what information is used to do that (i.e., the business model).

In data analysis requires techniques in the process, as for the techniques are as follows;

1. PEST

PEST is an analysis of external business environmental factors that include the political, economic, social and technological fields [3]. PEST is used to assess the market of a business unit or organizational unit. Directional PEST analysis is a framework for assessing a situation and assessing a strategy or position, company direction, marketing plan or idea. In this analysis a new opportunity or threat can be taken for the company. The four factors that are components of PEST are as follows:

a. Political factors, including government policies, legal issues, and include the formal and informal rules of the environment in which the company carries out activities. Example: Policies on taxes, labor regulations, trade regulations, political stability and local regulations.

b. Economic factors, including all factors that affect the purchasing power of customers and affect the climate of a company's business. Examples: economic growth, interest rates, exchange rate standards, inflation rates, prices of products and services.

c. Social factors, including all factors that can affect the needs of customers and affect the size of the existing market share. Examples: community education level, population growth rate, social environmental conditions, working environment conditions, safety and social welfare.

d. Technological factors, including all things that can help in dealing with business challenges and support the efficiency of business processes. Examples: technology research and development activities, automation, technology transfer speed, technology expiration rate.

2. SWOT analysis

SWOT analysis is a method to identify various actors systematically to formulate strategies based on the obtained logic, maximize strengths, and opportunities, then simultaneously minimize weaknesses and threats [3]. The SWOT analysis compares the external factors of opportunities and threats with the internal factors of strengths and weaknesses as for the explanation of the SWOT diagram, as shown in Figure 2.5 below:

Based on Figure 2.5, the SWOT model is described as follows:

a. Strength is something that can be done well by the company or a characteristic that can increase the company's competence, which strength can be in the form of physical assets, company expertise / specialization, reliable human resources, quality and innovative products, company position in market share.

b. Weaknesses are deficiencies that exist in a company, these weaknesses can be in the form of lack of human resource capabilities and expertise, lack of supporting company assets, lack of strategies in terms of promotion and marketing, and it could also be unclear business processes and poor coordination. .

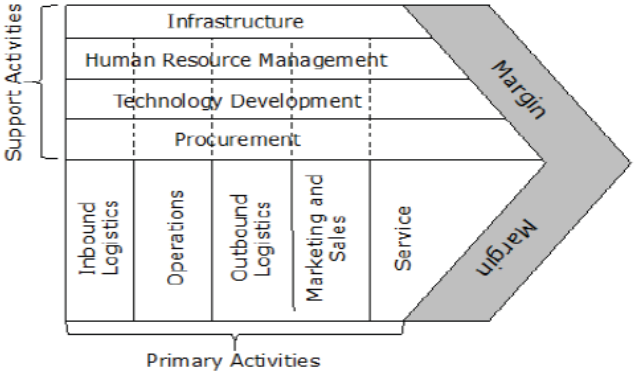
c. Opportunities are an important factor that needs to be considered in formulating a company's strategy.

d. Threat is a threat or challenge that needs to be aware of and anticipated because if not, then this threat can make the company suffer losses or fail in competition. These threats can be in the form of the emergence of new competitors, competitors having better resources, and possibly threats from internal parties.

3. Value Chain

Value Chain Analysis was proposed by Michael Porter in 1984 [3]. According to Porter, every company is a collection of activities carried out for production, marketing, shipping and product support [3]. This analysis is done by looking at the internal business environment that focuses on the main activities and supporting activities. Activities are carried out by looking at the tasks and functions of each organizational field. The principle of the value chain is how to map the entire work process or activity within the institution into two parts, namely, main activities and supporting activities. The purpose of this analysis is to create competitive capabilities in the organization.

The generic value chain formulated by Michael Porter is as follows [3]:



The following activities are included in the company's value chain according to Michael Porter [8]:

a. Primary Activities:

1. Inbound Logistics (Inbound Logistics)
   Activities related to the management of raw materials until the raw materials can be used in the production process.
2. Operation (Operation)
   Activities related to converting inputs into the form of final products (outputs), such as machinery, packaging, assembly, equipment maintenance, testing, printing, and facilities in operating activities.
3. Outbound Logistics
   Activities related to the collection, storage and physical distribution of products to buyers, such as goods warehousing, material handling, delivery operations vehicles, order processing and scheduling.
4. Marketing and sales (Marketing and Sales)
   Activities associated with providing a means by which buyers can purchase products and encouraging them to do so, such as advertisements, brochures and promotions.
5. Service (Service)
   Activities related to providing services to increase or maintain product value, such as installation,
   repair, training and product adjustment.

b. Support Activities

1. Purchase (Procurement)
   Activities related to all suppliers (Supplier).
2. Technology Development
   Activities related to all technology development.
3. Human Resource Management
   Activities related to all human resources.
4. Company Infrastructure (Firm Infrastructure)
   The company's infrastructure consists of a number of activities including general management, planning, finance, legal, government affairs and quality management.

4. Business System Planning (BSP)
It is a structured methodology or approach with the main focus on how information systems are structured, integrated, and implemented over a long period of time [1]. The basic concepts of BSP are related to the long-term goals of IT in an organization, namely;

a. Information systems must be supported by business goals and objectives.
b. Strategy Information systems must be recognized at all levels of management.
c. Information systems must consistently provide information at every layer of the organization.
d. Information systems must be able to withstand any changes in management. Information systems strategy must be implemented in each subsystem described in the information architecture.

The key to success in planning, developing and implementing an information architecture is the effective support of business objectives, such as;

a. Top-down planning with bottom-up implementation
b. Organize data as enterprise resource
c. Oriented to all business processes
d. Thorough use of the methodology.

III. PROPOSED METHOD

This study will discuss the process of developing the IT blue print needed to support the performance improvement of the Regional Office of the Ministry of Religion of Lampung Province. Related to this, the method chosen in this study is FEAF, which has several stages that refer to four levels, the stages of this research can be seen in the picture below.

Based on the picture above, the research was conducted through four levels, each level has several steps, namely:

1) FEAF Level 1
Level 1 is an identification of the condition of the Regional Office of the Ministry of Religion of Lampung Province globally which aims to collect information about the Regional Office of the Ministry of Religion of the Province of Lampung.
The steps are:
a. Conducting a literature study from several sources as a reference for designing an enterprise architecture that is in accordance with the conditions of the Regional Office of the Ministry of Religion of Lampung Province. Some of the materials that have been studied in the literature include:
i. Journal of "Hospital Reporting Information System Architecture Modeling Using FEAF" by Hadiansyah Ma'sum in 2014,
ii. Journal of "Enterprise Architecture Design for Kir Test Registration Using FEAF at DISHUB Sukabumi" by Asep Sutiawan, Risa Sri Marlianti, Salsa Tini Kareksi, Sub-Department of Saepudin in 2020,
iii. Journal of "Proposed FEAF Model for Strategic Planning of Information Systems at PT. Sumber Buana Motor Yogyakarta" by Erik Setiawan, Irya Wisnubadhra, Sapty F. Rahayu in 2015,
iv. Journal of "Information Architecture Framework Design for Government Agencies in Indonesia" by Khakim Ghozali in 2015,
v. Journal of "Development Studies and Proposed Design of Enterprise Architecture Framework" by Sofian Lusa, Dana Indra Sensuse in 2011,
vi. Journal of "Development of Enterprise Architecture Framework" by Nadya Safitri, Rully Pramudita in 2017,
vii. Journal of "Achieving CMMI Maturity Level 3 by Implementing FEAF Reference Models" by Fatemeh Kafili Kasmaee, Ramin Nassiri, Gholamreza Latif Shabgahi in 2010,
viii. Journal of "A systematic literature review: Critical Success Factors to Implement Enterprise Architecture" by Rizal Ansyori, Nanik Qodarsih, Benfano Soewito in 2018,
ix. Journal of "Developing a Method to Leverage FEAF by Deploying Val IT Enablers" by Parvaneh Afzali, Javad Rezapour, Zahra Rezapour, Milad Hemmatnezhad in 2016,
x. Journal of "E-Government Architectural Planning Using Federal Enterprise Architecture Framework in Purwakarta Districts Government" by Meriska Defriani, Mochzen Gito Official in 2019
xi. The Profile Book of the Regional Office of the Ministry of Religion of the Province of Lampung and the book "The Regional Office of the Ministry of Religion of Lampung Province in Figures in 2021"
b. Collect documents from the Regional Office of the Ministry of Religion of the Province of Lampung relating to the conditions, goals and objectives of the Regional Office of the Ministry of Religion of the Province of Lampung. Data collection is done by observation and interviews. In general, interviews are carried out simultaneously with observation activities, because at the time of the interview, the interviewer needs to visit the resource persons who are in the Regional Office of the Ministry of Religion of Lampung Province. So you can make direct observations. The interview process is addressed to the head of the sub-section/sub-coordinator or the party in accordance with the research needs.
The results of the interview were strengthened by observations on the condition of the Regional Office of the Ministry of Religion of Lampung Province. The data obtained from the interview and observation process at the Regional Office of the

Ministry of Religion of Lampung Province are as follows:

i. Book Profile of the Regional Office of the Ministry of Religion of Lampung Province
ii. SK correction sheet for each subsection of the Regional Office of the Ministry of Religion of Lampung Province
iii. Organizational structure
iv. Employee Data of the Regional Office of the Ministry of Religion of Lampung Province
v. List of tasks and functions
vi. Plan of the Regional Office of the Ministry of Religion of Lampung Province
vii. Appraisal of Civil Servant Work Performance
viii. Assessment of Functional Position Credit Score
ix. Monitoring and evaluation form for each field and subsection

c. The results of the interview show the condition of the Regional Office of the Ministry of Religion of Lampung Province, as well as the potential in the form of strengths and weaknesses it has.

2) FEAF Level 2

Level 2 is to identify the current business processes/requirements and those that will be needed in the future. The steps are:

a. Reviewing the results of interviews regarding valuable daily, monthly and annual activities for the Regional Office of the Ministry of Religion of Lampung Province.
b. Make proposals for important and necessary business processes for the Regional Office of the Ministry of Religion of Lampung Province in the future.
c. Analyze and classify business processes against the value chain, to identify the main activity groups and supporting activities.

3) FEAF Level 3

Level 3 is identifying and modeling the information architecture in the form of an overview of the database that will be used to accommodate the information system. The steps are:

a. Transforming structured business processes into business architecture.
b. Designing data classes and relationships with business processes.
c. Create a database design to accommodate the proposed information system.

4) FEAF Level 4

Level 4 is the creation and classification of enterprise architecture models based on the FEAF matrix.

From the 5x3 matrix, it can be seen that FEAF is a derivative of the Zachman Framework, namely by referring to the five rows from the perspective and the first three columns from the product. This level shows the design architecture as a column header, while the planer and owner perspectives focus on the definition of business architecture and documentation. Each row of the matrix represents a holistic view of the solution.

The higher perspective does not require a comprehensive understanding than the lower perspective. In other words, the top row is described in detail on the bottom row. Further understanding of the five FEAF perspectives are as follows;

1. Planner's perspective, explaining views or estimates of the scope of the system to be developed, the three defined cells are as follows;

a. The What column (List of Business Objects) contains data or information needed for the continuity of business functions.
b. The How column (List of Business Process), contains the business processes that occur at the Regional Office of the Ministry of Religion of Lampung Province which aims to achieve the agency's performance goals.
c. The Where (List of Business Locations) column contains a general description and geographical condition of the Regional Office of the Ministry of Religion of Lampung Province.

2. Owner's perspective, describes the enterprise model which is a business design and shows business entities, processes and their relationship. The three cells are defined as follows;

a. Column What (Semantic Model), is a data that is used to make it easier to design the database.
b. The How column (Business Process Model) contains an activity diagram that shows system activities in the form of a collection of actions, how each action starts, until the action ends. Activity diagrams can also describe more than one process at the same time.
c. The Where (Business Logistics System) column contains a more specific description of the location used to carry out business processes at the Regional Office of the Ministry of Religion of Lampung Province.

3. Designer's perspective, explains that the system model that is designed must show data elements, process flows and functions that describe entities. The three cells defined are as follows;

a. The What column (Logic Data Model) contains the Entity Relationship Digram (ERD) system structure in terms of defining the classes that will be created to build the system. Classes have what are called attributes and methods or operations.
b. The How column (Application Architecture) contains the application architecture that describes the proposed information system.
c. The Where column (System Geographic Deployment Architecture) contains a logical model of the connectedness of nodes on a network and an overview in the form of a network topology.

4. Builder's perspective, explains the technology model that must be adapted to the information system model such as input/output devices or other technology needs. The three cells defined are as follows;

a. The What (Physical Data Model) column contains a physical data model which is represented as a table along with the attributes that will be used to build the system to be created.
b. The How (System Design) column contains the input to be processed and the output generated by the system.
c. The Where (Technology Architecture) column provides a physical description of the technology needs at the Regional Office of the Ministry of Religion of Lampung Province, these needs are in the form of hardware, software and system software or operating systems.

5. Subcontractor Perspective, describes the detailed specifications used before the system is implemented. The three cells identified are as follows:

a. The What (Data Definition) column contains Data Definition Language (DDL) which are the commands used to define the structure of the database.
b. The How (Programs) column contains the methods needed to build the system
c. The Where (Network Architecture) column contains the network architecture, namely addressing each node on the network so that they can communicate with each other.

3.2 Tools

The tools used for smoothness in this research are as follows..

a. Hardware
   A set of computers with a Pentium processor or its class, at least 2 GB RAM, 320 GB hard disk.
b. Software
   Microsoft Windows 7 Operating System.

IV. CONCLUSION

This research produces an enterprise IT architecture design in designing the architecture business and formation systems to optimize the use of IS / IT. Furthermore, enterprise architecture design can be done make automation and integration of all business processes between divisions / work units at Regional Office of Kementerian Agama Lampung Province optimal. Everal information systems that exist in Regional Office of Kementerian Agama Lampung Province have been identified before the implementation of FEAF. It is hoped that the FEAF design will facilitate the development of an information system that can provide convenience to all.

REFERENCES

[1] R. Yunis and Theodora, "Penerapan Enterprise Architecture Framework Untuk Pemodelan Sistem Informasi," *JSM STMIK Mikroskil*, vol. 13, no. 2, pp. 159–168, 2016.

[2] S. Lusa and D. I. Sensuse, "Kajian Perkembangan Dan Usulan Perancangan Enterprise Architecture Framework," *Semin. Nas. Apl. Teknol. Inf.*, vol. 2011, no. Snati, pp. 17–18, 2011.

[3] E. Setiawan, I. Wisnubadhra, and S. F. Rahayu, "Usulan Model Feaf Untuk Perencanaan Strategis Sistem Informasi Pada Pt . Sumber Buana Motor," *Semin. Nas. Ilmu Komput. (SNIK 2015)*, no. Snik, pp. 125–128, 2015.

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Designing a Measurement Model for the Effectiveness of Online Learning Using C4.5 Algorithm

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Abstract— Technological developments in the world of education have led to many innovations to support education such as online learning in the learning process amid the Covid-19 pandemic. Changes in learning methods that occur suddenly from conventional learning methods or directly switch to distance learning methods or using online learning media greatly impact and affect students who come from underprivileged families and students who are in areas where internet access and infrastructure are lacking. support. This study aims to create a classification model for measuring the effectiveness of online learning in the Pringsewu area using the classification method. The classification method is used to classify data based on the nature of the data that has been recognized by each class. Various methods can be used to classify data, namely the C4.5 Algorithm method. The results of the research carried out are a design classification model for measuring the effectiveness of online learning in the Pringsewu area such as Internet Access, Network Infrastructure, Learning Media, Device Networks, Mastery of Technology Operations, School ICT Infrastructure, Learning Concepts, Motivation in Online Learning, Understanding of Learning Materials.

Keywords—Design, Effectiveness, Online Learning, C4.5 Algoritm

I. INTRODUCTION

The development of technology has many impacts and benefits on human life both positive and negative impacts both in work, interaction and socialization and in terms of education and learning. This proves that the development of technology greatly affects the progress of human civilization. Significant technological developments demand changes in the management of life and society including education. The development of technology in the world of education gave rise to many innovations to support education in the learning process during the Covid-19 pandemic.

Covid-19 is a virus that attacks the respiratory system and can cause death. Based on UNICEF data in 2020 more than 120 countries have imposed restrictions on social interaction through school closures that impacted 1.6 million students worldwide including Indonesia. The widespread spread of covid-19 in Indonesia forced the government to restrict social interactions including learning activities in schools. At least 60 million students in Indonesia have been affected by the covid-19 pandemic globally.[1]

With the Covid-19 pandemic, online learning has increased and become popular because all teaching and learning activities throughout Indonesia must apply online learning methods to break the chain of the spread of covid-19.

Research that has been done previously [2] with the title Exploring presence in online learning through three forms of computer-mediated discourse analysis has analyzed the effectiveness of online learning in teaching, social and cognitive and the results of the study showed positive results where learning using online media is effective in teaching, social and cognitive.

Research [3]. The research discusses the inability of students to complete timely studies at universities. The study used data mining techniques with two methods namely Algorithm C4.5 and Naive Bayes with preprocessing to obtain a quality dataset to predict student graduation status, the results showed that the C4.5 Algorithm method can be used to predict student graduation status with an accuracy rate of 79.08%.

Previous research conducted an analysis of online learning media on teaching and the use of the C4.5 algorithm method to predict student graduation. In this study, the authors tried to use the C4.5 method to create a measurement model of the effectiveness of online learning in the pringsewu region. The Pringsewu Region itself has never been measured the level of effectiveness of learning using online media. For this reason, research will be conducted to measure the effectiveness of learning using online media in the Pringsewu Region using the C4.5 data mining algorithm in classification using variables that can be used as criteria for determining the effectiveness of learning applications using online media. The C4.5 algorithm method is used because it is a classification method that can be helpful in finding models to describe the classification class effectiveness of applying online learning methods in the Pringsewu Region.

II. LITERATURE RIVIEW

A. Previous Research

Several previous studies related to this research, and used as a reference in this study are set out in table 1 below.

TABLE I. PREVIOUS RESEACH

No	Title	Description
1	The Effectiveness of Integrated Online Learning in the 4.0 Education Era	The research discusses the effectiveness of online learning in the 4.0 era which emphasizes the integration of the environment from various sources. The results of the study show that online learning will be effective if the essential components applied from laurillard include discursive, adaptive, interactive, and reflective aspects. Of the 117 students, 17 participants (14.53%) chose to use only online learning, while the other 89 students (76.07%) tended to choose a combination of online learning. Thus, it is important for innovation in the form of integration with the environment that refers to the digital learning ecosystem component that can accommodate learning styles, flexibility, and student learning experiences so that it can create positive feelings.
2	The Use of E-Learning in Project-Based Learning at SMA Negeri 1 Jepara	This study discusses the effectiveness of using e-learning as a solution to increase teacher-student interaction time which is lacking in the application of project-based learning. The results of the study show that the use of e-learning applications, both Schoology and Edmodo in PBP, is significantly effective, it can be seen from: (1) spiritual attitudes, social attitudes, projects, products, student responses are at a minimum good category and students' learning completeness has reached the Minimum Completeness Criteria (KKM), (2) the significance value is 0.018, which is smaller than = 0.05, which means that there are differences in the use of E-learning Schoology and Edmodo applications in PBP on student learning outcomes, (3) the significance value is 0.598 greater than = 0.05 which means that there is no difference in the learning outcomes of male and female students, and (4) a significance value of 0.906 is greater than = 0.05 which means that there is no relationship between the use of the PBP E-learning application and learning outcomes of male and female students.

B. Data Mining Concept

According to Efrain Turban (2005), Data mining is a process that uses statistical techniques, mathematics, artificial intelligence, and machine learning to extract and identify useful information and related knowledge from various large databases [4].

According to Daniel T. Larose (2004), Data Mining is the process of discovering meaningful new correlations, patterns, and trends by sifting through large amounts of data stored in repositories, using pattern recognition technology as well as statistical and mathematical techniques. [5]

According to Kusrini (2009), the terms data mining and knowledge discovery in databases are often used interchangeably to describe the process of extracting hidden information in a large database. Understanding the two terms have different concepts but are related to each other. One of the stages in the whole process of knowledge discovery in databases is data mining.

Based on some of the definitions of data mining above, it can be concluded that data mining is a process to find patterns using statistical techniques to explore hidden information in one large database.

Knowledge discovery in databases, in general, can be in the picture right below.

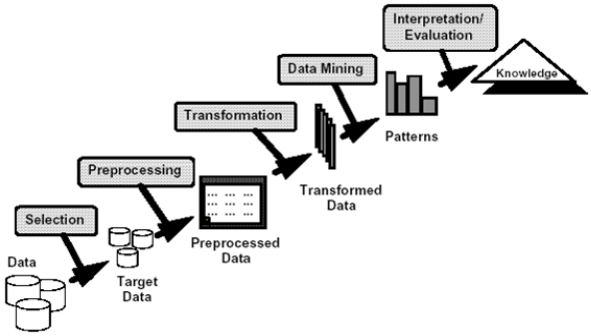


Figure 1 Stages of *Knowledge Discovery in Databases*

Data mining is divided into several groups based on the tasks that can be done, namely [5]:

1) description
   Sometimes analytical research simply wants to try to find a way to describe the patterns and trends contained in the data. Descriptions of patterns and trends often provide possible explanations for a pattern or trend.
2) Estimate
   Estimation is almost the same as classification, except that the estimation target variable is more numerical than categorical. The model is built using a complete record that provides the value of the target variable as the predicted value. Furthermore, in the next review, the estimated value of the target variable is made based on the value of the predictive variable.
3) Prediction
   The prediction has similarities with estimation and classification. It's just that, the prediction of the result shows something that hasn't happened yet (may happen in the future).
4) Classification
   In the classification of variables, objectives are categorical. For example, we will classify income into three classes, namely high income, medium income, and low income.
5) Clustering
   Clustering is a grouping of records, observations, or attention and forms a class of objects that have similarities. A cluster is a collection of records that have similarities with one another and have dissimilarities with records in other clusters. Clustering differs from classification in that there is no target variable in clustering.
6) Association
   Identify the relationship between various events that occur at one time

C. Online Learning

The definition of online learning is a learning method that uses an interactive model based on the Internet and Learning Management System (LMS). Like using Zoom, Google Meet, Google Drive, and so on. Online activities include Webinars, online classes, all activities carried out using internet networks and computers. *[6]*.

With the application of online learning methods, students can exchange information and create interactions that are real-time and non-real-time, in addition, the material can be designed multimedia all and dynamically. Learners can connect to various virtual libraries around the world and make it a medium for improving understanding. Teachers/instructors/lecturers can quickly add reference teaching materials that are case studies, industry trends, and technology projections going forward through various sources to add participants' insight into their teaching materials.

III. Research Methodology

A. Data Collection Techniques

Data collection methods are important in research and are strategies or ways used by researchers in collecting data needed in their research. The data collection methods used in this study are:

1. *Research Library*
   The literature review is conducted by reading, quoting, and making notes sourced on library materials that support and relate to research in this regard regarding data mining Algorithm C4.5
2. Questionnaire
   In this study, the authors will use electronic questionnaires (google form) behind closed doors. The distribution of questionnaires will be divided into two stages, the first stage will be carried out the distribution of questionnaires for the determination of criteria, and the second stage after the test validity and reliability of criteria. The answers provided are adjusted to the Likert scale. According to sugiyono (2016:136), "the Likert scale is used to measure the attitudes, opinions, and perceptions of a person or group about social events or phenomena".

B. Algoritma C4.5

Rock and Maimon, (2012) C4.5 algorithm are one of the methods for making decision trees based on training data that has been provided. The C4.5 algorithm is a development of ID3. Some of the developments carried out in C4.5 are as one that can overcome missing value, can overcome continued data, and pruning.[7]. The decision tree is the result of the process of calculating entropy and information gain, after repeated calculations until all attributes of the tree have a class and can no longer be done in the calculation process. [8].

The decision tree is usually expressed in the form of tables with attributes and records. An attribute states a parameter created as a criterion in the formation of a tree. Change the tree resulting in several rules. The number of rules is equal to the number of paths that may be built from root to leaf node(branch). [7]. Tree Praining is done to simplify the tree so that accuracy can increase. Pruning has two approaches:

1) *Pre-praining*, That is, stopping the development of a subtree early (i.e. by deciding not to further partition training data). When it stops immediately, the node turns into a leaf. These end nodes became the classes that most often appeared among a subset of the sample.
2) *Post-praining*, That is to simplify the tree by removing some subtree branches after the tree is completed. Nodes that are rarely cut will be leaf (end nodes) with classes that appear most often.

In general, the C4.5 algorithm for building decision trees is as follows:[9].

1.Select the attibute as the root.
2.Create branches for each value.
3.For cases in branches.
4.Repeat the process for each branch until all cases on the branch have the same class.

To select an attribute as a root is based on the gain value ratio of existing attributes. To calculate the gain ratio use the following equation formula.

$$Gain\_ratio(v) = \frac{Gain(v)}{Split\_Info(v)} \qquad (2.1)$$

Information:
Gain (v) *:* gain of each attribute
Split_Info *:* split attribute information

The value of split info *(v)* can be searched with equations

$$Split_{info(v)} = \sum_{i=1}^{n} \frac{|T_i|}{|T|} - log \frac{|T_i|}{|T|} \qquad (2.2)$$

Information:
n : Number of attributes
T : Number of data Instance frequencies
T_i : Number of frequencies in the i-th value attribute

Meanwhile, the calculation of entropy values can be seen in the following equation.

$$Entropy\ (S) = \sum_{i=0}^{n} -pi * \log_2 pi \qquad (2.3)$$

Information:
S : Case Set
n : Number of cases on partition S
pi : Proportion of Si to S

The C4.5 algorithm has the advantage of being able to produce a decision tree that is easily interpreted, has an acceptable level of accuracy, efficient in handling discrete and numerical type attributes, in constructing the C4.5 algorithm tree to read the entire sample of training data from storage and load it into memory. One of the disadvantages of the C4.5 algorithm in the category of "Scalability" is that it can only be used in the training data can be stored in its entirety and at the same time in memory.

C. Test Validity and Reliability

In a study before analyzing the data, the test of the research instrument will first be conducted. Data testing of research instruments can be done using tests of validity and reliability of instruments to be used in research. In this study, the authors used validity and reliability tests to

measure the validity and reliability of the criteria to be used to measure the effectiveness of online learning.

1. Tes Validity *(Bivariate Person – Product Moment)*

   According to (Sugiyono, 2016:168) "valid means that the measuring instrument used to get the data (measuring) is appropriate. The validity of the measuring instrument is tested by calculating the correlation between the value obtained from each item of the statement and the overall obtained on the measuring instrument. The method used to test validity in this study is Bivariate Person (Product Moment).

   The following product moment correlation formula:

$$r_{ix} = \frac{n\sum ix - (\sum i)(\sum x)}{\sqrt{[n\sum i^2 - (i)^2][n\sum x^2 - (\sum x)^2]}}$$

   Information:

   r_{ix} = Total item correlation coefficient *(bivariate person)*

   i = Item score

   r = Total Score

   n = Many subjects took the test

   Testing criteria *Bivariate Person (Product Moment)*

   a. If r calculates the > r table (test 2 sides with signification of 0.05) then the instrument or statement items correlate signification to the total score (declared valid).

   b. If r calculates the < r of the table (test 2 sides with signification of 0.05) then the instrument or statement items are not correlated signification to the total score (declared invalid).

2. Reliability Test *(Alpha – Cronbach)*

   According to (Sugiyono, 2016: 168) reliability is the result of research where there are similarities in data at different times. Reliability means keajegan, a measurement instrument that can be said to be real if the instrument can be used repeatedly and provide the same measuring results. An instrument reliability test is done to determine the consistency of the measuring instrument, whether the measuring instrument used remains consistent if used repeatedly. The reliability test method in this study used the alpha formula (Cronbach). Alpha formula is a procedure of finding reliability values by not requiring items into two groups (can also be applied to the two-side technique), so it can be applied to instruments with an odd number of items.

   Alpha Formula *(Cronbach)as follows*:

$$r_{ac} = \left[\frac{k}{k-1}\right]\left[1 - \frac{\sum \sigma b^2}{\sigma_{t^2}}\right]$$

Informations:

r_{ac} = Reliability of the instrument

k = Lost of questions

$\sum \sigma b^2$ = Number of item variants

σ_{t^2} = Varian total

Alpha assessment criteria (cronbach)

The significance test was carried out at a significance level of 0.05, meaning that the instrument can be said to be reliable if the alpha value is greater than the critical product-moment r.

D. Research Variabel

The data to be used in the research is data from the results of questionnaires distributed using online media (google form), where the attributes that will be used in the research questionnaire will be tested for validity and reliability first. Some of the attributes to be tested can be seen in the table below.

Table 1. Research Criteria

No	Criteria
1	Internet Access
2	Network Infrastructure
3	Learning Media
4	Device Network
5	Mastery of teachers in technology operation
6	School ICT Infrastructure
7	Learning Concept

IV. DISCUSSION

A. Validity Test

The validity test of the questionnaire was carried out to measure whether or not the questionnaire used in the study was valid. The test is carried out by correlating the score on each item with the total score then processing using the product-moment correlation formula using 109 data from the distribution of questionnaires that have been separated from the error questionnaire data.

Table 2 Variable Test

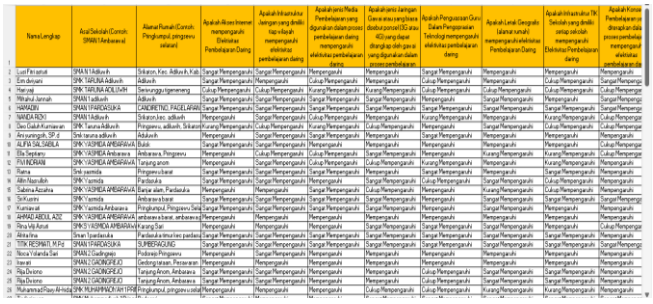


Table 3 Instrument Validity Test Results

No	Criteria	r Count	r Table	Information
1	Internet Access	0.628	0.176	Valid
2	Network Infrastructure	0.651	0.176	Valid
3	Learning Media	0.639	0.176	Valid
4	Device Network	0.648	0.176	Valid
5	Mastery of teachers in technology operation	0.564	0.176	Valid
6	School ICT Infrastructure	0.566	0.176	Valid
7	Learning Concept	0.551	0.176	Valid

Reliability Test

A reliability test was conducted to measure the consistency of the questionnaire which is an indicator of the construct or variable. A questionnaire is said to be reliable or reliable if the answers to the questions are consistent from time to time. Testing the reliability of the instrument using the Cronbach alpha formula.

Table 4 Reliability Testing Results of Research Variables

No	Criteria	r ac	Information
1	Internet Access	0.709	Reliabel
2	Network Infrastructure		
3	Learning Media		
4	Device Network		
5	Mastery of teachers in technology operation		
6	Shool ICT Infrastructure		
7	Learning Concept		

Based on the results of the validity and reliability tests that have been carried out, the 7 criteria presented are said to be valid and reliable as follows:

Tablel 5 Valid and reliable criteria

No	Criteria
1	Internet Access
2	Network Infrastrukture
3	Learning Media
4	Device Network
5	Mastery of teachers in technology operation
6	School ICT Infrastructure
7	Learning Concept

After testing the validity and reliability obtained 7 (Seven) valid and reliable criteria that will be used in this study, namely internet access, network infrastructure, learning media, learning concepts, network devices, mastery in technology operation, and ICT infrastructure owned by schools. In addition to these 7 (Seven) criteria, there are two (2) additional criteria, namely motivation in learning and understanding of learning materials referred to based on previous research conducted by I. M. Purwaamijaya, R. M. Masri, and B. M. Purwaamijaya. [10] where the criteria for motivation in learning and understanding of learning materials have been tested for validity and reliability.

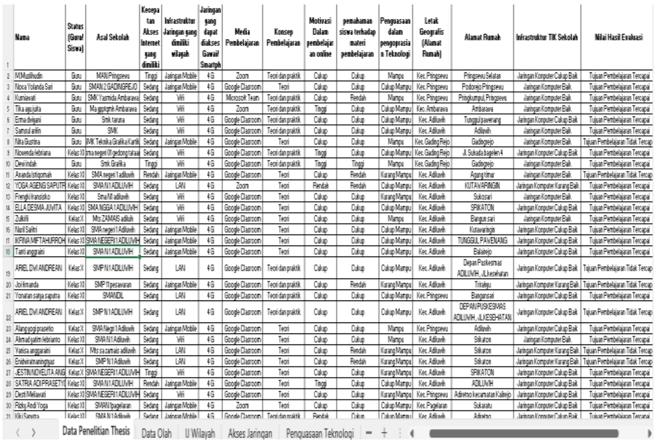
Table 6 Research Criteria

No	Criteria
1	Internet Access
2	Network Infrastructure
3	Learning Media
4	Device Network
5	Mastery of teachers in technology operation
6	School ICT Infrastructure
7	Learning Concept
8	Motivation in Online Learning
9	Students' Understanding of Learning Materials

B. Pre-Processing Data

Data preprocessing is an initial data processing technique carried out in data mining to convert raw data collected from various sources such as Google forms and questionnaires into cleaner information which is then used for further data processing. Based on the distribution of the questionnaires conducted, the results obtained are 670 raw data.

Table 7. Raw Data



1	Nama	Status (Guru/ Siswa)	Asal Sekolah	Kecepatan Akses Internet yang dimiliki	Infrastruktur Jaringan yang dimiliki wilayah	Jaringan yang dapat diakses Gawai/ Smartph	Media Pembelajaran	Konsep Pembelajaran	Motivasi Dalam pembelajaran online	pemahaman siswa terhadap materi pembelajaran	Penguasaan dalam pengoprasian Teknologi	Letak Geografis (Alamat Rumah)	Alamat Rumah	Infrastruktur TIK Sekolah	Nilai Hasil Evaluasi
2	M.Musthudin	Guru	MAN Pringsewu	Tinggi	Jaringan Mobile	4G	Zoom	Teori dan praktik	Cukup	Cukup	Mampu	Kec. Pringsewu	Pringsewu Selatan	Jaringan Komputer Cukup Baik	Tujuan Pembelajaran Tercapai
3	Noca Yolanda Sari	Guru	SMAN 2 GADINGREJO	Sedang	Jaringan Mobile	4G	Google Clasroom	Teori	Cukup	Cukup	Cukup Mampu	Kec. Pringsewu	Podorejo Pringsewu	Jaringan Komputer Baik	Tujuan Pembelajaran Tercapai
4	Kurniawati	Guru	SMK Yasmida Ambarawa	Sedang	Wifi	4G	Microsoft Team	Teori dan praktik	Cukup	Rendah	Mampu	Kec. Pringsewu	Pringkumpul, Pringsewu	Jaringan Komputer Baik	Tujuan Pembelajaran Tercapai
5	Tika ayujuita	Guru	Ma ggptqmk Ambarawa	Sedang	Wifi	4G	Zoom	Teori dan praktik	Tinggi	Cukup	Cukup Mampu	Kec. Ambarawa	Ambarawa	Jaringan Komputer Baik	Tujuan Pembelajaran Tercapai
6	Erna dwijani	Guru	Smk taruna	Sedang	Wifi	4G	Google Clasroom	Teori dan praktik	Cukup	Cukup	Cukup Mampu	Kec. Adiluwih	Tunggul pawenang	Jaringan Komputer Cukup Baik	Tujuan Pembelajaran Tercapai
7	Samsul arifin	Guru	SMK	Sedang	Wifi	4G	Google Clasroom	Teori dan praktik	Cukup	Cukup	Cukup Mampu	Kec. Adiluwih	Adiluwih	Jaringan Komputer Baik	Tujuan Pembelajaran Tercapai
8	Nita Gustina	Guru	SMK Teknika Grafika Kartik	Sedang	Jaringan Mobile	4G	Google Clasroom	Teori	Cukup	Cukup	Mampu	Kec. Gading Rejo	Gadingrejo	Jaringan Komputer Baik	Tujuan Pembelajaran Tidak Tercap
9	Novenda febriana	Kelas XI	sma negeri 01 gedong tataan	Sedang	Wifi	4G	Google Clasroom	Teori dan praktik	Tinggi	Cukup	Cukup Mampu	Kec. Gading Rejo	Jl. Sukada bagelen 4	Jaringan Komputer Cukup Baik	Tujuan Pembelajaran Tercapai
10	Dewiindah	Guru	Smk Grafika	Tinggi	Wifi	4G	Google Clasroom	Teori dan praktik	Tinggi	Tinggi	Mampu	Kec. Gading Rejo	Gadingrejo	Jaringan Komputer Baik	Tujuan Pembelajaran Tercapai
11	Ananda Istiqomah	Kelas XI	SMA negeri 1 adiluwih	Rendah	Jaringan Mobile	4G	Google Clasroom	Teori	Cukup	Rendah	Kurang Mampu	Kec. Adiluwih	Agung timur	Jaringan Komputer Baik	Tujuan Pembelajaran Tidak Tercap
12	YOGA AGENG SAPUTR	Kelas XI	SMA N 1 ADILUWIH	Sedang	LAN	4G	Zoom	Teori	Rendah	Rendah	Cukup Mampu	Kec. Adiluwih	KUTAWARINGIN	Jaringan Komputer Kurang Baik	Tujuan Pembelajaran Tercapai
13	Frengki fransisko	Kelas XI	Sma N1 adiluwih	Sedang	Wifi	4G	Google Clasroom	Teori	Cukup	Cukup	Kurang Mampu	Kec. Adiluwih	Sukosari	Jaringan Komputer Baik	Tujuan Pembelajaran Tercapai
14	ELLA DESMA JUVITA	Kelas XI	SMA NGGA 1 ADILUWIH	Sedang	Wifi	4G	Google Clasroom	Teori	Cukup	Cukup	Cukup Mampu	Kec. Adiluwih	SRIKATON	Jaringan Komputer Cukup Baik	Tujuan Pembelajaran Tercapai
15	Zulkifli	Kelas X	Mts ZAMAIS adiluih	Sedang	Wifi	4G	Google Clasroom	Teori	Cukup	Cukup	Mampu	Kec. Adiluwih	Bangun sari	Jaringan Komputer Baik	Tujuan Pembelajaran Tercapai
16	Nuril Safitri	Kelas XI	SMA negeri 1 Adiluwih	Sedang	Jaringan Mobile	4G	Google Clasroom	Teori	Cukup	Cukup	Cukup Mampu	Kec. Adiluwih	Kutawaringin	Jaringan Komputer Cukup Baik	Tujuan Pembelajaran Tercapai
17	IKFINA MIFTAHURROH	Kelas XI	SMA NEGERI 1 ADILUWIH	Sedang	Jaringan Mobile	4G	Google Clasroom	Teori	Cukup	Cukup	Cukup Mampu	Kec. Adiluwih	TUNGGUL PAWENANG	Jaringan Komputer Cukup Baik	Tujuan Pembelajaran Tercapai
18	Tarti anggraini	Kelas XI	SMA N 1 ADILUWIH	Sedang	Jaringan Mobile	4G	Google Clasroom	Teori	Cukup	Cukup	Cukup Mampu	Kec. Adiluwih	Balairejo	Jaringan Komputer Cukup Baik	Tujuan Pembelajaran Tercapai
19	ARIEL DWI ANDREAN	Kelas X	SMP N 1 ADILUWIH	Sedang	LAN	4G	Google Clasroom	Teori dan praktik	Cukup	Cukup	Cukup Mampu	Kec. Adiluwih	Depan Puskesmas ADILUWIH, Jl.kesehatan	Jaringan Komputer Cukup Baik	Tujuan Pembelajaran Tidak Tercap
20	Joi fimanda	Kelas XI	SMP 11 pesawaran	Sedang	Jaringan Mobile	4G	Google Clasroom	Teori dan praktik	Cukup	Rendah	Kurang Mampu	Kec. Adiluwih	Trirahyu	Jaringan Komputer Kurang Baik	Tujuan Pembelajaran Tidak Tercap
21	Yonatan satya saputra	Kelas XI	SMANDIL	Sedang	LAN	4G	Google Clasroom	Teori dan praktik	Cukup	Cukup	Cukup Mampu	Kec. Pringsewu	Bangunsari	Jaringan Komputer Cukup Baik	Tujuan Pembelajaran Tercapai
22	ARIEL DWI ANDREAN	Kelas X	SMP N 1 ADILUWIH	Sedang	LAN	4G	Google Clasroom	Teori dan praktik	Cukup	Cukup	Cukup Mampu	Kec. Adiluwih	DEPAN PUSKESMAS ADILUWIH, JL.KESEHATAN	Jaringan Komputer Cukup Baik	Tujuan Pembelajaran Tidak Tercap
23	Alang yogi prasetio	Kelas X	SMA Negri 1 Adiluwih	Sedang	Jaringan Mobile	4G	Google Clasroom	Teori	Cukup	Cukup	Mampu	Kec. Pringsewu	Adiluwih	Jaringan Komputer Cukup Baik	Tujuan Pembelajaran Tercapai
24	Ahmad yatim febrianto	Kelas XI	SMA N 1 Adiluwih	Sedang	Wifi	4G	Google Clasroom	Teori	Cukup	Cukup	Mampu	Kec. Adiluwih	Srikaton	Jaringan Komputer Baik	Tujuan Pembelajaran Tercapai
25	Yanisa anggaraini	Kelas X	Mts sa zamais adiluwih	Sedang	LAN	4G	Google Clasroom	Teori	Cukup	Rendah	Kurang Mampu	Kec. Adiluwih	Srikaton	Jaringan Komputer Kurang Baik	Tujuan Pembelajaran Tidak Tercap
26	Endwiratnaningtyas	Kelas X	SMP N 1 Adiluwih	Sedang	LAN	4G	Google Clasroom	Teori	Cukup	Rendah	Kurang Mampu	Kec. Adiluwih	Srikaton	Jaringan Komputer Kurang Baik	Tujuan Pembelajaran Tidak Tercap
27	JESTIN NOVELITA ANG	Kelas X	SMA NEGERI 1 ADILUWIH	Tinggi	Wifi	4G	Google Clasroom	Teori	Cukup	Cukup	Kurang Mampu	Kec. Adiluwih	SRIKATON	Jaringan Komputer Cukup Baik	Tujuan Pembelajaran Tercapai
28	SATRIA ADI PRASETYO	Kelas XI	SMA N 1 ADILUWIH	Rendah	Jaringan Mobile	4G	Google Clasroom	Teori	Tinggi	Cukup	Cukup Mampu	Kec. Adiluwih	ADILUWIH	Jaringan Komputer Cukup Baik	Tujuan Pembelajaran Tercapai
29	Desti Meliawati	Kelas XI	SMA NEGERI 1 ADILUWIH	Sedang	Wifi	4G	Google Clasroom	Teori	Cukup	Cukup	Kurang Mampu	Kec. Pringsewu	Adiretno kecamatan Kalirejo	Jaringan Komputer Cukup Baik	Tujuan Pembelajaran Tercapai
30	Rizky Andi Yoga	Kelas XI	SMAN 1 pagelaran	Sedang	Jaringan Mobile	4G	Zoom	Teori	Cukup	Cukup	Cukup Mampu	Kec. Pagelaran	Sukaratu	Jaringan Komputer Cukup Baik	Tujuan Pembelajaran Tercapai
31	Kiki Saputra	Kelas XI	SMA N 1 Adiluwih	Sedang	Jaringan Mobile	4G	Google Clasroom	Teori dan praktik	Rendah	Cukup	Cukup Mampu	Kec. Adiluwih	Adiretno	Jaringan Komputer Cukup Baik	Tujuan Pembelajaran Tercapai

Data Penelitian Thesis | Data Olah | IJ Wilayah | Akses Jaringan | Penguasaan Teknologi

The amount of data in the raw data was obtained from google forms and printed questionnaires distributed in 17 SMA/SMK/equivalent in the Pringsewu district. From a total of 670 data, 147 of them were obtained from google forms and another 523 were obtained from the distribution of printed questionnaires. Of the 670 data collected, only 659 can be processed, while the other 11 data are error data. The error data contained in the raw data is data that cannot be corrected or used, this is because the 3 data are data obtained from junior high school students while in this study focused on online learning at the SMA/SMK/equivalent level, a total of 8 other data are data obtained from outside the Pringsewu area, while in this study only focuses on the Pringsewu district.

C. Modeling Process Using C4.5 Algorithm

This process is an implementation of making a classification model on data classification. In this process, there are two stages, namely the formation of a tree and changing the tree into a rule. In this process, the Rapid miner's application is used as a tool to make the data mining process.

Here are the steps of the C4.5 algorithm using Rapid miner.

a. Import Data Set
   The data set import process is carried out by importing or uploading the data set that will be used in the Rapid Miner application.
b. Change of Role to Target/Label
   At this stage, variable type changes and target/label changes are made.
c. Next, a filter is carried out on the missing data so that the process will not occur Error
d. Application of the Decision Tree Model (C4.5)
   At this stage, the selection of the model that will be used in the classification process is carried out.

After carrying out the four stages of the data testing process using an algorithm, a model formed from student data will be obtained based on variables such as Internet Access, Network Infrastructure, Learning Media, Network Devices, Mastery of Technology Operations, School ICT Infrastructure, Learning Concepts, Motivation in Learning Online, Understanding of Learning Materials, which have been tested for validity and reliability will form a decision tree which can then be used as a model for measuring the effectiveness of online learning.

BAB V CONCLUSION

Based on the discussion that has been described measuring the effectiveness of online learning using the C4.5 Algorithm on the data of high school/vocational/equivalent students in the Pringsewu area, it can be concluded that the model or function that describes the effectiveness of online learning classes on the data of high school/vocational/equivalent students in the Pringsewu area, it was formed using the C4.5 Algorithm method using several criteria that were used as the basis for measuring the effectiveness of online learning in the Pringsewu area, including internet access speed, network infrastructure owned by the region, networks that can be accessed by devices, learning media, learning concepts, motivation in online learning, understanding of learning materials, mastery of technology operation, and ICT infrastructure. From several criteria that are used as the basis for the measurement, then it is processed using a rapid miner to build a measurement model that is described using a decision tree.

REFERENCES

[1] UNICEF, "COVID-19 dan Anak-Anak di Indonesia Agenda Tindakan untuk Mengatasi Tantangan Sosial Ekonomi," *J. Educ. pshycology Couns.*, vol. 2, no. April, pp. 1–12, 2020, [Online]. Available: www.unicef.org.

[2] M. Zhu, S. C. Herring, and C. J. Bonk, "Exploring presence in online learning through three forms of computer-mediated discourse analysis," *Distance Educ.*, vol. 40, no. 2, pp. 205–225, 2019, doi: 10.1080/01587919.2019.1600365.

[3] E. Etriyanti, D. Syamsuar, and N. Kunang, "Implementasi Data Mining Menggunakan Algoritme Naive Bayes Classifier dan C4.5 untuk Memprediksi Kelulusan Mahasiswa," *Telematika*, vol. 13, no. 1, pp. 56–67, 2020, doi: 10.35671/telematika.v13i1.881.

[4] B. E. Turban, J. E. Aronson, and T. Liang, *Decision Support System and Intelegent System*, 7th Ed. Ji. Yogyakarta: Penerbit Andi Yogyakarta, 2005.

[5] D. T. Larose, *Discovering Knowledge in Data An Introduction to Data Mining*. Canada: Published simultaneously in Canada, 2005.

[6] M. F. Rifai, H. Jatnika, and B. Valentino, "Penerapan Algoritma Naïve Bayes Pada Sistem Prediksi Tingkat Kelulusan Peserta Sertifikasi Microsoft Office Specialist (MOS)," *PETIR*, vol. 12, no. 2, pp. 131–144, 2019.

[7] A. Wanto, "Data Mining Algoritma & Implementasi," in *E-Book*, Cetakan 1,., T. Limbong, Ed. Yayasan Kita Menulis, 2020.

[8] E. P. Cynthia, E. Ismanto, S. Syarif, K. Riau, U. M. Riau, and J. T. Tambusai, "MENGKLASIFIKASI DATA PENJUALAN BISNIS GERAI," *JURASIK*, vol. 3, no. 3, pp. 1–13, 2018.

[9] K. E. T. Lutfi, *Algoritma Data Mining*. Yogyakarta: Penerbit Andi Yogyakarta, 2009.

[10] I. M. Purwaamijaya, R. M. Masri, and B. M. Purwaamijaya, "The Effectiveness of Online Learning Methods During the Covid-19 Pandemic," vol. 5, no. 2, pp. 191–199, 2021, doi: 10.2991/assehr.k.210203.093.

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Prediction of Graduation of Students of the Lampung School of Technology Nusantara using the K-Nearest Neighbor and Naive Bayes Algorithm

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***Abstract*— Predicting student graduation is the main factor for campuses to be able to assess the performance of each study program in learning achievement in each semester. Nusantara High School of Technology (STTN) Lampung has difficulty predicting graduation, so the machine learning approach with the K-Nearest Neighbor algorithm and the Naïve Bayes algorithm is very important in predicting graduation. In this paper, we discuss the K-Nearest Neighbor and Naïve Bayes methods which in research at STTN Lampung used the Rapidminer 9.1 application, with a total data of 372 student graduations which were then processed by previous data to obtain samples to be studied, then obtained a sample of 186 graduation students from the 2017 class. and 2019, for S1 Industrial Engineering and S1 Electrical. The results showed that the approach with the Naïve Bayes algorithm had a higher prediction accuracy of 89.09% compared to the K-Nearest Neighbor algorithm which obtained an accuracy rate of 74.77%. Further research can be carried out with other methods and samples from other year classes to produce more diverse predictions.**

Keywords — Prediction of student graduation, K-Nearest Neighbor Algorith,Naive Bayes Algorithm

I. INTRODUCTION

One of the benefits of the SIAKAD (Academic Information System) application in universities is to describe the achievement index of learning outcomes for each student to assess their activeness in taking lectures in each semester. Universities through special data processing institutions such as BAAK (Administrative Academic and Student Affairs Agency) usually provide Semester Results Reports which are presented to the Higher Education Service Institute (LLDikti) every semester, requiring accurate data complete about the results of student learning assessments. This need can be developed through research for campuses for future decision making, Each campus has a vision and mission that is in accordance with the field of study program it manages and will feel very satisfied, if the student activity reflected in the Graduation Index (IP) every semester is satisfactory because the better the IP, the student learning achievement every semester will be good. [1]

Therefore, to improve the quality of graduation and increase the accreditation of the Lampung School High of Technology Nusantara, it is necessary to predict students who will graduate on time. Prediction of student graduation is one of the most important and appropriate for forming patterns that may provide useful indications on student data, amounting to big. Therefore, a method is needed to solve this problem using the Data Mining method.

The previous research [2] with the title Students performance prediction using KNN and Naïve Bayesian, present study, by comparing the three evaluation parameters (Accuracy, Recall and Precision).

Research [3]. This study discusses the predictive model of student performance using K Nearest Neighbour and Naïve Bayes as classification techniques applied to the data set for secondary General certificates, which were collected from the ministry of education in the Gaza Strip. This study uses the K Nearest Neighbor and Nave Bayes algorithms, where the Naïve Bayes algorithm has the highest accuracy of 93.17% which means a strong relationship between features that affect student performance, and will help to predict student performance for next year.

Previous research conducted a measurement of student performance on the general certificate of secondary education in the Gaza Strip using the K Nearest Neighbor and Naïve Bayes algorithms. In this study, the authors tried to use the K Nearest Neighbor and Naïve Bayes methods to measure the graduation rate of students at the Nusantara College of Technology, Lampung. Lampung School of Technology Nusantara itself has never measured the graduation rate of students. Therefore, research will be conducted to measure student graduation at the Lampung School of Technology Nusantara using the K Nearest Neighbor and Naïve Bayes algorithms in classification using variables that can be used as criteria to determine student graduation. The K Nearest Neighbor and Nave Bayes algorithm methods are used because they are classification methods that can assist in measuring the level of accuracy to describe student graduation at the Lampung School of Technology Nusantara.

II. LITERATURE RIVIEW

A. Machine Learning

According to Andreas C. Muller & Sarah Guido (2017), Machine Learning is part of the field of science related to statistics, artificial intelligence and computer science that can predict the results of analysis and can learn data.[4]. According to Widodo Budiharto (2016), the Machine Learning process is the same as data mining. Both look for patterns, but Machine Learning uses data to improve understanding of the program itself.

B. K-Nearest Neighbour Method

K-Nearest Neighbors Algorithm is the simplest Algorithm in Machine Learning. The way to use it is to build a machine learning model to store the training data set and make predictions for the new data point, then look for the nearest data point. (Andreas C. Muller & Sarah Guido, 2017). K-Nearest Neighbors Algorithm is a supervised learning algorithm. (Mustakim, Giantika Oktaviani, 2016). The principle of the K-Nearest Neighbors Algorithm is to use a non-parametric algorithm commonly used in classification and regression (Widodo Budiharto, 2016). The steps used in implementing the K-Nearest Neighbors Algorithm are as follows:

1. Collect data with various Algorithms.
2. Calculate the distance value (distance calculation).
3. In calculating the distance, you can use the Euclidean distance formula
4. Analyze data with various algorithms.
5. Processing training data
6. Calculating error rate.
7. Entering data and running the algorithm so that it can determine which class fits the data. (Widodo Budiharto, 2016).

Predicting students' academic performance using a modified kNN algorithm Moohanad Jawthari and Veronika Stoffov, 2021 Shows that the proposed algorithm has an accuracy of 14% better than the standard one, and is not sensitive to outliers.

Application of Data Mining Classification Method for Student Graduation Prediction Using K-Nearest Neighbor (K-NN) Algorithm by Mohammad Imron and Satia Angga Kusumah, 2018. This study aims to determine the level of accuracy that has been conveyed by the K-Nearest Neighbor (K-Nearest Neighbor) algorithm. NN) in predicting the graduation rate of students at Stmik Amikom Purwokerto. The results showed that the K-NN method produced a high accuracy of 89.04%.

Machine Learning Algorithms for Student Employability Prediction Using R G Vadivu and K.Sornalakshmi (2017), to predict job skills based on their regular performance. Using data the algorithm is applied to a data set of 250 students with 59 attributes. The results showed that the accuracy obtained after the analysis for KNN was 95.33% and for Nave Bayes was 97.67%.

C. Naïve Bayes Method

The Naive Bayes algorithm predicts future opportunities based on past experience, so it is known as Bayes' theorem. The main characteristic of this Nave Bayes Classifier is a very strong assumption (nave) of the independence of each condition/event. Predicting Students'Academic Performance Using Naïve BayesAbdullah Baz, Fatima Alshareef, Ebtihal Alshareef, Hosam Alhakami, Tahani Alsubait. The aim of their research is to predict students' academic performance at Umm Al-Qura University by using Naive Bayes method, one of the most known data mining classification algorithms. This classifier helps to predict the final GPA of students at early stages based on courses' grades in the first year. The classification algorithm called Naïve Bayes is employed on the dataset by using the WEKA tool. dataset is collected from Umm Al-Qura University database. This dataset consists of 138 records of students who graduated from College of Computer and information Systems in the year 2019, associated with 13 attributes including student ID, gender, eight courses' grades, GPA of both first and second semester in the first's year and the final GPA.Results achieved show that Naïve Bayes can be used for predicting students' academic performance at early stages in the first year with an accuracy of 72.46%

Students performance prediction using KNN and Naïve Bayesian Ihsan A. Abu Amra, Ashraf Yunis Maghari, 2017. This paper proposes a student performance prediction model using KNN and Nave Bayes as classification techniques applied to data sets for secondary General certificates, which were collected from the ministry of education. in the Gaza Strip. In our presented study, by comparing the three evaluation parameters (accuracy, Recall and Precision) for the two KNN and Naïve Bayes algorithms, the NaïveBayes algorithm has the highest accuracy of 93.17% which means a strong relationship between the features that affect student performance, and will help for predictions of student performance for the next year. Naïve Bayes is better than KNN, which means a strong relationship between the features that affect student performance, and it will help to predict student performance. Sometimes, KNN will be better than Naïve Bayes for other datasets and different IDEs. As future work, more classification algorithms can be applied to different educational data sets.

Text Classification for Student Data Set usingNaive Bayes Classifier and KNN ClassifierRajeswari R.P, Kavitha JulietDr.Aradhana. Theexperiment carriedout shows that Naives Bayes classifier is goodclassifier with accuracy of 66.67 than KNNclassifier with 38.89.Toemphasize on performance and accuracy of theseclassifiers using Rapid miner for Student Data Set.

III. RESEARCH METHODOLOGY

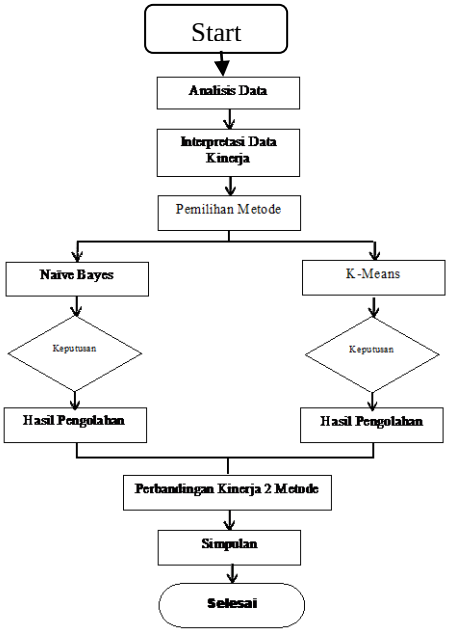

Figure 2. Research Methodology

Preprocessing is one of the important stages for data in the mining process. The data used in the mining process is not always in an ideal condition for processing. Sometimes in the data there are various problems that can interfere with the results of the mining process itself, such as missing values, redundant data, outliers, or data formats that do not match the system.

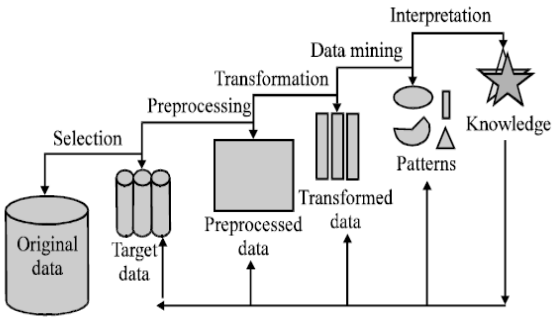

Figure 3. The position of data preprocessing in data mining

The amount of data to be processed is 186 data. In The amount of data to be processed is 186 data. In the data retrieval process on Rapidminer for the Naïve Bayes and K-Nearest Neighbor algorithms directly in csv formatfrom the transformed data. Furthermore, cross validation is carried out for the data that has been taken. K-Fold Cross validation is a statistical method that can be used to evaluate the performance of a classification model where the data is separated into two parts, namely training process data and test data. k-Fold Cross Validation is used because it can reduce computation time while maintaining the accuracy of the estimate. According to (Jiang, Ping., 2017) K-Fold Cross Validation is a type of cross validation test that serves to assess the process performance of an algorithm method by dividing data samples randomly and grouping the data as much as the K k-fold value.

IV. DISCUSSION

A. *Analysis of Data Requirements*

Before carrying out the process of calculating the algorithm, data collection is first carried out. The data used in this study is data for undergraduate students of Industrial Engineering and Electrical Engineering at the Nusantara Lampung High School of Technology class 2017 to 2019. The student data used are 372 student data consisting of 228 Industrial Engineering Bachelors and 144 Electrical Engineering Bachelors. The research taken has an input attribute of semester achievement index (IPS) 1 to 4 and a Grade Point Average (GPA) and the output attribute is Graduation. The research data obtained can be seen in table 1 as follows:

	NIM	Nama Mahasiswa	IPS 1	IPS 2	IPS 3	IPS 4	IPK	Keterangan Lulus/Tidak Lulus
0	17120001	A. FERNANDO SANI	3.11	3.15	2.63	2.20	2.73	Ya
1	17120002	AGUSTIAWAN WIBOWO	2.74	2.55	2.63	2.20	2.59	Ya
2	17120003	AHMAD AL-GHANY	2.53	2.80	3.13	2.35	2.86	Ya
3	17120004	AJI PANGESTU	2.63	2.65	2.50	2.20	2.47	Tidak
4	17120005	ANGGI DWI SAPUTRI	2.53	2.65	2.50	2.20	2.47	Tidak
368	19111038	TANJUL IRAWADI	3.90	3.37	3.00	3.00	3.31	Ya
369	19111039	AGUS SYARIPUDIN	3.10	2.79	2.88	3.00	3.00	Ya
370	19111040	WELY SUSANTO	3.45	3.00	3.00	3.17	3.11	Ya
371	19111025.P	DEBBY FEBRIAN SAPUTRA	3.20	2.89	3.76	3.00	3.31	Ya

372 rows × 8 columns

Table 1 Student Data for S1 Industrial Engineering and S1 Electrical Engineering, Nusantara Technological College Lampung, 2016 to 2019

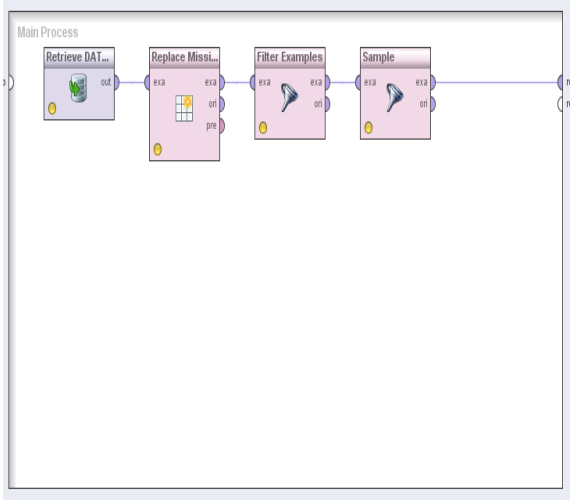

Figure 3. Data preprocessing stage using Rapid Miner 5.3

B. *Data Transformation*

After the data needs analysis process, the next step is to carry out the data transformation process. Based on the data from the 2017 to 2019 batch of the Lampung Nusantara High School of Technology, the data that will be transformed are the Grade Point Average (GPA) and a statement of pass or fail. The data is data that will be used as input attributes that will be used for analysis with the Naïve Bayes Algorithm and k-nearest neighbor. The transformation process is done by making a classification on the input attribute. The classification of input attributes can be seen in table 4.3 as follows:

Table 2. Classification of Student Graduation Predictions

Atribut	Klasifikasi
IPK	< 2,50 (Tidak) > 2,50 (Ya)

C. *Test Results*

Based on 186 student data from the 2017 to 2019 batches that have been tested, the results of the calculation of accuracy and error for each algorithm are obtained. The results of testing each algorithm are known that the performance of the Naïve Bayes Algorithm is better than the K-Nearest Neighbor Algorithm. However, classification accuracy cannot achieve perfect results in the absence of

errors. This is influenced by the amount of test data and training data used from the preprocessing stage. For the nave Bayes algorithm, the accuracy reaches 96.77% which is quite good, this is because of the advantages of the Naive Bayes Algorithm itself, which is capable of classifying even though it has training data that is little for parameter estimation. Meanwhile, the K-Nearest Neighbor Algorithm produces a low 89.25% accuracy, this is because the algorithm is not effective if the amount of training data is small.

K-Nearest Neighbour Algoritma

The amount of data to be processed is 186 data. The data retrieval process in Rapidminer for the K-Nearest Neighbor Algorithm is directly in csv format. The data processing process uses the K-Nearest Neighbor Algorithm as shown below

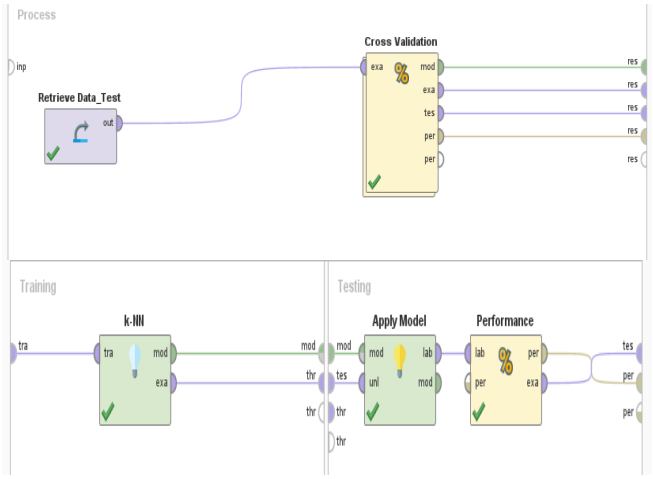

Figure 4. The K-Nearest Neighbor Algorithm data processing process

Nave Bayes Algorithm

In this data processing using the data retrieval process in Rapidminer 9.1 for the Naïve Bayes Algorithm directly in csv format. The data processing process uses the Naïve Bayes Algorithm as shown in Figure 4 below:

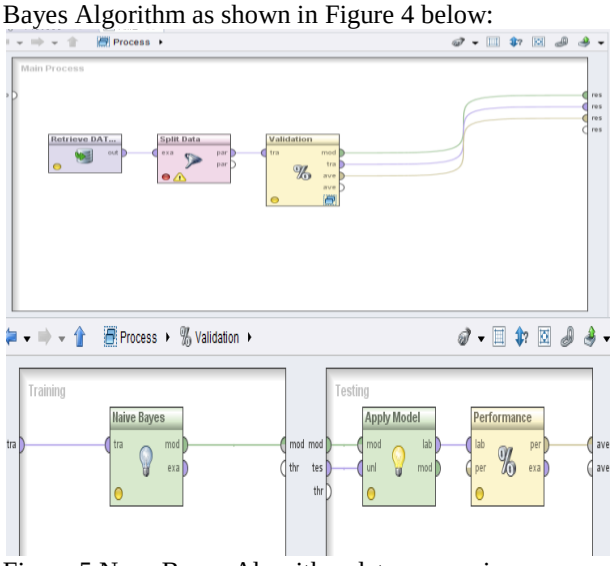

Figure 5 Nave Bayes Algorithm data processing process

V. CLOSING

A. *Conclusion*

At the testing, analysis and design stage of the student graduation rate prediction system using data from students of the Lampung Nusantara High School of Technology class 2017 to 2019 by comparing k-Nearest Neighbors and Naive Bayes, it can be concluded:

1. After applying the Naive Bayes and K-Nearest Neighbor methods to classify the graduation rates of 2017 to 2019 students, it is known that the performance of the Naive Bayes method is superior to the K-Nearest Neighbor method.
2. The results of the comparison of accuracy from the evaluation of the algorithm using metrics Accuracy and 10-fold Cross Validation obtained an accuracy of 89.25% for K-Nearest Neighbor while Naïve Bayes reached 96.77%., in other words the Nave Bayes Algorithm is Better than the Algorithm Naive Bayes.
3. The Naïve Bayes model with 10 fold Cross Validation achieves the highest accuracy compared to the K-Nearest Neighbor algorithm.

B. *Suggestion*

From the results of this study, several suggestions were obtained that could be considered for further research, including:

1. Considerations in further development, it is hoped that it can predict other things, such as the eligibility for scholarships, determining the cost of the Per-Semester Development Unit to the length of the study period that students may take.
2. The feature extraction process can remove unnecessary variables that can affect the accuracy of the training, testing process and the results obtained.
3. The student achievement prediction system can be used for the Nusantara Lampung High School of Technology to predict student graduation rates well.

REFERENCES

[1] Alpaydin, Ethem. 2010. *Introduction to Machine Learning. Second Edition. The MIT Press: Cambridge, Massachusetts*.

[2] Bonaccorso, Giuseppe. 2017. *Machine Learning Algorithm. Packt: Birmingham-Mumbai.*

[3] Budiharto, Widodo. 2016. *Machine Learning & Computational Intelligence*. Penerbit Andi: Yogyakarta.

[4] Cormen, Thomas H. dkk. 2009. *Introduction to Algorithm Third Edition*. The MIT Press: United States of America.

[5] Guido, Sarah. & Andreas C. Muller. 2017. *Introduction to Machine Learning with Python.O'Reilly Media*: United States of America.

[6] Hunt, John. 2019. *A Begineers Guide to Python 3 Programming. Springer*: United Kingdom.

[7]. Hurwitz, Judith. & Daniel Kirsch. 2018. *Machine Learning for Dummies*. IBM Limited Edition: United States of America.

[8] Igual, Laura & Santi Segui. 2017. *Introduction to Data Science*. Springer: Spanyol.

[9] Kataria, Aman. & M. D. Singh. 2013. *A Review of Data Classification Using K-Nearest*

[10] Neighbors Algorithm. International Journal of emerging Technology and Advanced Engineering, Vol. 3, Issue 6, June 2013, 1-7.

[11] Kubat, Miroslav. 2017. *An Introduction to Machiine Learning Second Edition*. Springer: University of Miami, United State of America.

[12] Muhardi & Eka Sabna, 2016. Penerapan Data Mining untuk Memprediksi Prestasi Akademik Mahasiswa Berdasarkan Dosen, Motivasi, Kedisiplinan dan Hasil Belajar. Journal CoreIT. Vol. 2, No. 2, Desember 2016.

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Designing a Lecturer's Performance Data Warehouse Model Using Star Scheme

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***Abstract*— Lecturer performance at Sumatera Institute of Technology is very influential in learning activities. In this situation, a comprehensive control is needed. Further, data of lecturers, research, and so on were massive stored in database due to the number of this institution' lecturers was more than 500 lecturers. Thus, the leader needed a monitoring system to control lecturers' performance in the institution. To solve this problem, it must be something that able to produce information which support monitoring needs.**

Data warehouse is collection databases were stored in a database. It can support the process of making decision based on information was formed from data warehouse. Thus, in this research, warehouse data which contain support information based on tri dharma of university will be formed. Moreover, warehouse data in this research will be formed on 3 schemes. These schemes are Educational Scheme, Research Scheme and Service Scheme will be functionated as data to make leader's monitoring dashboard. *Star Scheme design* was chosen to make these 3 schemes. Those schemes were data basic structures which will be used as a reference for the development of lecturer's performance appraisal data warehouse. Education scheme, Research scheme, and Service scheme were formed from data source which collected from systems. Therefore, these schemes can be used to build a warehouse data in the next research. Star Schema is a model has a small number of tables and clear join path, therefore the query can be done quickly.

Keywords—data warehouse, star scheme design, lecturer performances

I. INTRODUCTION

Education gives knowledge from any fields including technology field. Thus, it is crucial instrument in human' life system. In the crucial needs of education, there were technology universities in Indonesia and Sumatera Institute Technology (ITERA) was one of them which built in 2014 [1].

A huge number of lecturers and college student's effect massive data recorded in ITERA's database system. Thus, data searching and data processing needed a long time.

In addition, data warehouse development is used to process education, research and service data from Sumatera Institute of Technology's system. Therefore, this data warehouse will be a reference and model for lecturer performance measurementIn addition, data warehouse development is used to process education, research and service data from Sumatera Institute of Technology's system. Therefore, this data warehouse will be a reference and model for lecturer performance measurement

Data warehouse formation is the initial stage of initializing the construction of data warehouse. Further, this research used star schema modeling.

II. LITERATURE REVIEW

A. Data Warehouse

Data warehouse is data information collection has *subject-oriented*, *integrated*, *nonvolatile*, and *time-variant* that aim to support the management decision-making process. Mannino found that data warehouse is central data store from basic data operation and others which were integrated, cleaned, and archived to support decision-making. While McLeod said, data warehouse is a large capacity storage system. In this case, data was collected by adding new record rather than updating existing records with new information [2]. In addition, Poniah (2001) found that data warehouse is not a product but an environment which user able to find strategic information in. Data warehouse is a summary and it is a logic data collection that was separated from operational database. Further, Ferdiana (2008) stated that data warehouse is a concept and technology combination facilitated organization to process and look after history data which collected from system of operational application [3]. This kind of data was only used for making decision process rather than company daily operational activities.

Physically, data warehouse is a database. However, in traditional database design using normalization but in data warehouse normalization is not the best way. Data warehouse is storage based on subject but application. While subject is a part of a company. For example, subject of Manufacture Company is a sale, consumer, inventory and other subjects. While operational database was database used in system.

The choice of star scheme in this research is based on the need for fast data to be presented as a monitoring system. The star schema has a small number of tables and a clear join path, able to support data needs with faster queries, fast loading, and good data consistency.

B. Design Schema

Forming database model is on of data warehouse steps which will be used as basic database scheme. User's needs and data effected data warehouse dimensional design. Dimensional model should be designed as user's need and able to survive and adapt from any changes well. Further, the outcome of this model must to be relational database which support OLAP cubes to serve query instant result to analyze:

1. Dimension Tables describe the business entity of an enterprise. Dimension tables generally contain descriptive data, where the data rarely changes.
2. Fact Tables is a table that describes the business transactions of an enterprise is usually called a detail table[4]. Fact tables generally contain data that is directly related to the business process.
3. Dimensional Model Scheme The following are some of the schemas commonly used to design a data warehouse:
   a) Star schema, if all dimension tables are linked directly to the fact table and one fact table must have a relationship with at least one dimension table.
   b) Snowflake schema, if one or more-dimension tables are not directly related to the fact table but must be related through another dimension table.
   c) Constellation schema, if one dimension table is shared by one or more fact tables.

C. Star Schema

A star schema is composed of one or more central fact tables, a set of dimension tables, and the joins that relate the dimension tables to the fact tables. This section describes these components and outlines some of the decisions you need to make before designing a decision-support schema [10].

A Star Schema consist of a table relationship between fact table and a dimension table. There is one fact table and is in the middle between dimension tables, the dimension table will relate to the fact table so it call as Star Schema because it is look like star.

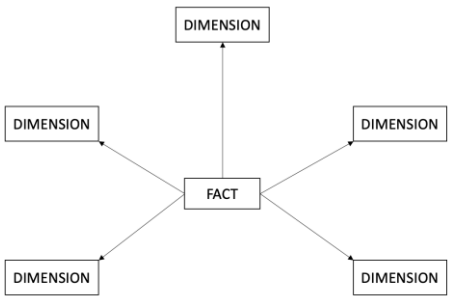

Figure 1. Star Schema

Research previously with title "Research on Extract, Transform and Load (ETL) in Land and Resource Star Schema Data Warehouse" [2]

III. Research Methodology

In this study using a development methodology with several stages.

A. Determining the Subject of the Data Warehouse

In determining the subject of the data warehouse. The main subject in this research is to produce data on education, research, and service.

B. Determining the Data Source

This is the stage of collecting the required data. And determine where the data source will be taken from.

C. Modeling

This is the final stage in this research, which is to form a model in the form of a star schema based on the data sources that have been collected.

Figure 2. Diagram of staging star schema

IV. Implementation

The subject of this research is to build a data warehouse model to be able to produce information about lecturer performance, later. In this case, it refers to three main schemes, namely education, research, and service schemes.

A. Determinatio*n of Data Sources*

The data sources that will be used in the three aforementioned schemes come from various sources that are already available in the institutional database.

1. Education *Data Sources*
   To form educational data, data is needed from the personnel database, the academic database, and the department database.
2. Research *Data Sources*
   To form research data required data from the staffing database, lecturer's workload database, research database.
3. Dedication/Service Data Sources
   To form service data, data is needed from the staffing database, lecturer workload database, community service database

The database that has been mentioned for each data source requirement comes from the existing system in the institution.

a) Staffing Database
b) Siakad *Database*
c) Department Database
d) Lecturer's Workload Database
e) Research Database
f) Public Service Database

B. Star Schema

This stage is the design stage which is the final stage in this research, namely doing data warehouse modeling. Creating a data model as a place to store data that has been

transformed, this refers to the data source that has been provided. The model used is the Star Schema.

1. Education Scheme Model

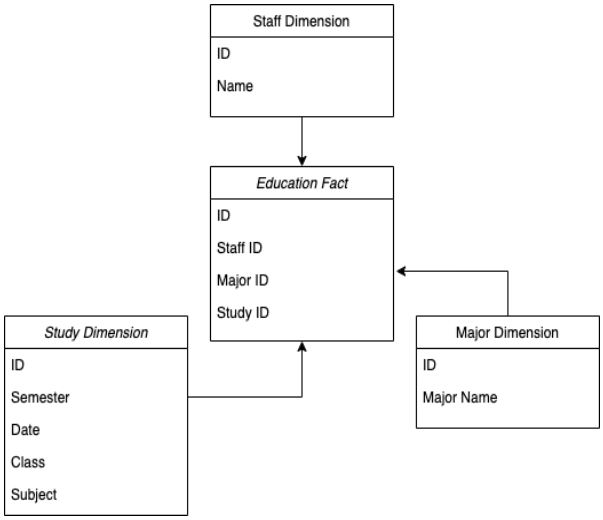

Figure 3 Education Scheme

2. Research Scheme Model

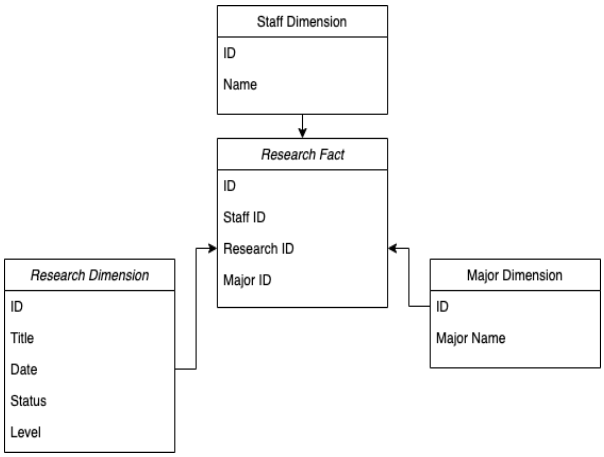

Figure 4 Research Scheme

3. Service Scheme Model

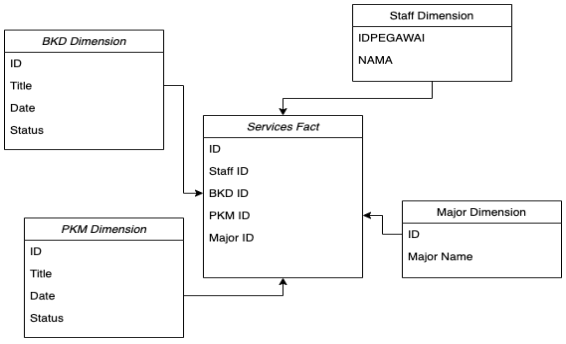

Figure 5 Service Scheme

C. Results

The purpose of this research is to create a model in the form of a star schema that can be used for data warehouse development in the subject of lecturer performances.
Based on the three schemas that have been formed in the star schema model, three fact tables are obtained, namely: the education fact table, the research fact table, and the services fact table. These three schemas will be used as a reference for making the data warehouse structure. As a data repository that can produce accurate information about lecturer performance.

1. Education Fact Table

Table 1 Education Fact Table

No	Field
1	ID
2	Staff ID
3	Major ID
4	Study ID

Based on table above, some information will be formed that can be processed:

- Staff ID
  This field will generate staff data, which will be used as identity data.

- Major ID
  This field will generate major study of the identity owners.

- Study ID
  This field will generate all of lecture data. For example, class, study, semester, etc.

2. Research Fact Table

Table 2 Research Fact Table

No	Field
1	ID
2	Staff ID
3	Major ID
4	Research ID

Based on table above, some information will be formed that can be processed:

- Staff ID
  This field will generate staff data, which will be used as identity data.

- Major ID
  This field will generate major study of the identity owners.

- Research ID
  This field will generate research data. For example, title, date, status, and level.

3. Service Fact Table

Table 3 Service Fact Table

No	Field
1	Staff ID
2	Major ID
3	BKD ID
4	PKM ID

Based on table above, some information will be formed that can be processed:

- Staff ID
  This field will generate staff data, which will be used as identity data.

- Major ID
  This field will generate major study of the identity owners.

- BKD ID
  BKD is a data source of the lecturer workload system. Will generate service data. For example, title, date, and status.

- PKM ID
  PKM is a data source that comes from the community service system. Will generate service data. For example, title, date, and status.

FUTURE WORKS

This research focuses on the formation of a complete model to meet the needs of the formation of lecturer performance analysis. In future research, the model data generated in this study can be used. By going through the data warehouse development process using the model mentioned above.

REFERENCES

[1] Chandra, A. (2010). Perancangan Data Warehouse pada Software Laboratory Center. *Comtech*, Vol. 1, No. 2, hlm. 589.

[2] Hanlin Qin, Xianzhen Jin, Xianrong Zhang,. "Research on Extract, Transform and Load(ETL) in Land and Resource Star Schema Data Warehouse" 2012 Fifth International Symposium on Computational Intelligence and Design., doi: 10.1109/ISCID.2012.38.

[3] ITERA, "Tentang Institut Teknologi Sumatera," [Online]. Available: www.itera.ac.id.

[4] Khusnul Khotimah and Sriyanto, Perancangan Dan Implementasi Data Warehouse Untuk Mendukung Sistem Akademik (Studi Kasus Pada STKIP Muhammadiyah Kotabumi), Jurnal TIM Darmajaya, Vol. 02, No. 01, pp. 95, 2016..

[5] Kimball, Ralph and Ross, Margy. 2002. The Data Warehouse Toolkit Second Edition. John Wiley and Sons, Inc.

[6] Kurniawan, N. B. Desain Dan Implementasi Data Warehouse Studi Kasus Pemetaan Daerah Rawan Bencana Provinsi Sumatera Barat. *Tesis Program Studi Pascasarjana Informatika Sekolah Teknik Elektro dan Infromasi (STEI) Institut Teknologi Bandung*, pp. 6, 2011.

[7] Masdiana Sagala, Implementasi Data Warehouse Pada Perpustakaan Universitas Katolik Santo Thomas, Jurnal Teknik Informatika Unika St. Thomas (JTIUST), Vol. 03, No. 01, pp. 34, 2018.

[8] Microsoft, "Star Schema" [Online]. Available: https://docs.microsoft.com/en-us/power-bi/guidance/star-schema

[9] Nolan, S. A. Microsoft SQL Server 7.0 Data Warehousing Training Kit. . USA : Microsoft Prees. 2000.

[10] Oracle, "Understanding Star Schemas" [Online]. Available: http://gkmc.utah.edu/ebis_class/2003s/Oracle/DMB26/A73318/schemas.htm

[11] P. Ponniah, Data Warehousing Fundamentals. A Comprehensif Guide For IT Professionals, John Wiley & Sons, Inc., 2001

[12] Ramanti Dharayani, K. A. Implementasi ETL (Extract, Transform, Load) Pangkalan Data Perguruan Tinggi dengan Menggunakan State-Space Problem. *e-Proceeding of Engineering*, Vol. 2, No. 1, pp. 1160, 2015.

[13] Rainardi V. 2010. "Building a Data warehouse With Examples in SQL Server". New York. Apress.

[14] M. Zhu, S. C. Herring, and C. J. Bonk, "Exploring presence in online learning through three forms of computer-mediated discourse analysis," *Distance Educ.*, vol. 40, no. 2, pp. 205–225, 2019, doi: 10.1080/01587919.2019.160036

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Twitter Sentiment Analysis on The use of Sinovac Vaccine in Indonesia

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***Abstract*— Coronavirus Diseases (Covid-19) was reported the first time in Wuhan, Hubeu Province, China 2019. On March 11th 2021 World Health Organization (WHO) declared covid-19 as a world pandemic. To reduce the number of deaths and the number of the transmission of covid-19 is by the vaccination. Several vaccines have been evaluated by WHO to against covid-19, Indonesian Government officially announced the use of Sinovac Vaccine produced by Sinovac Life Science Co, China. This vaccination topic becomes one of the massive topics discussed by the Indonesian people and various responses on social media such as Twitter. The technique used, is crawling tweets from Twitter users worldwide using the English language from May 24th 2021 – August 31st 2021 with the keyword "sinovac vaccine". This study aims to analyze public sentiment regarding the usage of sinovac vaccine in Indonesia. The method used is Naïve Bayes because it has a simple algorithm with high accuracy. The result shows the classification accuracy rate is 80.99% and majorities' responds are neutral and positive. However, the preprocessing data has the rule to get excellent result for the accuracy. Future study can also classify the tweets into different queries and other classification methods can be applied such as Super Vector Machine and KNN.**

Keywords*— *Covid-19, Sinovac Vaccine, Sentiment Analysis, Naïve Bayes

I. INTRODUCTION

Coronavirus Diseases (Covid-19) was reported the first time in Wuhan, Hubeu Province, China 2019. On March 2nd 2021 Indonesian Government announced have found the first two cases of covid-19 in Indonesia and on March 11th 2021 World Health Organization (WHO) declared covid-19 as a world pandemic[1].

To reduce the number of deaths and the number of the transmission of covid-19 is by the vaccination. Researchers around the globe have developed vaccines to overcome the situation. There are several vaccines have been evaluated by WHO to against covid-19, these include AstraZeneca/Oxford vaccine, Johnson and Johnson, Moderna, Pfizer/Biotech, Sinoparm, and Sinovac[2]. From the various types of covid-19 vaccines, Indonesian Government officially announced use Sinovac Vaccine produced by Sinovac Life Science Co, China[3]. Sinovac Vaccine have been passing the evaluation for the clinical trials and the level of effectiveness. In Indonesia reaches 65.3% of effectiveness[4], in Brazil reaches 50% of effectiveness and in Turkey reaches 83.5 of effectiveness. And the target for the vaccination in Indonesia is 208.382.680[5].

However, this vaccination topic becomes one of the massive topic discussed by the Indonesian people and rise the series of the questions on social media such as Twitter and most of the people discussed about the safety of the vaccine process. There are currently 206 million active Twitter users worldwide and Indonesia entered in to the 6th position with 15.7 million users[6].

Sentiment Analysis is one of the part of machine learning domain. This studies that analyze the opinions, sentiments, attitudes, research, and emotions from the public point of view toward the public services, problems, or to any massive issues or topics.

It is interesting to know how the world community responds and given their opinions and perspectives toward the vaccination process for sinovac vaccine on social media. Thus, the response will be divided into two group of sentiment: sentiment positive, sentiment negative, and sentiment netral. The data source in this study were taken from tweets user worldwide written in English with the keyword "Sinovac Vaccine" using the crawling technique using Twitter API in the range of May 24th 2021 – August 31st 2021. The result contributes to the government or any stake holder that related to this topic.

The next section covers the related work done on sentiment analysis, while chapter three explains the research methodology. Next, the segment four will describe the result and discussion.

II. LITERATURE STUDYS

A. Sentiment Analysis

Sentiment analysis is known as opinion mining, which is a process of understanding, extracting, and processing textual data automatically to obtain sentiment information in a sentence. In texts, sentences, and messages, the fundamental

concept of sentiment analysis is to detect text polarity. In this sentiment analysis is use the TextBlob as can see on fig.3.

TextBlob is python library for Natural Language Processing (NLP)[7]. TextBlob has semantics labels that help with fine-grained analysis. Higher subjectivity means that the text contains personal opinion rather than factual information. TextBlob calculates subjectivity by looking at intensity, which the intensity determines whether a word modifies another word.

Preprocessing is to minimize the vocabulary of words contained in the text message. Below is the pre-processing task that used in this research[8].

1) Case folding: changing all the character on dataset to lowercase. The purposes of case folding are to make the same letterform.
2) Document filtering: removes the special characters and symbols, punctuation marks, urls address, and usernames.
3) Tokenizing: separates words in each sentence into the separate words.
4) Stopword removal: remove the unimportant words or have no meaning such is the conjunctions or the prepositions.
5) Stemming: transforms a word into a root of word.

In this study, the sentiment divided into three classes, sentiment positive, sentiment negative, and sentiment neutral. Thus, this study uses Naïve Bayes (NB) algorithm. Naïve Bayes methods are a set of supervised learning algorithm based on applying Bayes' theorem with the Naïve assumption of independence between every pair of features. Below is the Bayes theorem.

$$P(A|B) = \frac{P(B|A)P(A)}{P(B)}$$

Where:

TABEL 1 BAYES THEOREM

P(A)	:	The prior probability of belonging to class i
P(B)	:	Normalizing constant, or probability of seeing the given input vector over all possible inputs vectors
P(B|A)	:	The conditional probability of seeing input vector B given we know the class is A

B. *Related Study*

Several previous studies of sentiment analysis in Indonesia regarding the vaccination have done reviewed. These include how the Indonesian people given their reaction on facebook page that own by the Ministry of Health[9], in this research found that the Indonesian citizen given their negative opinion through the process of the vaccination in Indonesia. Analyzing the public opinion regarding the covid-19[10] and the result shown that the community had the positive reaction during the covid-19 pandemic, public opinion on online learning during the pandemic in Indonesia[11] and the result is most the community given their negative opinion on that.

The researchers on these research are using the machine learning algorithm Naïve Bayes to analysis the sentiment.

III. METHODOLOGY

This study uses the python as the programming language with the several libraries such as Tweepy and TextBlob and rapidminer. There are six steps in this study: 1). Data preparation including the crawling and labelling, 2). Pre-processing including case folding, filtering, tokenizing, stopword removal, and stemming, 3). Feature selection, 4). Modeling, 5). Label prediction, and 6). Result including the analyzing and result. As can be seen in fig. 1.

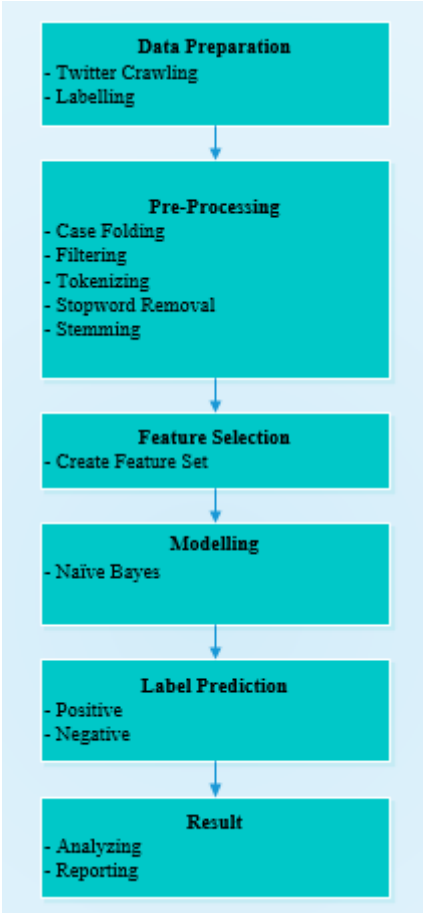

Fig. 1 Research Methodology

A. *Data Preparation*

The key word for crawling data on Twitter is "Sinovac vaccine" with the tweets written in English using English language. In this study there are fourth variables that were retrieved: "date" where the user posts the tweets, "user" means username that posts the tweets, "tweet" mean the tweet or opinion that posted by the Twitter users, and "sentiment". Search tweet API, Tweepy, and TextBlob are libraries that are used in python for crawling data from May 24th 2021 – to August 31st 2021. As can be seen in fig. 2.

```
import tweepy
import re
from textblob import TextBlob
import numpy as np
```

```
[ ]  api_key = "zCbw9hBTSAG3nlW1oNFN0aoS4"
     api_secret_key = "yveQJ2P9Cf90LV1hbvYFPFANFp8KcvJaKgfCRSTIyRnNLTpgWK"
     access_token = "180278318-IOPrftLCRztWf1d2o36m3nZR8noLugVNd4pp97tD"
     access_token_secret = "jDk1xpW9dyKsHWHyqnyO0jDh6QgoA1yd4kw7fxDbdVMmy"
```

```
[ ]  auth = tweepy.OAuthHandler(api_key, api_secret_key)
     auth.set_access_token(access_token, access_token_secret)
     api = tweepy.API(auth)
```

Fig. 2 Crawling with API Key

From crawling data on May to August 2021, there are 78.145 rows raw tweets from users worldwide with three group polarity; positive, negative, and neutral. As mentioned in the previous stage, the polarity for each tweets above had been classifying by TextBlob. On this raw tweets have a lots of noise such as the url link, emoji's, and special character, as can see in table 1.

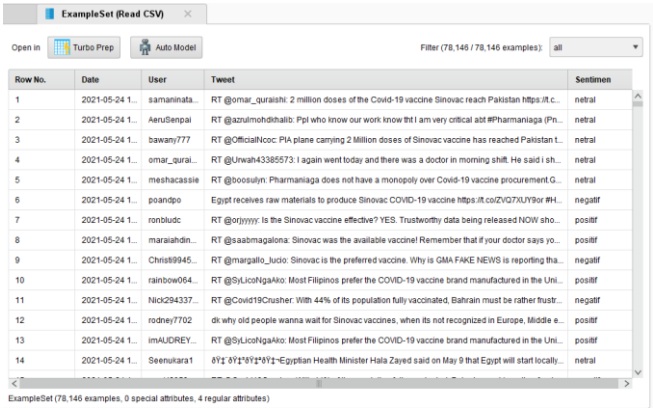

Fig. 3 Raw Tweets

Thus, the next step is pre-processing to get the clean dataset.

B. *Pre-Processing*

- Case folding: in this study all the tweets changing to the lowercase.
- Document filtering: all the special character, has tag, url address, etc are removed.
- Tokenizing: chopping the text or into the words.
- Stopword: the irrelevant words are removed.
- Stemming: converting the words into the root words.

After the pre-processing process using Rapidminer has been done, there are 41.605 rows clean tweets. As can see in fig. 3.

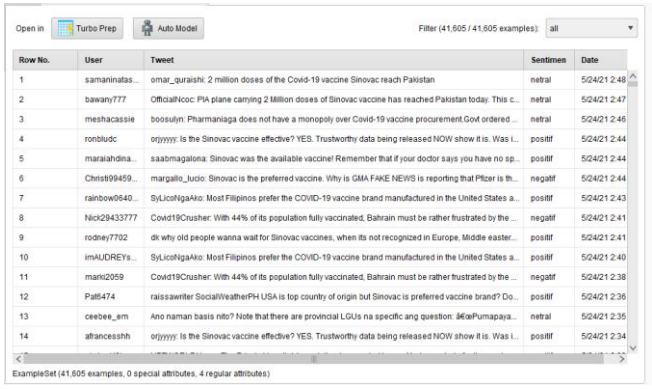

Fig. 4 Clean tweets

Most of the polarity for clean tweets are neutral, positive, and negative as can see in fig. 4.

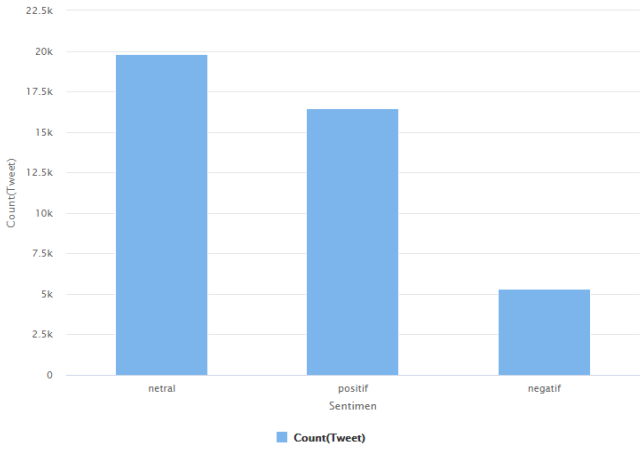

Fig. 5 Visualization Tweets Polarity

C. *Feature Section*

After getting the result in pre-processing data, there are 16.461 tweets for positive tweets, 5.313 tweets for negative tweets, and 19.831 tweets for neutral tweets. As can be found in table 2.

TABEL 2 CLEAN TWEET

Clean tweets	**41.605 tweets**
Neutral	19.831 tweets
Positive	16.461 tweets
Negative	5.313 tweets

D. *Modeling*

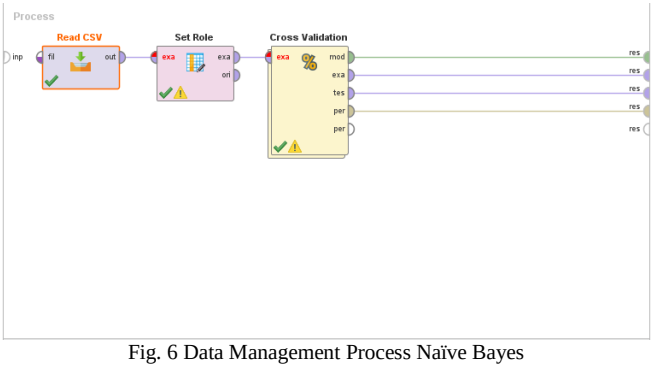

Fig. 6 Data Management Process Naïve Bayes

To build the modelling management using Naïve Bayes algorithm, is using the Rapidminer. As can see in fig. 6 and fig 7. The dataset is divided into two, namely training data and testing data which are automatically done by the Cross Validation on fig. 6. Cross-validation method is used to avoid overlapping in testing data and the performance is for performance evaluation on classification task.

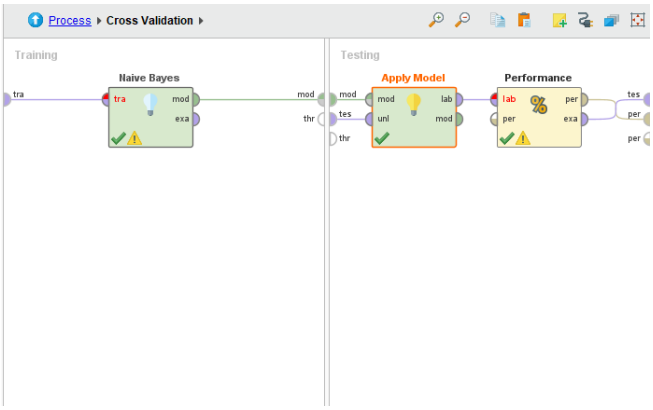

Fig. 7 Data Management Process Using Naïve Bayes

The accuracy result for Naïve Bayes algorithm as can see bellow in fig. 8.

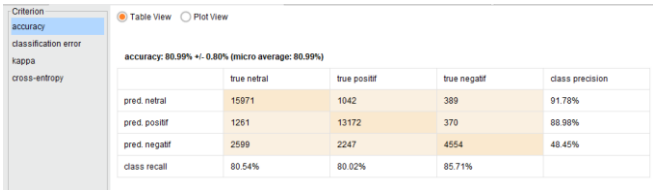

Fig. 8 Naïve Bayes Accuracy

E. Label Prediction

From the previous stage, as explained in fig. 8, the accuracy for the sentiments label is 80,99% as shown in next stage.

IV. RESULT AND DISCUSSSION

The result shows the accuracy using Naïve Bayes algorithm with rapidminer is 80, 99% with three polarities: positive, negative, and neutral. Due to the public awareness about the vaccination against the covid-19, most of the community worldwide has given neutral and positive reaction.

Thus, the writing style and the structure of the language posted on Twitter by user's also huge challenges for sentiment analysis process in this study. Especially on pre-processing process with the huge of dataset text.

V. CONCLUSION AND RECOMMENDATION

This study aimed to analyzed sentiments on the use of Sinovac Vaccine in Indonesia according to positive, negative, and neutral polarities on social media Twitter. Based on the results, the accuracy using Naïve Bayes algorithm is 80,99% and majorities responds are neutral and positive. However, public awareness to get the vaccine against the covid-19 has the main role in this period.

Future study can also classify the tweets into different queries and other classification methods can be applied such as Super Vector Machine and KNN.

REFERENCES

[1] "Listings of WHO's response to COVID-19." https://www.who.int/news/item/29-06-2020-covidtimeline (accessed Nov. 03, 2021).

[2] "COVID-19 Vaccines Advice." https://www.who.int/emergencies/diseases/novel-coronavirus-2019/covid-19-vaccines/advice (accessed Nov. 02, 2021).

[3] "Consulate General of The Republic of Indonesia In Chicago, THE UNITED STATES OF AMERICA," *Kementerian Luar Negeri Repulik Indonesia*. https://kemlu.go.id/chicago/en (accessed Nov. 03, 2021).

[4] "BPOM Issues EUA for Sinovac COVID-19 Vaccine," *Sekretariat Kabinet Republik Indonesia*, Jan. 11, 2021. https://setkab.go.id/en/bpom-issues-eua-for-sinovac-covid-19-vaccine/ (accessed Nov. 03, 2021).

[5] S. Moutinho, "Chinese COVID-19 vaccine maintains protection in variant-plagued Brazil," 2021, doi: 10.1126/SCIENCE.ABI9414.

[6] "Twitter: most users by country," *Statista*. https://www.statista.com/statistics/242606/number-of-active-twitter-users-in-selected-countries/ (accessed Nov. 02, 2021).

[7] "TextBlob: Simplified Text Processing — TextBlob 0.16.0 documentation." https://textblob.readthedocs.io/en/dev/ (accessed Nov. 10, 2021).

[8] D. A. Nurdeni, I. Budi, and A. B. Santoso, "Sentiment Analysis on Covid19 Vaccines in Indonesia: From The Perspective of Sinovac and Pfizer," in *2021 3rd East Indonesia Conference on Computer and Information Technology (EIConCIT)*, Apr. 2021, pp. 122–127. doi: 10.1109/EIConCIT50028.2021.9431852.

[9] A. Harun and D. P. Ananda, "Analysis of Public Opinion Sentiment About Covid-19 Vaccination in Indonesia Using Naïve Bayes and Decission Tree," vol. 1, p. 6, 2021.

[10] M. Syarifuddin, "ANALISIS SENTIMEN OPINI PUBLIK MENGENAI COVID-19 PADA TWITTER MENGGUNAKAN METODE NAÏVE BAYES DAN KNN," vol. 15, no. 1, p. 6, 2020.

[11] U. Verawardina, F. Edi, and R. Watrianthos, "Analisis Sentimen Pembelajaran Daring Pada Twitter di Masa Pandemi COVID-19 Menggunakan Metode Naïve Bayes," vol. 5, p. 7, 2021.

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INTERNET OF THINGS (IoT): DESIGN AND BUILD MICRO CLIMATE SYSTEM CONTROL IN GREENHOUSE

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***Abstract*- Conventional *greenhouse* technology has been replaced by the development of *Smart Farming*. In green house that use *smart farming* technology, there is monitoring and control system. The measurable growth factors for *tomato* are temperature, room humidity and soil moisture. Regional characteristics and climate factors are often unpredictable and cause these factors to inhibit the growth of tomato. In this system, it is made by *monitoring* and *controlling* room temperature, soil moisture according to the needs of tomato. In this system, to detect temperature and soil moisture, the DHT11 sensor is used, while the soil moisture sensor is used to detect soil moisture. NodeMCU ESP8266 acts as the main brain or microcontroller in the Micro Climate System. This monitoring system can measure temperature, room humidity and soil moisture levels, and can control the system to match the appropriate parameters.**

***Keywords*- Internet of Things, tomato, Smart farming, Greenhouse, Controlling, Monitoring.**

I. INTRODUCTION

Indonesia has horticultural commodities which are seen as a source of new growth in the agricultural sector, because they have high market potential. Along with the increase in Indonesia's population, public demand for horticultural products in the country is expected to increase. Horticultural commodities consist of vegetables, ornamental plants and medicinal plants and fruits, these four parameters have an important role in fulfilling community nutrition and economic potential in Indonesia[1]. According to the Ministry of Agriculture, the demand for vegetables and fruits is very high, the horticulture sub-sector grew 7.85 percent in the fourth quarter of 2020 in Indonesia[2]. The large appleimport of horticultural products, especially fresh fruit, shows that domestic production has not been able to contribute to meeting their needs. To encourage the increase in domestic fruit production and quality, over the last few years the Directorate General of Horticultural Production has launched a program to establish production center areas and increase crop production in Indonesia by utilizing technology that can overcome the problems of crop production in Indonesia. Only by producing high-quality fruit in sufficient quantities can Indonesia stem the entry of imported fruit. Tomatos as one of the fruits that are dependent on imports are the most needed commodities by the community, this can be seen from the high import value of tomatos compared to other imported fruits. In increasing the production of tomatos, it cannot be applied in any area because each area has different land characteristics[3]. One way to determine a suitable location for the development of tomato is to pay attention to the agro-climatic parameters, namely climatic factors which include air temperature, air humidity and soil moisture [4]. These three factors greatly determine the growth, development, and production of plants because the tomato fruit plant. With the rapid development of technology, Indonesia is forced to follow these developments in the agricultural sector, one of which is by following the sophistication of Internet of Things (IoT) technology. The development of agricultural systems to be automated and connected to the internet can be called the Smart Farming system[5]. To overcome the above problems, an innovation is needed that aims to help increase the production of tomatos to be much easier, economical (cost-effective), minimize labor costs and increase crop yields and provide better production, by using a Smart Farming system that can see from 3 parameters, namely controlling and monitoring air temperature, air humidity and soil moisture[6]. then formed the system "Micro Climate System (MIS)". Where the system will be built based on a website and able to make the stability

of air temperature, air humidity, and soil moisture more monitored and controlled.

II. METHOD

A. Diagram of System

From the accompanying image the input grooves are temperature sensors and air moisture (DHT11), soil - moisture sensors. The complete sequence of processes in the system of processing data that are read by sensors which microcontroller esp8266 as both control and client and initially enabled will seek wi-fi connections. Nodemcu will send the value of air temperature, air humidity, and soil humidity to the server so it will be shown on web in real time. At the output or output contains lights for lighting and heating, fans for air circulation, water pumps for watering plants, and LCD as an indicator viewer on the device. can be seen in Figure 1.

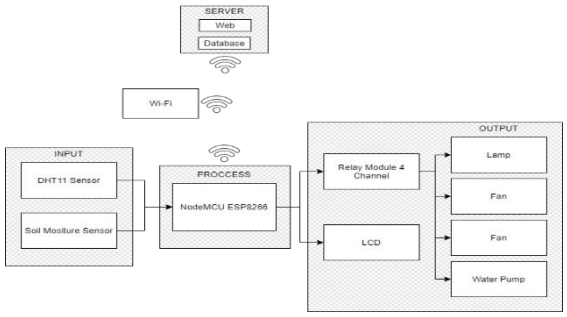

Figure 1. Microclimate System Hardware Design

The operating system of the entire set above is that the device has web control input and monitors accessible on smartphones, computer personnel and devices that support the web browsers. Web controls and monitors will be used if nodemcu is online and then nodemcu can be used as a relay control that is used to power lights, water pumps, and fans. DHT11 sensors are used to measure air temperature and air humidity on smart green house while soil levels are used to measure soil humidity on smart green house in which both sensors can be monitored in real time on the website.

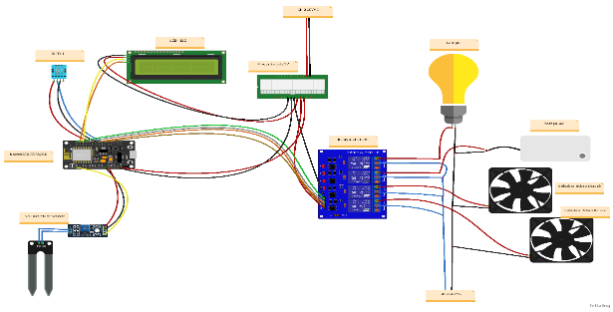

Figure 2. Micro climate System Circuit

B. Principles and System Work

The DHT11 sensor circuit is used to measure air temperature and humidity where the sensor measurement results will be processed by the NodeMCU so that it will be displayed on a web page in real time. The image of the DHT11 sensor circuit and its layout can be seen in the following figure 3.

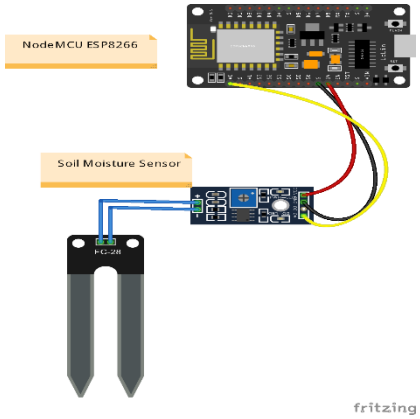

Figure 3. Soil Moisture Sensor Diagram

In the DHT11 sensor circuit the VCC pin (red wire) is connected to the power pin (3v), the GND pin (black wire) is connected to the DHT11 pin, the DATA pin (blue wire) is connected to the D6 pin on the NodeMCU.

the output of the soil moisture sensor changes its value from 0-1023. so that it can be converted to a percentage, you can use the following equation:

Soil_Moisture=(100-(ADC value/1023) x 100)

The Soil Moisture Sensor circuit is used to measure soil moisture where the sensor measurement results will be processed by the NodeMCU so that it will be displayed on a web page in real time. The image of the soil moisture sensor circuit and its layout can be seen in the following figure.

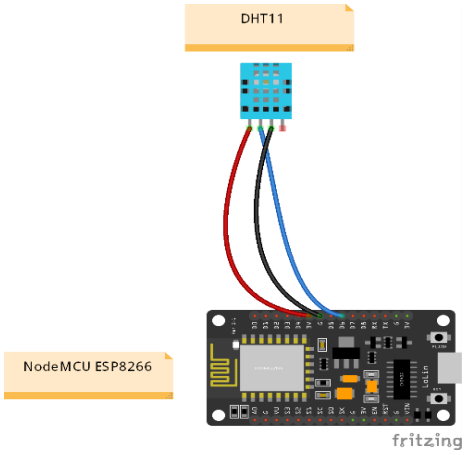

Figure 4. DHT11 Sensor Diagram

In the soil moisture sensor circuit the VCC pin (red wire) is connected to the power pin (3v), the GND pin (black wire) is connected to the soil moisture sensor pin, the DATA pin (yellow wire) is connected to pin A0 on the NodeMCU. This is because the data to be taken on the soil moisture sensor is analog.

Users can control and monitor from afar using the website as in Figure 5. There are three options on the controller's menu with two on/off switches that are used to control lights, water pumps and fans. The monitoring menu has three measured parameters of air temperature, room humidity and soil humidity. To get a good measurement, the calibration of the sensor can be done first.

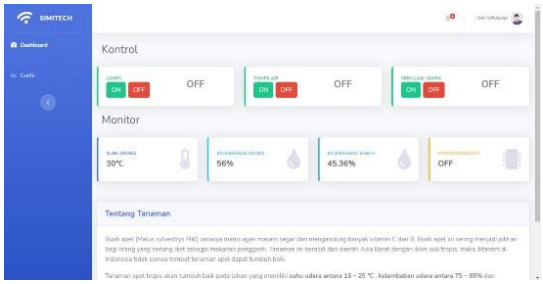

Figure 5. website desktop display

C. System Control Algorithm Design

From Figure 6 above, it is explained that the process flow starts from the initialization of the microcontroller with Wifi, if the on button is pressed then the lights, water pump (nozzle), water pump (drip hose), and fan will turn on by displaying the status on the ON status web page, if the off button is pressed then the lights, water pump and fan will turn off by displaying the status on the OFF status web page.

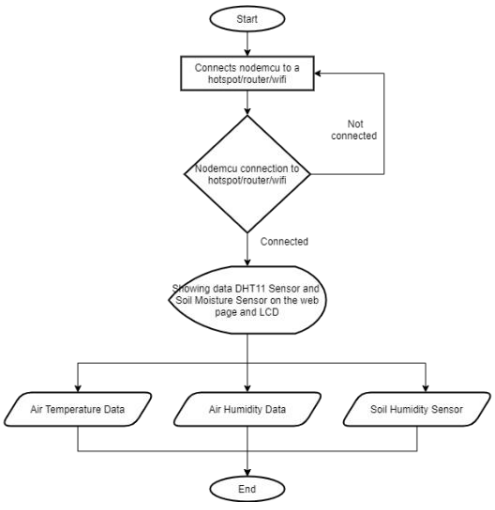

Figure 6. flowchart controlling of system

From Figure 7 above, it is explained that the process flow starts from the initialization of the microcontroller with Wifi and then displays the DHT11 sensor data and the Soil Moisture Sensor in the form of room temperature data, room humidity, and safe soil moisture. This data is displayed on the website and LCD.

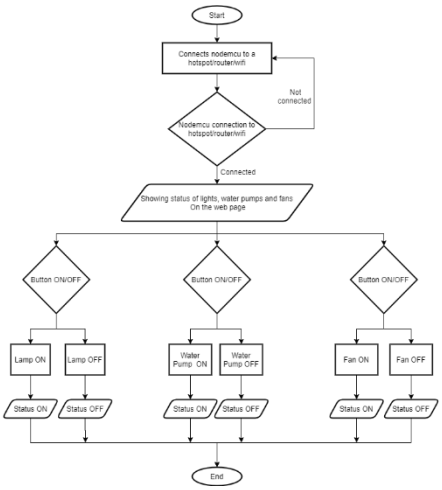

Figure 7. Flowchart Monitoring of System

III. RESULT AND ANALYSIS

A. Application Testing

These tests are performed to test and know that the created applications can be connected and run properly. This tests were performed by sending commands through the smart green house application with the push of the button on the application intelligence on websites that contain commands to turn on or off electrical appliances. In this test the smart green house android app provided some guidance to link into the system. The following guidelines including:

1. Press the keys-to connect the application to the system.
2. Press the button-disconnect button for applications with systems
3. Press the button ON "lamp" - to turn the light on.
4. Press the button OFF "lamp" - to turn the light off.
5. Press the button ON "water pump" - to turn the water pump on .
6. Press the button OFF "water pump" - to turn the water pump off.
7. Press the button ON "fan" - to turn the fan on .
8. Press the button OFF "fan" - to turn the fan off.

If a user immediately presses the button to turn on or off an electrical device without pressing connect the first button, then the notice will appear.

B. Testing Tool

To get accurancy of monitoring and controlling home electronic equipment with feedback form controlled devices via sensors that produce status on website as a sign, displayed in the form of measurement tables as follows

Table 1 accuracy of monitoring and controlling

No	Controlling	Time Feedback(second)	Monitoring
1	Button Lamp on	5	Lamp on
2	Button Fan 1 on	5	Fan 1 on
3	Button Fan 2 off	5	Fan 2 off
4	Button Pump on	5	Pump on

$$\text{Time average feedback}=\frac{(5+5+5+5)}{4}$$

Time average feedback = 5 second

IV. CONCULSION

The control system design works according to orders given through the Internet using websites. Able systems control the three electrical appliances that are the lights, the water pump and the fan. System testing may work just fine, command to turn on or off electrical appliances goes on in just a few seconds and feedback from the system to the status of the website is Life or death goes well for 5 seconds.

REFERENCES

[1] M. Ryu, J. Yun, T. Miao, I. Y. Ahn, S. C. Choi, and J. Kim, "Design and implementation of a connected farm for smart farming system," *2015 IEEE SENSORS - Proc.*, pp. 1–4, 2015, doi: 10.1109/ICSENS.2015.7370624.

[2] A. Walter, R. Finger, R. Huber, and N. Buchmann, "Smart farming is key to developing sustainable agriculture," *Proc. Natl. Acad. Sci. U. S. A.*, vol. 114, no. 24, pp. 6148–6150, 2017, doi: 10.1073/pnas.1707462114.

[3] S. R. Rupanagudi, B. S. Ranjani, P. Nagaraj, V. G. Bhat, and G. Thippeswamy, "A novel cloud computing based smart farming system for early detection of borer insects in tomatoes," *Proc. - 2015 Int. Conf. Commun. Inf. Comput. Technol. ICCICT 2015*, 2015, doi: 10.1109/ICCICT.2015.7045722.

[4] D. P. Rubanga, K. Hatanaka, and S. Shimada, "Development of a simplified smart agriculture system for small-scale greenhouse farming," *Sensors Mater.*, vol. 31, no. 3, pp. 831–843, 2019, doi: 10.18494/SAM.2019.2154.

[5] R. Dagar, S. Som, and S. K. Khatri, "Smart Farming - IoT in Agriculture," *Proc. Int. Conf. Inven. Res. Comput. Appl. ICIRCA 2018*, no. Icirca, pp. 1052–1056, 2018, doi: 10.1109/ICIRCA.2018.8597264.

[6] M. S. Farooq, S. Riaz, A. Abid, K. Abid, and M. A. Naeem, "A Survey on the Role of IoT in Agriculture for the Implementation of Smart Farming," *IEEE Access*, vol. 7, pp. 156237–156271, 2019, doi: 10.1109/ACCESS.2019.2949703.

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Evaluation of Metro City Government Website Using WEBUSE Method

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***ABSTRACT*—Metro City is one of the Madya Cities in Lampung Province which has the goal of "The Realization of an Educated, Healthy, Prosperous and Cultured Metro City". To balance this goal, a facility is needed which is expected to help the community and the government to be able to find and provide information easily and clearly. Metro City has tried to build a forum so that its people can get information easily and clearly, as evidenced by the existence of a metrokota.go.id page. However, the problem is that many people in Metro City and its surroundings do not yet know the benefits or functions of the website. This is evidenced by the data of respondents filling out the questionnaire from the percentage of 100% who are natives of Metro City, only 26.8%. So with this basis the Metro City website must be evaluated to find out the shortcomings of the website. This research refers to the Website Usability Evaluation (WEBUSE) approach to determine the results of the usability evaluation on the Metro City Government website with 4 categories of assessment, namely Content Organization and Readability, Navigation And Link, User Interface Design, Performance And Effectiveness. The WEBUSE method used focuses on the development of a web-based usability evaluation system with a subjective action approach that involves the participation of Metro City Government website users to provide an assessment of their website. The purpose of this study is to evaluate whether the Metro City Government website can provide optimal service to users. After measuring WEBUSE, the Metro City Website of the 4 variables measured, in Content organization and readability produces a value of 0.654 "Good", Navigation and link got a value of 0.663 "Good", Performance and effectiveness produces a value of 0.667 "Good", while in user design The interface gets a "Moderate" result with a score of 0.560.**

Keywords—WEBUSE, Metro City, Website

I. INTRODUCTION

1.1 Background

Advances in information and communication technology provide many benefits to society. The website is one of the means of information for the entire general public. For that we need a website that focuses on the web appearance of its functionality. So that it can provide the information needed by users on the website and also user satisfaction with the appearance of the website is very important.

Metro City Government has quite good prospects in the fields of Education, Trade and Agriculture through the Vision and Mission of Metro City, namely "The Realization of an Educated, Healthy, Prosperous and Cultured Metro City". For this reason, Metro City has created a website with the address metrokota.go.id. as a means of information. Metro City has implemented website-based information technology in order to achieve the goals and objectives of the Metro City Government, namely to disseminate information. A test is needed to determine the usability and the results of the assessment can be used as a reference to determine the level of user satisfaction.. The method used in this research is WEBUSE.

WEBUSE is a method used to evaluate a website from the usability aspect on all types of web and domains [1]. This model aims to determine the extent of studying the level of ease of the system, the use of a system in helping a problem. [2]. WEBUSE method used to evaluate web or sites focusing on a web-based evaluation system have as many as 24 questions for evaluate the usability of the site [6].

In general, the success of developing a website can be measured based on usability. Usability refers to how users can learn and use a website to achieve its goals and how satisfied they are with its use. The usability level determines whether the website is accepted by the user and used in the long term, so there needs to be an evaluation of the usefulness of the Metro City website.

1.2. Topics and Limits

Based on the background that has been described, the topics/problems in this research are: How are the results of website evaluation using the WEBUSE method?. This study uses the WEBUSE method approach in evaluating usability on the Metro City Government website with dimensions Content Organization and Readability (COR),

Navigation and Link (NAL), User Interface Design (UID) and Performance and Effectiveness (PAE).

1.3. Purpose

The research has the aim of evaluating the quality of the current Metro City website in terms of usability using the WEBUSE method to determine the usability level of the website.

II. RESEARCH METHODS

As mentioned above, web measurement is carried out using the (WEBUSE) method. Web Usability Evaluation Tool is a usability evaluation method whose assessment is web-based using a questionnaire so as to allow evaluators to assess the usability of the website to be evaluated. [3]. WEBUSE is used to test the usability of the website so that it is known the value and level of website usability to be evaluated [4]. WEBUSE is one indicator of the success of a website when there is interaction between users in doing something with the website [5].

To evaluate a site using the WEBUSE method, which focuses on a web evaluation system, there are 24 questions created to evaluate the ease of use of the site. The WEBUSE method can evaluate the ease of use of all types of sites and spaces. The data analysis tool uses descriptive statistics. This shows that WEBUSE can be used to evaluate ease of use on the Metro City website. The 4 categories in the WEBUSE Method are, Content organization and readability (COR), Navigation and links (NAL), User interface design (UID), and Performance and effectiveness (PAE) [7].

1. Content, Organization & Readability

Great substance is content that is easy for clients to understand, clear and efficient. A well-organized site can give clients a quick understanding. In the meantime, site clarity is estimated through whether the framework is working effectively and providing the right data.

2. Navigation & Links

The strategy used to adequately and proficiently view and access data on the site to assist the site's clients is called Navigation. Meanwhile, combine the capacity to associate clients by selecting and clicking join on the hypertext page (landing page), which causes the launch of a new page. A good connection should use text rather than design so that it is easy for the client to do.

3. User Interface Design

UI configuration is a strategy and method that requires careful thought when planning and developing a site. The essentials of planning a UI configuration include setting goals, deciding on a client and delivering valuable substance. In order to guarantee the best results, it is necessary to consider various UI configuration issues and good execution for the client.

4. Performance & Effectiveness

Site execution can be estimated by how fast the site acts in a given cycle or exchange resulting in fast and effective client execution. For a while, feasibility is the site's achievement to create the right data for the client [8].

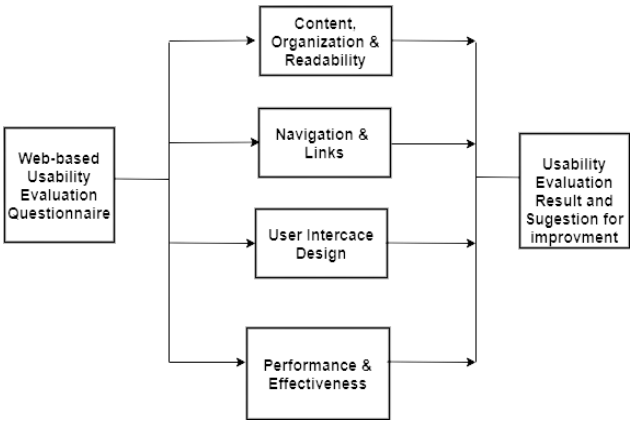

Figure 1. *WEBUSE* Evaluation Progress [6].

From the WEBUSE questionnaire, there are values that can represent how well the level of usability of a website is. The value is divided into 5 ranges of values, each value representing the level of good or bad usability. The merit value of the WEBUSE questionnaire can be seen in table 1.

Table 1. Merit score weight table [8].

Choice	**Merit**
Strongly Disagree (STS)	0.00
Disagree (TS)	0.25
Neutral (N)	0.50
Agree (S)	0.75
Strongly Agree (SS)	1.00

Then based on 4 categories of use, the average value for each category is considered as the point of use for each category. Points in category x are defined as follows:

$$x = \frac{[\sum (\textit{Weight of each question from each category})]}{\textit{number of question}}$$

Description :

x = *Poin usability*

$\sum$ = The total number of merits for each question from the category.

WEBUSE evaluation results in the form of usability points based on the response to each question given to the user. Usability assessment based on WEBUSE consists of several levels which can be seen from the calculation of usability points. Table 2 shows the point of use usability and the level of use usability.

Table 2. Poin dan *Level Usability Website* (WEBUSE) [9]

Poin	Level Usability
$0 \leq x \leq 0.2$	Bad
$0.2 \leq x \leq 0.4$	Poor
$0.4 \leq x \leq 0.6$	Moderate
$0.6 \leq x \leq 0.8$	Good
$0.8 \leq x \leq 1.0$	Excellent

Table 3. Questions on the WEBUSE

NO	Question	*Value*				
		1	2	3	4	5
COR 1	Does the website contain interesting material and topics and is always updated?					
COR 2	Do you find it easy to find what you want on the website?					
COR 3	Is the content on the website well organized and neat?					
COR 4	Do you find it easy to read the contents of the website at this time?					
COR 5	Do you feel comfortable and familiar with the language used on the website?					
COR 6	Don't you need to scroll left and right when reading the website content?					
NAL 1	Do you find it easy to know the position / whereabouts of various information when browsing the website?					
NAL 2	Does the website have instructions and links that make it easier for you to get the information you want?					
NAL 3	Do you find it easy to browse websites using existing links or the back button in the browser?					
NAL 4	Are the links on the website well maintained and unchanging?					
NAL 5	Will you be directed to a new tab when browsing the information contained on the website?					
NAL 6	Is the placement of links or menus arranged in a standard and easily recognizable manner?					
UID 1	Is the website interface design attractive and attractive?					
UID 2	Do you feel comfortable with the color combinations used in the website?					
UID 3	The website does not contain annoying features such as advertisements, scrolling or blinking text and repetitive animations ?					
UID 4	Does the website have a consistent and unchanging appearance?					
UID 5	Does the website not contain too many web advertisements?					
UID 6	Is Website Design interesting and easy to learn how to use?					
PAE 1	Don't you have to wait too long to download a file or open a page?					
PAE 2	Do you find it easy to distinguish links that have been and have not been visited?					
PAE 3	Can you easily access this website all the time?					
PAE 4	The website responds in line with expectations for all actions taken ?					
PAE 5	I feel efficient when using the website to find out various information on the metro city?					
PAE 6	The website always gives a clear and useful message when I feel like I don't know how to process something?					

III. Results and Discussion

The WEBUSE questionnaire was distributed to 41 respondents who accessed the Metro City Government website. The questionnaire was conducted online via a shared link. The results obtained in Table 4.

Table 4. WEBUSE Question Results

	SS	S	N	TS	STS
COR 1	3	23	11	4	0
COR 2	3	19	14	5	0
COR 3	5	22	10	3	1
COR 4	4	23	12	1	1
COR 5	4	25	11	0	1

COR 6	2	23	11	4	1
NAL 1	3	21	12	4	1
NAL 2	3	26	10	2	0
NAL 3	3	25	13	0	0
NAL 4	2	24	14	0	1
NAL 5	3	25	10	2	1
NAL 6	3	24	11	2	1
UID 1	4	16	8	8	5
UID 2	4	11	12	9	5
UID 3	7	16	9	6	3
UID 4	4	16	11	5	5
UID 5	9	13	10	6	3
UID 6	5	14	11	6	5
PAE 1	4	15	20	2	0
PAE 2	3	27	9	2	0
PAE 3	3	22	16	0	0
PAE 4	2	26	10	3	0
PAE 5	2	22	17	0	0
PAE 6	4	25	11	1	0

Description:

SS : Strongly Agree

S : Agree

N : Neutral

TS : Disagree

STS : Strongly Disagree

The results of the table above are sourced from 41 respondents consisting of 26.8% of people in Metro City, 73.2% of people outside Metro City. With educational background 4.9% Master, 51.2% Bachelor, 36.6% Diploma and 7.3% High School. The types of work of the respondents also varied, consisting of 34.1% private employees, 12.2% teachers and 53.7% with other types of work.

In this study, the method used is the WEBUSE method where the results of the questionnaire will be converted into the form of merit [10].

The next stage is to process the data from the WEBUSE questionnaire where the results obtained are Table 5 below.

Table 5. Usability Rate Results

No	Variable Name	Skor	Results
1	Content, organization and readability (COR)	0.654	Good
2	Navigation and link (NAL)	0.663	Good
3	Desain user interface (UID)	0.560	Moderate
4	Performance and effectiveness (PAE)	0.667	Good

From the table, the results of the values of the 3 variables get "Good", while the User Interface Design results get "Moderate" with a score of 0.560 from all respondents to the Metro City Government website.

After conducting an assessment on the website which is an effort to improve the usability of the Metro City Government website. Ratings are useful for making the website easy for users to use and increasing user satisfaction. The Metro City Government website has something that attracts users, among other things, the writing style is simple and easy to follow. In addition, it has value as a provider of up-to-date information and news.

The conclusions that can be drawn from the research conducted are as follows.

1. The highest result obtained for the WEBUSE method for the category (PAE) Performance and effectiveness is 0.667 and is included in the "Good" Usability Level.
2. The UID category is rated with the “Moderate” Usability Level category.

The results of the UID that get a "Moderate" value for the future Metro City Government can make improvements in arranging the UI so that it can be liked by website users.

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REFERENCES

[1] D. Pratiwi, M. C. Saputra, and N. H. Wardani, “Penggunaan Metode User Centered Design (UCD) dalam Perancangan Ulang Web Portal Jurusan Psikologi FISIP Universitas Brawijaya,” *J. Pengemb. Teknol. Inf. dan Ilmu Komput.*, vol. 2, no. 7, pp. 2448–2458, 2017, [Online]. Available: http://j-ptiik.ub.ac.id/index.php/j-ptiik/article/view/1609.

[2] K. T. Martono, O. D. Nurhayati, and E. Didik Widianto, “Usability Analysis with Webuse Model in Information System Design in Monitoring Child Growth and Development,” *IOP Conf. Ser. Mater. Sci. Eng.*, vol. 803, no. 1, 2020, doi: 10.1088/1757-899X/803/1/012037.

[3] J. Karaman, “Analisis Usability Aplikasi Cizgi Rent A Car Berbasis Mobile Menggunakan Metode WEBUSE,” *J. Comput. Inf. Syst. Technol. Manag.*, vol. 3, no. 2, pp. 93–100, 2020.

[4] B. Fajrianti, A. Rachmadi, and F. A. Bachtiar, “Evaluasi dan Perbaikan Desain Antarmuka Pengguna Situs Web SMK Negeri 1 Bangsri dengan Menggunakan WEBUSE dan Human Centered Design,” *J. Pengemb. Teknol. Inf. dan Ilmu Komput. Univ. Brawijaya*, vol. 2, no. 9, pp. 3168–3177, 2018.

[5] N. Aini, R. Ibnu Zainal, and A. Afriyudi, “Evaluasi Website Pemerintah Kota Prabumulih Melalui Pendekatan Website Usability Evaluation (Webuse),” *J. Ilm. Betrik*, vol. 10, no. 01, pp. 1–6, 2019, doi: 10.36050/betrik.v10i01.20.

[6] A. A. J. Ibnurozi, R. Santi, and C. E. Gunawan, “Analisis Pengukuran Usability Pada Situs Badan Pusat Statistik Provinsi Sumatera Selatan Dengan Menggunakan Metode Webuse,” *J. Inf. Technol. Ampera*, vol. 1, no. 2, pp. 119–132, 2020, doi: 10.51519/journalita.volume1.isssue2.year2020.page119-132.

[7] N. Oktaviani, “Analisa Website Media Elektronik Di Sumsel Melalui Penerapan Usability Pada Evaluasi Metode Webuse,” *Semin. Nas. Inov. Teknol.*, pp. 223–230, 2017.

[8] K. D. P. Novianti, I. W. O. Sukardiyasa, and I. P. D. Setiawan, “Usability analysis using webuse method in Bisma Informatika certification registration system,” *Compiler*, vol. 10, no. 1, p. 43, 2021, doi: 10.28989/compiler.v10i1.973.

[9] Andiputra and R. Tanamal, “Analisis Usability Menggunakan Metode Webuse Pada Website Kitabisa.Com [Analysis of Usability Using Webuse Method on Website Kitabisa.Com],” *Bus. Manag. J.*, vol. 16, no. 1, pp. 11–15, 2020.

[10] I. K. Dewi, Y. T. Mursityo, and R. R. P. Mardi, “Analisis Usability Aplikasi Mobile Pemesanan Layanan Taksi Perdana Menggunakan Metode Webuse dan Heuristic Evaluation,” *J. Pengemb. Teknol. Inf. dan Ilmu Komput. Univ. Brawijaya*, vol. 2, no. 8, pp. 2909–2918, 2018.

Evaluation of the Pesawaran Regency Government Website Using the Method Usability Testing

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***Abstract*— The Development of information and communication technology plays an important role in the implementation of e-government. The goal is that governance involving government, the private sector and society can be created in such a way that it is effective, efficient, productive and responsive.**

Pesawaran regency is one of the regencies in Lampung Province that has implemented e-government through the website, with the address pesawarankab.go.id. This research draws on the Website Usability Evaluatio (WEBUSE) approach to evaluating usability on the website of the Pesawaran Regency Government with dimensions of Content, Organization and Readability, Navigation and Links, User Interface Design and Performance and Effectiveness. Website Usability Evaluation (WEBUSE) focuses on developing a web-based usability evaluation system with a subjective action approach involving user participation to provide an assessment of a website.

The development of the Website Usability Evaluation (WEBUSE) approach as a standard usability measurement, with a web-based questionnaire evaluation method that allows users to assess the usability of the website to be evaluated. The purpose of this research is to find out the level of Usability of the Pesawaran Regency Government website can provide optimal service to users.

Keywords—evaluation, website, webuse, pesawaran regency

I. INTRODUCTION

Advances in information and communication technology provide many benefits to humans. This progress occurred in various fields, ranging from education, military, economics, and medicine to government. In the field of government, the benefits obtained by users, whether they are individual users, groups, organizations, companies or agencies are the existence of e-government services. e-government based on The World Bank Group (2001) in Kumorotomo (2009) is "E-Government refers to the use by government agencies of information technologies (such as Wide Area Network, the internet, and mobile computing) that have the ability to transform relations with citizens, business and other arms of government". From this definition, it can be seen that e-government refers to the use of information technology in government agencies or public institutions. The goal is that governance relationships involving the Government, the private sector and the community can be created in such a way that they are more effective, efficient, productive and responsive. The concept of e-government refers not only to the use of technology but also to the principle that the use of technology will make the system for determining policies and public services better and make the government more accountable to the community.

Pesawaran Regency is one of the regencies in Lampung province, Indonesia that has implemented e-government through the website, with the address https://pesawarankab.go.id/. Given its long existence, evaluation is needed to maximize its function. Based on Presidential Instruction No. 3 of 2003 which explains that in order to achieve good e-government governance, continuous evaluation is necessary.

In general, the success of developing a website can be measured based on usability. Usability refers to how users can learn and use a website to achieve its goals and how satisfied they are with its use. The level of usability determines whether the website is accepted by the user and used in the long term. So it is necessary to evaluate the usability of the website of the Bandung City Culture and Tourism Office to find out what improvements must be made to increase user satisfaction with the services provided by the website.

Therefore, we need an appropriate method to evaluate the usability of a website. By evaluating the usability of the website, we can determine the level of system quality and user satisfaction from the usability aspect. The method used is the Website Usability Evaluation tool (WEBUSE) method because this method covers all usability aspects of various

usability tool methods, namely WAMMI, webSAT, Bobby, and protocol analysis. The WEBUSE method is a method that can be used to evaluate the usability of a website to find out good and bad usability problems for various types of websites.

Website Usability Evaluation (WEBUSE) focuses on developing a web-based usability evaluation system with a subjective action approach that involves the participation of users to provide an assessment of a website. The development of the WEBUSE approach as a standard for measuring usability, with a web-based questionnaire evaluation method that allows users to assess the usability of the website to be evaluated (Chiew and Salim, 2003). This study refers to the WEBUSE approach to evaluate the usability of the Prabumulih City Government website with the dimensions of Content, Organization and Readibility, Navigation and Links, User Interface Design and Performance and Effeciveness.

II. Research Methods

WEBUSE (Website Usability Evaluation) is a questionnaire developed for the usability development of a website. This questionnaire consists of 24 questions with five answer options which are divided into four dimensions.

A. Content, Organization and readability

Good content is content that is easy to understand by users, clear, and well organized. A well-organized website can provide a quick understanding for users according to Leavitt and Shneiderman (Marcus, 2011). Meanwhile, the readability of a website is measured through whether the system functions properly and provides accurate information (Baltzan and Phillips, 2009).

B. Navigation and Link

The method used to find and access information on a website effectively and efficiently to help website users is called Navigation. Meanwhile, links function to connect users by selecting and clicking on links on hypertext pages (homepages), which causes new pages to open. Good links should use text rather than graphics so that they are easily understood by users according to Leavitt and Shneiderman (Marcus, 2011).

C. Design User Interace

User interface design is a method and procedure that requires careful consideration when designing and developing websites. The important things in designing user interface design include setting goals, determining users and providing useful content. To ensure the best results, it is necessary to consider various user interface design issues and good performance for users according to Leavitt and Shneiderman (Marcus, 2011).

D. Performance and Effetiveness

Website performance can be measured by how fast a website carries out certain processes or transactions so as to produce fast and efficient user performance (Baltzan and Phillips, 2009). Meanwhile, effectiveness is the success of a website in producing the right information for users according to Leavitt and Shneiderman (Marcus, 2011). From the WEBUSE questionnaire, there are values that can represent how well the level of usability of a website is. The value is divided into 5 value ranges, each value representing a good or bad level of usability. The merit value of the WEBUSE questionnaire can be seen in table 1 [11]. Meanwhile, the value of Usability point and corresponding usability tools can be seen in the table below:

TABLE 1. Usability Questionnaire Merit Value

Usability	Strongly Agree (SS)	Agree (S)	Neutral (B)	Do Not Agree (TS)	Strongly Disagree (STS)
Score	1.0	0.75	0.5	0.25	0

TABLE 2. Usability Point and Coresponding Usability Tools

Points	$0.8 \leq x \leq 1.0$	$0.6 \leq x \leq 0.8$	$0.4 \leq x \leq 0.6$	$0.2 \leq x \leq 0.4$	$0 \leq x \leq 0.2$
Score	Excellent	Good	Moderate	Poor	Bad

The average of each measurement indicator of importance (importance) and performance (performance) is calculated using the following formula:

$$x = \frac{[\sum(merit\ for\ each\ question\ of\ the\ category)]}{(number\ of\ questions)}$$

III. Result and Discussion

A. Characteristics of Respondents

Respondents in this study were determined by using a random sampling method where respondents were selected randomly, both those residing in Pesawaran Regency and outside Pesawaran Regency. According to Sugiyono (2010), the random sampling method is taking sample members from the population at random without regard to the existing strata in the population. The considerations of respondents in this study are as follows:

- People in Pesawaran Regancy
- People outside Pesawaran Regancy
- Have or are currently using the website of the Pesawaran Regency Government

Respondents used in this study amounted to 34 people. According to Roscoe quoted from Uma Sekaran, study sample sizes of more than 30 and less than 500 are appropriate for most studies. Thus, this study with a sample of 34 people can be carried out.

B. Creating Usability Testing Scenario Tasks

CreatinUsability measurement is carried out to assess whether the interaction between users and the application is going well. Measurements are carried out following the concept of user testing, with an emphasis on measurement and not testing. The purpose of this measurement is to identify usability problems that can affect system interaction with users. In accordance with these objectives, the measurement paradigm chosen is usability testing by

focusing on measuring user performance through the implementation of several tasks that have been prepared. The measurement technique chosen is user testing, where respondents are asked to carry out certain tasks Usability Testing Scenario Tasks.

C. Quistionnaire Making

The questionnaire is divided into 5 parts, which are as follows:

1. First part
   This sheet contains respondent information such as name, age, gender.
2. Second part
   The second sheet is a WEBUSE approach question with the dimensions of Content, Organization and Readability.
3. Third part
   The third sheet is a WEBUSE approach question with Navigation and Link dimensions.
4. Fourth part
   The third sheet is in the form of WEBUSE approach questions with User Interface Design dimensions.
5. Fifth part
   The third sheet is a WEBUSE approach question with the dimensions of Performance and Efficiency.

D. Usability Analysis

The results of the usability questionnaire have values that can represent how good the usability level of a website is. The value is divided into 5 value scales, each value representing the level of good or bad usability.

By using a questionnaire, the results of the usability value of each variable item are obtained.

The following are the details of respondents' answers

TABLE 3. Details of Usability Answers by Respondents

	SS	S	B	TS	STS
COR1	6	25	5	1	0
COR2	6	27	3	1	0
COR3	4	25	6	1	1
COR4	4	25	7	0	1
COR5	4	25	6	0	2
COR6	4	25	6	1	1
NAL1	5	27	5	0	1
NAL2	4	20	9	1	3
NAL3	5	19	12	0	1
NAL4	7	19	10	1	0
NAL5	5	20	8	3	1
NAL6	6	19	10	1	1
UID1	13	17	6	1	0
UID2	10	20	4	2	1
UID3	3	17	10	4	3
UID4	4	16	10	4	3
UID5	8	18	6	4	1
UID6	4	16	11	4	2
PAE1	6	15	11	3	2
PAE2	5	16	13	3	1
PAE3	6	13	14	3	1
PAE4	2	19	11	4	1
PAE5	4	20	11	2	0
PAE6	4	16	14	2	1

TABEL IV. Summary of Usability Calculation Results

No.	Variable Name	Score	Results
1	Content, Organisation And Readability	0,717	Good
2	Navigation and Links	0,691	Good
3	User Design Interface	0,667	Good
4	Performance and Effectiveness	0,641	Good

IV. CONCLUSION

Based on the results of research on the evaluation of the Pesawaran Regency Government Website with the Usability Testing Method, the following conclusions can be drawn:

1. The results of the calculation of each usability variable show that only the error variable can be categorized as moderate. So, it can be said that the usability of the website of the Pesawaran Regency Government is in a good category with an average value of 0.68 for all variables.
2. Based on the calculation of the gap analysis, the results of the website service quality show a positive value, which means that the service quality of the Pesawaran Regency Government website is in accordance with user expectations.

REFERENCES

[1] Alfiqie, M. Y., & Aknuranda, I. , & Wardani, N. H. (2018). Evaluasi *Usability* Pada Aplikasi UBER Menggunakan Pengujian *Usability*. Jurnal Pengembangan Teknologi Informasi dan Ilmu Komputer. Vol. 2, No. 9, September 2018, hlm. 2599-2606.

[2] Kadafi, A. R. (2016). Evaluasi *Usability Website* Sekolah Islam Terpadu Nurul Fikri Depok Menggunakan Web *Usability.* KNIT-2 Nusa Mandiri.

[3] Q. Aynayya, M. C. Saputra and D. Pramono, "Evaluasi Usability dan Rekomendasi Perbaikan Tampilan Website Seleksi Mahasiswa (SELMA) Universitas Brawijaya," *Jurnal Pengembangan Teknoogi Informasi dan Ilmu Komputer,* pp. Vol. 2 No.4 : 1446-1456, 2018.

[4] R. M. Davison, M. G. Martinsons and N. Kock, "Principles of Canonical Action Research," *Info Systems J*, pp. Vol. 14 : 65-86, 2004.

[5] Santoso, H. B., Delima, R., & Wahyuni (2018). Webuse *Usability* Testing For Farmer And Farmer Group Data Collection System. International Conference on Informatics and Computing

[6] S. Eko, Z. Mazalisa and R. Andryani, "Usability Testing Untuk Mengukur Penggunaan Website Inspektorat Kota Palembang," *Jurnal Teknik Informatika Universitas Bina Darma Palembang,* 2014.

[7] Sugiyono. (2010). *Metode Penelitian Kuantitatif, Kualitatif dan R&D*. Bandung: Alfabeta.

[8] T. Chiew and S. Salim, "Webuse: Website Usability Evaluation Tool," *Malaysian Journal of Computer Science*, pp. 47-57, 2003.

[9] U.Sekaran, Metode Penelitian Bisnis, Jakarta: Salemba Empat, 2006.

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Design of Data Visualization for Publication of Scientific Work by Lecturers of The Management Master's Program

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Abstract— Research which is one of the elements of Tri Dharma has been carried out by lecturers as tasks and responsibilities that are carried out regularly every year. Create data visualizations using Google Data Studio, which can provide information on scientific publications for Master of Management lecturers based on the track record of submission of each lecturer based on the citation index of published scientific works, and find out the location or city of Master of Management lecturers from Bachelor to Doctoral. This research has succeeded in displaying data visualization of lecturers' scientific publications using Google Data Studio according to the citation index so as to help leaders evaluate lecturer's performance. The data sources used in this data visualization system with Google Data Studio are stored in Google Sheets. Data is collected from Google Scholar, Scopus, and WOS sites. This study also presents data on the history of lecturers' education by showing where the management master's lecturers have studied

Keywords—*Dashboard, Scientific Work Lecturers, Google Data Studio;*

I. INTRODUCTION

Lecturers are professional educators and scientists with the main task of transforming, developing, and disseminating science, technology, and art through education, research, and community service[1]. The main task of lecturers according to the law on teachers and lecturers is the application of the Tri Dharma of Higher Education for lecturers. Research which is one of the elements of the Tri Dharma has been carried out by lecturers as tasks and responsibilities carried out

Higher Education IIB Darmajaya has 9 operating study programs, one of which is the Master of Management study program, the Master of Management study program has 7 active lecturers. Every year these lecturers publish scientific papers to fulfill their research assignments. In evaluating the performance of lecturers so far the study program is still doing manual calculations by recapitulating the lecturers' scientific works that are published and only documented. In today's era, a system like this is far behind for monitoring needs and cannot provide information quickly.

Making data visualizations using Google Data Studio which can display scientific publications of Master of Management lecturers based on the track record of each lecturer's submission, is very helpful for leaders in evaluating the performance of lecturers in fulfilling their responsibilities. In addition to displaying scientific publications, this lecturer dashboard also provides information on the location or city where the Master of Management Lecturer is studying to provide information on the educational history of the Master of Management lecturer IIB Darmajaya. The results of this study can be known quickly and easily without manual calculation of the number of scientific papers published by Master of Management lecturers according to the citation index of scientific works such as Google Scholar, Scopus, and Web of Science (WoS). The results of this data visualization are expected to be a solution to existing problems, the information available in this data visualization can be understood quickly because it uses responsive and supportive graphs and tables. This will save time and energy in data processing and minimize the possibility of human error because almost all calculations are done by software**.**

II. LITERATUR REVIEW

A. Previous Research

Previous research that is on the same topic as this research and is the basis of this research will be shown in table 1 below:

Table 1. Previous Research

Title	Strength	Weakness
Implementation of Business Intelligence System For Research Data in Higher Education [2]	The research dashboard designed to assist leaders in analyzing data to study research trends carried out at XYZ College, and can be used to support decision making and later can also be used as a lecturer's performance measurement	This study does not explain the citation index of each lecturer's scientific work
Publication Information System Design and Research of Lecturers[3]	On the information system this can be displayed publication / research graph based on the year of publication or research, based on lecturers and type of publication or research	This study does not explain the citation index of each lecturer's scientific work

Table 1 above explains the titles, strengths, and weaknesses of previous studies with the same topic as this study. The research gap from previous research is that both in displaying data visualization, they do not provide information about the citation index of scientific papers published by lecturers. So that the authors are interested in conducting research by providing information related to the citation index of scientific works published by lecturers.

B. Data Visualization

The development of information systems has influenced data presentation pattern. Generally the data is displayed in the form of a table, but now the presentation and good and correct data visualization and in accordance with the need to provide more information value good for use. The visualization technique is convert data into a visual format so that characteristics of the data and the relationships between the data can be analyzed and reported [4].

A visualization can be defined as a function that maps from a data point domain to various visual primitives. The main purpose of visualization is to get people to visually estimate size. In this sense, geometric primitives are visually twice as large to represent twice as large data. This is especially true for visualization analysis. We claim a "good" visualization if the accurate data point size is recognized by visual primitives [5].

In visualization, data, information and knowledge are three terms used extensively, often in an interrelated context. In many cases, they are used to indicate different levels of abstraction, understanding or truthfulness . for instances,visualization is concerned with exploring data and information, the primary objective in data visualization is to gain insight into an information space, and Information Visualization is for data mining and knowledge discovery [6]

C. Dashboard

Dashboards are broadly defined as “a visual display of data used to monitor conditions and/or facilitate understanding highlighting the various definitions that exist for the dashboard, while Slightly highlighting discrepancies in information that dashboard users would normally need to monitor [7]. The organization's complex data is turned into useful data and then executive analysts use these tools to analyze the data in depth to track the data and find out what is happening to it in real-time, leading to the cancellation of several reports that take a long time to analyze. Since charities are interested in providing analytical techniques that support productive families by increasing their profits, these tools have been highlighted to be used to analyze customer behavior [8]

1. Functional Features of Dashboard Button
   Years ago, software vendors, for example, Microsoft, and JasperSoft, participated in developing leading-edge dashboard solutions. The vendor claims that the use of dashboards will improve business performance in terms of increasing customer satisfaction, return on investment, and increasing cash flow. The dashboard includes three (key) features as the most important to include in it: search using filters to show more details for dashboard interactivity where browsing performance is configured in individual visualization, scenario analysis and presentation flexibility.
2. Predictive Analysis:

Predictive data analysis “is a branch of advanced data analysis used to make predictions about unknown future events”. Predictive analytics uses statistical models and predictive techniques to understand the future or fill in information we don't have

3. Prescriptive Analytics:
   Prescriptive data analysis "is a branch of data analysis that uses the application of computational science to optimize the set of decisions that a person has to make in a given situation" Prescriptive analytics is considered the most valuable part of data analytics because it can be used to recommend specific decisions that we have to make in order to achieve a result. desired business

D. Google Data Studio

Launched in May 2016 as part of Google's paid Analytics 360 suite, Google Data Studio is a new data visualization program designed as an easy-to-use tool to represent complex data sets in an attractive and clear way. In August 2016, Google made this program free to the public. Data Studio is still in beta release; the third-party features and integrations reviewed here are subject to change, but are effective as of August 2017. Data Studio's core functions are dashboard-style visual interpretation of social media and web analytics such as Google AdWords and YouTube analytics; however, the support of tools such as MySQL and Google Sheets suggests that the program can be used by researchers to interpret their own data in an equally attractive and user-friendly format [9].

Google Data Studio allows users to:

1. Connect to the data source,
2. Create custom calculations, dashboards and reports,
3. Share and collaborate with others
4. This product offers templates and a gallery of sample reports (developed by the community) users can take advantage of instead of starting from a blank page. Some of them are quite visually appealing. Based on the author's observations from various sources, there are 4 main strengths of Google Data Studio[10]:
   1. Price (Free)
   2. Integrated with Google Platform
   3. Cloud Based
   4. Provide sample report for users to get started.

*E. **Metode CRISP***

CRISP provides a standard nonproprietary and freely available process for incorporating data mining into the general problem solving strategy of a CRISP business or research unit, having a life cycle consisting of six stages, as illustrated in Figure 1. Note that the phase sequence is adaptive. That is, the next phase in the sequence often depends on the results associated with the previous phase. The most significant dependencies between the phases are indicated by arrows. For example, suppose we are in the modeling phase. Depending on the behavior and characteristics of the model, we may have to return to the data preparation phase for further refinement before moving on to the model evaluation phase. The iterative nature of CRISP is denoted by the outer circle in Figure 1.

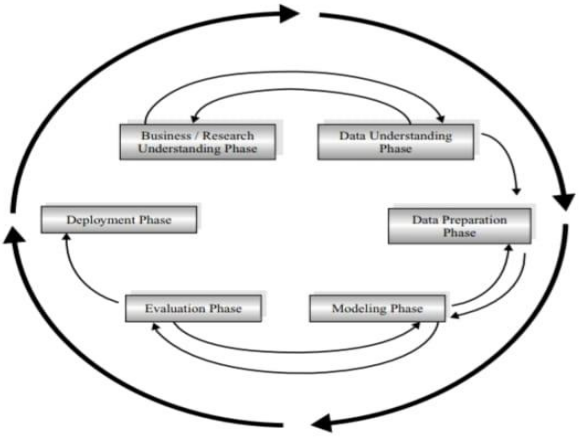

Figure 1. CRISP is an iterative adaptive process.

Often, the solution to a particular business or research problem leads to further interesting questions, which can then be attacked using the same general process as before. Lessons from past projects should always be taken as input into new projects. The following is an outline of each phase. While it is possible that problems encountered during the evaluation phase may send the analyst back to one of the previous phases for improvement, for simplicity we only show the most common loops, returning to the modeling phase [11]

III. METODOLOGI

The methodology for working on data visualization in this study is to fulfill the desired objectives, a flow is made in the stages of the research to be carried out. This study uses the following CRISP-DM methods:

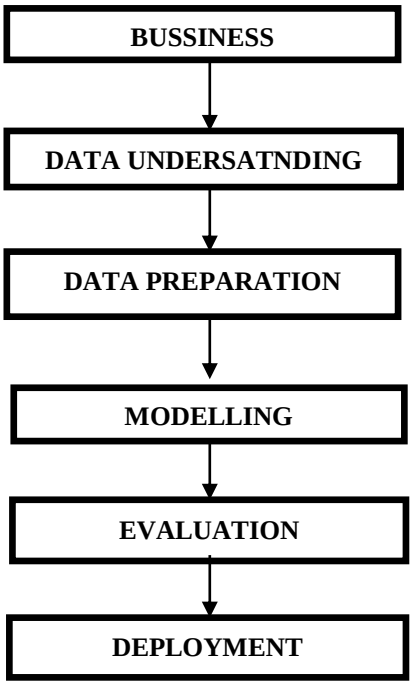

Figure 2 Flow in Research Stages

The stages in Figure 2 are the flow in this research:

1. Business understanding

   This stage can be called the research understanding stage which includes the objectives and requirements of the project.

2. Data understanding

   This stage is carried out by collecting data using exploratory data analysis to familiarize oneself with the data and find initial insights, evaluating the quality of the data.

3. Data Preparation

   The data preparation is to prepare the initial raw data for the final data set that will be used for all subsequent stages. In this stage, select the desired cases and variables, analyze the appropriate ones for analysis. Performing transformations on specific variables, if needed, cleans up the raw data so that it is ready for modeling tools. The data is processed using Ms. Excel.

4. Modelling ,

   This phase is done by selecting and applying appropriate modeling techniques. The database that has been created must be able to connect with the tools that will be used to create visualizations. The tools used in this research is Google Data Studio.

5. Evaluation

   This phase sees the suitability of the dashboard that has been made with the initial needs. If the initial objectives are met, the evaluation stage is declared successful.

6. Deployment

   This phase, if the existing data is clean, then the dashboard can be made. The type of diagram used will adapt to the needs of the organization. If necessary, calculations will be made with special formulas to be able to visualize certain things.

IV. IMPLEMENTATION

The implementation of this research is several visualizations with Google Data Studio from the published data of scientific work of the Master of Management IIB Darmajaya lecturers and the display of the location of the Master of Management lecturers of IIB Darmaja studying. Several types of charts used in Google Data Studio are bar charts, bubble maps, charts and tables, plus filter controls

A. Dashboard Title Pages and Google Scolar Indexed Scientific Works

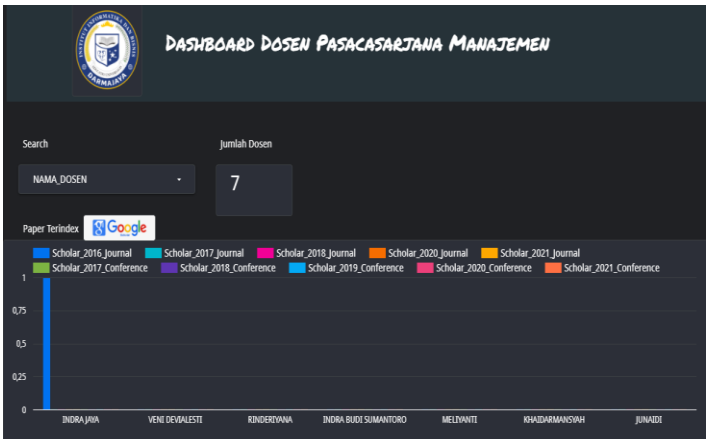

Figure. 2. Google Scholar Indexed Title Page and Scientific Work Dashboard

The dashboard above provides information on the scientific work of each lecturer who submits Google Scholar indexed journals every year. The results of the implementation show one lecturer who submitted journals in 2017.

B. Display of Scientific Work of Lecturers Indexed by Scopus every year

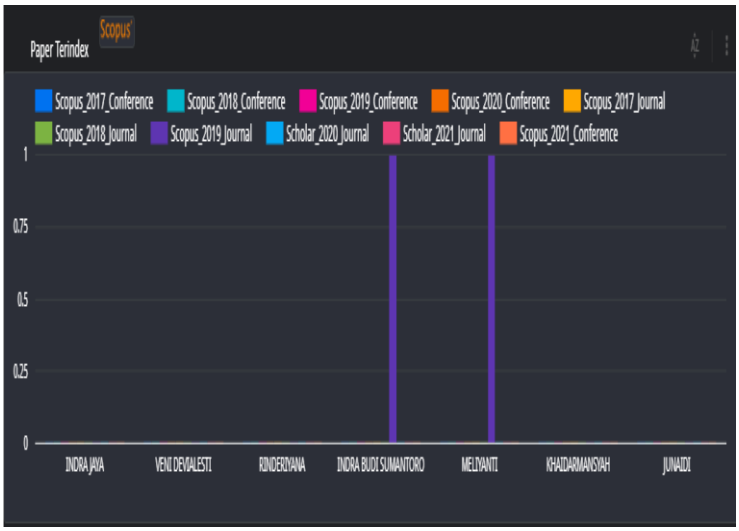

Figure 3. Scopus Indexed Scientific Work Dashboard

The dashboard above provides information on the scientific work of each lecturer who submits Scopus indexed journals, both journals and conferences every year. The results of the implementation show two lecturers who submitted journals in 2019 as many as 2 journals. In 2020 2 lecturers submitted 3 journals this year because lecturers on behalf of Indra Jaya publish in the same year.

B. Display of WOS Indexed Lecturer Scientific Work per year

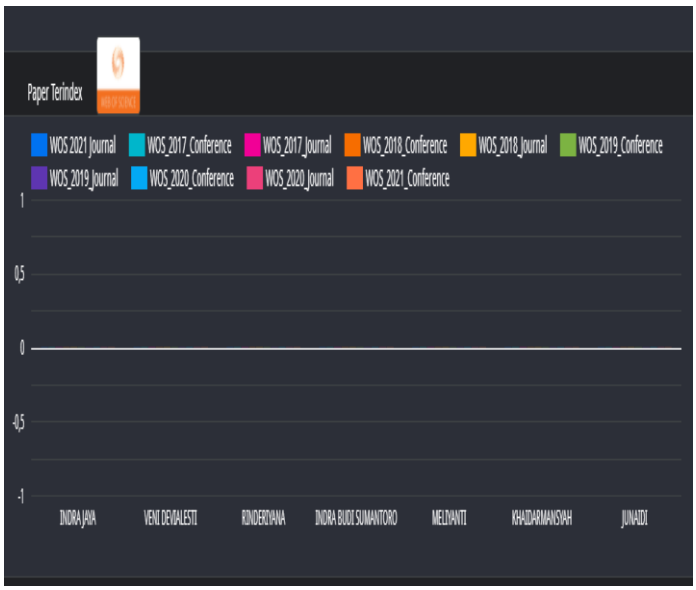

Figure 4. WOS Indexed Scientific Work Dashboard

The results of the implementation can be seen that there are no lecturers who submit journals indexed to WOS.

C. Display of Lecturer's Scientific Work Summary

Figure 5. Dashboard of Lecturer's Scientific Work Recapitulation

The Dahboar above provides information on the number of lecturers' scientific works that have been published in the period 2017 to 2021.

D. Display of Locations of Lecturers Undergoing Education

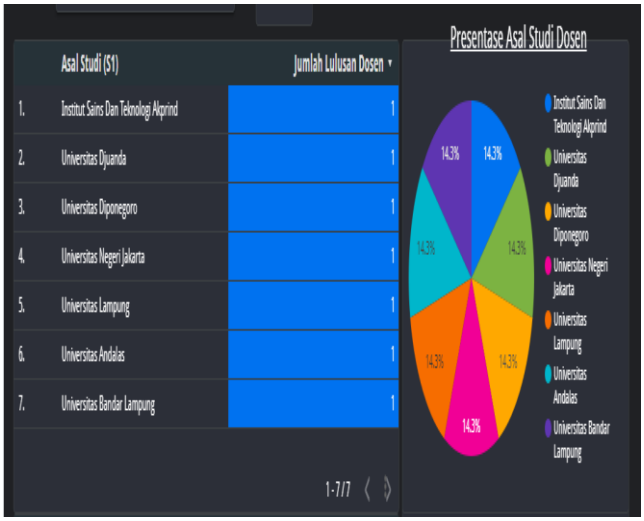

Figure 6. Dashboard of Lecturers' University for Bachelor's Education

Figure 7. Dashboard of Lecturers' University for Masters Education

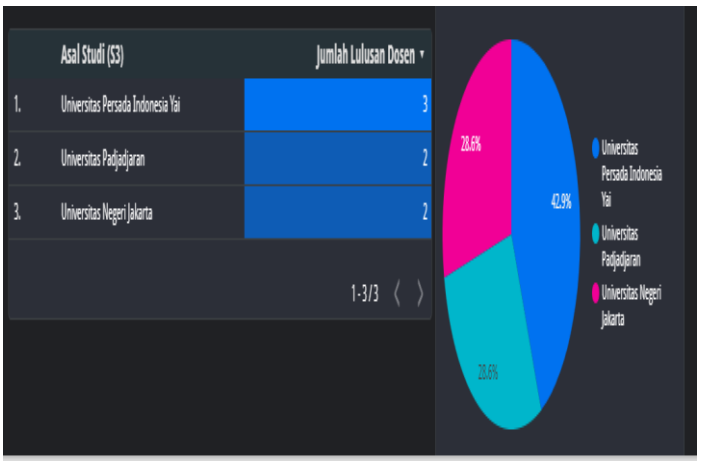

Figure 8. Dashboard of Lecturers' University for Doctoral Education

Dashboard Figures 6, 7, and 8 provide information on the educational history of management masters lecturers which are explained with university diagrams for studying from bachelor to doctoral

V. CONCLUSION

This research has succeeded in displaying data visualization of lecturers' scientific publications based on citation indexes so as to help leaders evaluate lecturers' performance. The data sources used in this data visualization system with Google Data Studio are stored in Google Sheets. Data is collected from Google Scholar, Scopus, and WOS sites. This study also presents historical data on lecturers' education by presenting university lecturers from the Master of Management program who are currently studying. However, in this study there are still many shortcomings that are expected to be carried out further research. The use of this research data is not enough so that the pattern formed on the diagram is not good enough.

ACKNOWLEDGMENT

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REFERENCE

[1] P. RI, *Undang-Undang-Nomor-14-Tahun-2005*. 2005.

[2] F. N. Hasan, "Implementasi Sistem Business Intelligence Untuk Data Penelitian di Perguruan Tinggi," *Pros. Semin. Nas. Teknoka*, vol. 4, no. 2502, pp. I1–I10, 2019, doi: 10.22236/teknoka.v4i1.3943.

[3] S. A. Fathurrahman, Ahmad Samsul Irfan AKbar, "Perancangan sistem informasi publikasi dan penelitian dosen," *Publ. Res. Inf. Syst.*, vol. 5, no. 2, pp. 149–158, 2018.

[4] Soleh, M. A. Dewi, Arfiah, and Asdin, "Metode Peninjauan Dashboard Dari Business Intelligence Untuk Membuat Keputusan Lebih Baik," *Semin. Nas. Teknol. Inf. dan Multimed.*, pp. 13–18, 2013.

[5] X. Li, A. Kuroda, H. Matsuzaki, and N. Nakajima, "Advanced aggregate computation for large data visualization," *IEEE Symp. Large Data Anal. Vis. 2015, LDAV 2015 - Proc.*, pp. 137–138, 2015, doi: 10.1109/LDAV.2015.7348086.

[6] R. Toasa, M. Maximiano, C. Reis, and D. Guevara, "Data Visualization Techniques for real-time information - A Custom and Dynamic Dashboard for Analyzing Sur veys ' Results," *2018 13th Iber. Conf. Inf. Syst. Technol.*, pp. 1–7.

[7] M. Elshehaly *et al.*, "QualDash: Adaptable generation of visualisation dashboards for healthcare quality improvement," *IEEE Trans. Vis. Comput. Graph.*, vol. 27, no. 2, pp. 689–699, 2021, doi: 10.1109/TVCG.2020.3030424.

[8] S. Tanko, H. Al-Saeed, R. Alali, S. Alawami, S. Brahimi, and G. Kirishina, "Performance dashboard for productive families," *2nd Int. Conf. Comput. Appl. Inf. Secur. ICCAIS 2019*, pp. 1–4, 2019, doi: 10.1109/CAIS.2019.8769481.

[9] G. Snipes, "Product Review Google Data Studio," *J. Librariansh. Sch. Commun.*, vol. 6, no. 1, p. 5, 2018.

[10] D. Fernando, "Data Visualization Using Google Data Studio," *Natl. Semin. Inf. Technol. Eng.*, vol. 1, no. November, pp. 71–77, 2018, [Online]. Available: https://e-jurnal.lppmunsera.org/index.php/snartisi/issue/view/100.

[11] T. Daniel, *An Introduction to Data Mining.* .

Paper

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Factors in Measuring the Earning Quality in the Consumption Industry of Public Companies

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Abstract- The purpose of this study was to empirically find the effect of reporting timeliness, default risk, and the audit committee on earnings quality in consumer goods industrial sector companies listed on the IDX in 2016-2019. The data in this study used secondary data in the form of annual financial reports and annual reports for 2016-2019. The method of data collection used the purposive sampling technique. The population in this study was the consumer goods industry sector companies listed on the IDX in 2016-2019. The number of samples was 21 companies. The data analysis technique used the multiple linear regression analysis with SPSS software version 22. The result of this study found that the timeliness of reporting and the audit committee variables had no significant effect on earnings quality. Meanwhile, the default risk had a significant effect on the earnings quality.

Keywords- Earnings quality, Timeliness of Reporting, Default Risk, Audit Committee

I. INTRODUCTION

In this increasingly advanced era, various information can be easily obtained. An information is said to be informative if the information can change the *belief* of investors in making investment decisions. The importance of earnings information is stated in *Statement of Financial Accounting Concept* (SFAC) No. 1 which states that earnings have benefits for assessing management performance, helping to estimate the ability of earnings in the long term, as well as being able to predict profits and assess risk in investment or credit. For investors themselves, information from the company is the basis in making decisions to invest. Earnings quality is the quality of earnings information available to the public that is able to show the extent to which earnings can influence decision making and can be used by investors to assess the company [1].

Earnings quality can be influenced by many factors, including the following: timeliness of reporting, *default risk*, and audit committee .Timeliness of reporting is a reflection of the quality of the company's performance which can reflect the credibility or quality of accounting information (including earnings information) reported [2]. The delay in reporting time will have an impact on the decisions of investors who become doubtful due to increased uncertainty. Therefore, the more timely the company submits its financial statements, the higher the quality of earnings proxied by ERC [3].

Default risk is the company's failure to pay interest or loan principal at the right time [4]. Companies that have high debt values can provide an increase in profits that can strengthen the position and security of *bondholders* compared to shareholders. The impact will affect the decision-making situation by investors who are increasingly careful in making decisions related to companies that have high risk [2]. The audit committee is a committee that works professionally and independently and is formed by the board of commissioners. The role of the audit committee is very much needed because the existence of an audit committee is expected to improve earnings quality through supervision of the financial reporting process [5]. The more number of audit committees a company has, the better protection and control over the accounting and financial processes. So that management can issue financial reports with reliable earnings quality.

From the results of several previous studies, indicating that there is a *research gap* on the variables of reporting timeliness , *default risk* , and the audit committee on earnings quality, research [2] concludes that reporting timeliness and *default risk have* no effect on earnings quality. Meanwhile, *political connection* has a negative effect on earnings quality. Research [6] concludes that timeliness affects earnings quality . Research [7] which concludes that the risk of debt failure affects earnings quality and is statistically significant . Research [8] which concludes that the audit committee has a positive and significant effect on earnings quality. And research [9] which concludes that the audit committee has no effect on earnings quality.

The consumer goods industrial sector was chosen because this sector is one of the sectors of manufacturing companies that play an active role in the Indonesian capital market. The development of the consumer goods industry in Indonesia has increased significantly from year to year. This is indicated by the large number of investors who are interested in investing their shares in the consumer goods industry sector. Thus the more the company increases, the higher the management of the company will be.

II. LITERATURE REVIEW

A. Signaling Theory (*Signaling Theory*)

Signal theory was first coined by Michael Spence (1973) in his research entitled *Job Market Signaling* . *Signaling theory* is the shareholder's perspective on the company's opportunities to increase the value of the company in the future, where the information is provided by the company's management to shareholders [10] *Signaling theory* or signal theory explains why a company has the urge to provide financial statement information to external parties. This makes *signaling theory* emphasizes the importance of information issued by the company which can then be used for investment decisions from outside the company.

B. Earnings Quality

Earnings quality according to [11] in his book, " *Earnings Quality refers to the relevance of earnings in measuring company performance* ". Earnings quality is earnings in the financial statements that reflect the actual financial performance of the company [5].

The *earning quality* ratio shows the relationship between cash flow and net income, the higher the ratio the higher the earnings quality because the larger the portion of operating profit realized in cash and not on an accrual basis. Earnings quality is based on the earnings-cash-accrual relationship which is measured using the ratio of operating cash to earnings, which is indicated by operating cash flow. Earnings that are closer to operating cash flows indicate that the earnings are of higher quality [12].

C. Reporting Timeliness

Timeliness is the availability of information to decision makers when needed before the information loses its power to influence decisions. Relevant information will be useful for users if it is timely before users lose the opportunity or ability to influence decisions to be taken (IAI, 2015). Timeliness is one way to measure the transparency and quality of financial reporting. Timeliness is one of the supporting elements for the quality of financial reports [13].

D. Default risk

Default risk is the company's failure to pay the interest or principal on the loan in a timely manner. Default risk is something that investors pay great attention to [4] The risk of failure is the use of debt and assets by companies that have fixed costs to increase investors' potential profits. Although companies with high risk can promise high returns, on the other hand, the level of uncertainty is also high [14]. *Default risk* reflects the high level of corporate debt, so it can be seen that the quality of the company in the future will be in an unfavorable situation [15] . *Default risk is* proxied by using a measure of the level of *leverage. Leverage* is a ratio that measures the ability of both long-term and short-term debt to finance company assets [16].

E. Audit Committee

The audit committee is a group of people who are selected by a larger group to carry out certain jobs or to perform special tasks or a number of members of the client company's board of commissioners who are responsible for assisting the auditor in maintaining his independence from management. The audit committee is tasked with assisting the board of commissioners to monitor the financial reporting process by management to increase the credibility of the financial statements. The audit committee's duties include reviewing the accounting policies applied by the company, assessing internal controls, reviewing external reporting systems and compliance with regulations [17].

The existence of the Audit Committee is regulated through Bapepam Circular Number: SE/03 PM/2002 (for public companies) and the Decree of the Minister of BUMN Number: Kep-103/MBU/2002 (For BUMN) The Audit Committee consists of at least three people, chaired by a Commissioner Independent company with two independent external people who master and have accounting and finance background.

F. HYPOTHESIS BUILDING

The Effect of Timeliness of Reporting on Earnings Quality

Timely reporting will provide a good signal (*good news*) to investors towards the company, because timely reporting shows that the report does not contain *noise* or interference so that investors will judge the earnings quality. This is in line with research [6] which concludes that timeliness affects earnings quality. Based on this description, the following research hypotheses are proposed:

H1 : Timeliness of Reporting has a significant effect on Earnings Quality.

Effect of *Default Risk* on Earnings Quality

Default risk is the company's failure to pay the interest or principal on the loan in a timely manner. *Default risk is* proxied by using a measure of the level of *leverage* . The higher the level of corporate *leverage,* the lower the quality of the company's earnings. In accordance with signal theory, companies with high levels of *leverage* cause investors to have less confidence in earnings information published by companies [5]. This is in line with research [7] which states that the risk of debt failure affects earnings quality and research [18] which concludes that *leverage* has a significant effect on earnings quality. Based on this description, the following research hypotheses are proposed:

H2: *Default Risk* has a significant effect on Earning Quality.

Influence of the Audit Committee on Earnings Quality

The more number of audit committees a company has, the better protection/protection and control over the accounting and financial processes will be. With a larger number of audit committees in a company , if a problem occurs, the audit committee will be able to solve the problem easily. The company will show a signal that the performance of a good audit committee will improve the quality of the profits generated by the company [5]. This is in line with research [8] which states that the audit committee has a positive and significant effect on earnings quality. Based on this description, the following research hypotheses are proposed:

H3 : The Audit Committee has a significant effect on Earnings Quality.

III. RESEARCH METHODS

The population used in this study are all consumer goods industrial sector companies listed on the IDX in 2016-2019. This study uses a sampling method in the form of *non-probability sampling* with *purposive sampling technique* as the type of sampling.

A. DEFINITION OF VARIABLE OPERATING

Earnings Quality

In this study, earnings quality is proxied by *Earning Quality* [19]. Where earnings quality is measured by the ratio between cash flow from operations divided by *Earnings Before Interest and Taxes* (*EBIT)* or income/earnings before interest and taxes . The greater the ratio, the better the earnings quality, with the following formula:

$$Earning\ Quality = \frac{CFO}{EBIT}$$

Reporting Timeliness

Bapepam Regulation Number XK2, Attachment to the Decree of the Chairman of the Capital Market and Financial Institution Supervisory Agency Number: KEP346/BL/2011 concerning the submission of periodic financial reports of issuers or public companies states that annual financial reports must be accompanied by an Accountant's report in the context of auditing financial statements. The annual financial report must be submitted to Bapepam and LK and announced to the public no later than the end of the third month (90 days) after the date of the annual financial report (end of the financial year). However, for the 2019 annual financial report, the Indonesia Stock Exchange (IDX) provides relaxation to issuers or public companies due to the impact of the Covid-19 outbreak, the Financial Services Authority (OJK) provides relaxation regarding the submission of financial reports and holding a general meeting of shareholders, related to the status of COVID-19 emergency. According to the Decree of the Board of Directors of the Indonesia Stock Exchange No. Kep-00057/BEI/08-2020, Regarding Relaxation of Deadline for Submission of Annual Financial Reports, Quarter I Financial Reports, Mid-Annual Financial Reports and Annual Reports stipulates that the deadline for submitting Annual Financial Statements and Company Annual Reports is extended for 2 (two) months from the deadline for submitting the report.

In this study, timeliness of reporting is measured using a *dummy* variable [20] with the category being for companies that are on time given a value of 1 and companies that are not on time (late) are given a value of 0.

Default Risk

Default risk in this study is proxied by using a measure of the level of *leverage* [5]. The calculation of the *leverage* ratio used is based on the total value of debt and total assets as follows:

$$LEV = \frac{Total\ Utang}{Total\ Assets}$$

Audit Committee

The audit committee is tasked with assisting the board of commissioners to monitor the financial reporting process by management to increase the credibility of financial reports [17] The audit committee in this study was measured using the number of audit committee members in the company [9] as follows:

KA = Number of the company's audit committee.

IV. RESULTS AND DISCUSSION

The results of the normality test using the one sample Kolmogorov-Smirnov test presented in the table above show that the Kolmogorov-Smirnov significant value is 0.200. With a significant value for the dependent variable in the Kolmogorov-Smirnov test obtained 0.200> 0.05 indicating H0 is accepted and the data is normally distributed . Based on the multicollinearity test in the table above, the results of the VIF calculation show that the variables of reporting timeliness, default risk, and the audit committee have a VIF value of less than 10 and a tolerance of more than 0.10. This shows that there is no correlation between the independent variables or there is no multicollinearity. Based on the results of the autocorrelation test, the DW value was 1.383 with k = 3 and N = 73 values obtained dL = 1.5645 and dU = 1.6768. It can be concluded that the value of DW < 4-DU or 1.383 < 2.3231, so it can be concluded that there is no autocorrelation symptom in the data used. Heteroscedasticity test results using the glejser test described in the table above show that all test variables do not contain heteroscedasticity because the significant value is > 0.05. So it can be concluded that this regression model has met the assumption of heteroscedasticity. This shows that the variation of the data is homogeneous. In the *summary* model , the R *square* value of 15.9% variation or change in Earnings Quality can be explained by Timeliness of Reporting, *Default Risk*, and the Audit Committee. The remaining 84.1% is influenced by other variables not examined in this study. Based on the table anova, the significant coefficient results show that the significant value is 0.007 <0.05 with an F count of 4.360. This means that the model is feasible to use for research and also means that the regression model can be used to predict earnings quality or it can be said that reporting timeliness, *default risk*, and the audit committee together have a significant effect on earnings quality.

Based on the results of the t statistical test above, it is known that: (1) Reporting Timeliness (X1) is 0.284, which means it is greater than 0.05, so it can be concluded that H1; rejected, meaning that the Timeliness of Reporting variable has no effect on Earnings Quality. (2) *The Default Risk* (X2) is 0.010, which means it is smaller than 0.05, so it can be concluded that H2; accepted, meaning that the *Default Risk* variable has an effect on Earning Quality. (3) The Audit Committee (X3) is 0.143, which means it is greater than 0.05, so it is concluded that H3; rejected, meaning that the Audit Committee variable has no effect on Earnings Quality.

DISCUSSION

The Effect of Timeliness of Reporting on Earnings Quality

The results showed that the timeliness of reporting variables had no effect on earnings quality, so the first hypothesis was rejected. The results of this study can be seen in the data of this study, the variable timeliness of reporting by 45% shows that of the entire sample only 45% report financial statements in a timely manner, which means that there are still many companies that are late in reporting financial statements and have no effect on the quality of their earnings. Timeliness is the quality of the availability of information when needed. However, this also still depends on the reaction of investors who see other factors in the financial statements besides the timeliness of reporting [2]. The results of this study are in line with research [2] which also shows that timeliness of reporting has no effect on earnings quality.

Effect of *Default Risk* on Earnings Quality

The results showed that the *default risk* variable had an effect on earnings quality, so the second hypothesis was accepted. In this study, the *default risk is* proxied by using a *leverage* measure . Based on the results of data processing through SPSS, it can be seen that the results of the t test show that *default risk* has a significant negative effect on earnings quality. This is evidenced by the value of the coefficient *default risk* (*leverage*) is negative 0.796 with a t value of -2.667 and a significance value of 0.010 <0.05, which means that the higher the level of corporate *leverage*, the lower the

quality of the company's earnings. In accordance with signal theory, companies with high levels of *leverage* cause investors to have less confidence in earnings information published by companies [5]. The results of this study are in line with research [18] and [7] which conclude that *leverage.*

Influence of the Audit Committee on Earnings Quality

The results showed that the audit committee variable had no effect on earnings quality, so the third hypothesis was rejected. This study shows that the sample companies have at least 3 members of their audit committee and only a few have audit committees of 4 people. Few or many audit committees in the sample companies do not affect the quality of earnings. It is possible that the existence of an audit committee within the company is only a formality to implement Bapepam regulation Number: SE/03 PM/2002 (for public companies) and Minister of BUMN Decree Number: Kep-103/MBU/2002 (for BUMN). the number of audit committees does not guarantee that audit committee members have expertise in their fields, so the supervisory role of the financial reporting process is less effective [21]. The results of this study are in line with research [9] which shows that the audit committee has no effect on earnings quality.

V. CONCLUSIONS

This study aims to empirically examine the effect of reporting timeliness, *default risk* , and audit committee on earnings quality in consumer goods industrial sector companies listed on the IDX in 2016-2019. The data used in this study is secondary data in the form of annual financial reports and annual reports for 2016-2019 and the data collection method using the *Purposive Sampling* technique and obtained 21 companies. Based on the results of the research described in the previous chapter, the conclusions that can be drawn are as follows: [a] Timeliness of Reporting does not affect the Quality of Earnings in manufacturing companies in the consumer goods industry sector listed on the IDX for the 2016-2019 period. [b] *Default Risk* affects Earnings Quality in manufacturing companies in the consumer goods industry sector listed on the IDX for the 2016-2019 period. [c] The Audit Committee has no effect on Earnings Quality in manufacturing companies in the consumer goods industry sector listed on the IDX for the 2016-2019 period.

REFERENCES

[1] Wulansari, Y. 2013. *The Effect of Investment Opportunity Set, Liquidity and Leverage on Earning Quality in Manufacturing Companies Listed on the Stock Exchange* . Accounting journal.

[2] Lungkang, FA 2020. The Influence of Reporting Timeliness, *Default Risk* , and *Political Connection* on Earnings Quality. *Thesis* . Telkom University.

[3] Dewi, IG Ayu RP, & Idawati, PDP 2017. *Finance and Its Impact on Earning Response Coefficient* . Scientific Journal of Accounting and Business. Vol.2(1).

[4] Ratnasari, D., Sukarmanto, ET, & Sofianty, D. 2017. The *Effect of Earnings Persistence, Firm Size and Default Risk on Earnings Response Coefficient* . Accounting journal. Vol.2.

[5] Karlina, EY 2016. Analysis of Factors Affecting the Quality of Company Earnings in the Goods and Consumption Industry Listed on the Indonesia Stock Exchange. *Thesis.* STIE Perbanas Surabaya.

[6] Satria, DI 2014. *The Influence of Mandatory Disclosure, Voluntary Disclosure, Financial Leverage, And Timeliness of Financial Report Submission on Earnings Quality in Manufacturing Companies on the Indonesia Stock Exchange. Journal of Economic Management and Business.*

[7] Setyaningsih, N. 2017. *The effect of debt default risk and tax allocation between periods on earnings quality (a case study on manufacturing companies listed on the Indonesian stock exchange in 2011-2015)* .

[8] Bawoni, T. 2020. *The Effect of Liquidity, Inter-period Tax Allocation and the Audit Committee on Earnings Quality* . Proceedings of the Economics Cluster Unissula Student Scientific Conference (KIMU). Vol.53(9).

[9] Fauziyah, EN 2020. *The Effect of Capital Structure, Company Size, Liquidity and Audit Committee on Earning Quality in Manufacturing Companies . Journal of Chemical Information and Modeling* . Vol.21(1), p:1–9.

[10] Brigham, EF, & Houston, JF 2014. *Fundamentals of Financial Management* . Jakarta: Four Salemba.

[11] Subramanyam, KR, & Wild, JJ 2014. *Financial Statement Analysis. Eleventh Edition* . Singapore: McGraw Hill.

[12] Murniati, T., Sastri, IIDA. M., & Rupa, IW 2018. *Factors Affecting Earnings Quality in Manufacturing Companies Listed on the IDX in 2012 - 2016* . KRISNA Journal: Collection of Accounting Research. Vol.10(1), p: 89–101.

[13] Rudianto. 2018. *Intermediate Accounting* . Jakarta: Erlangga.

[14] Delvira, M., & Nelvirita. 2013. *Effect of Systematic, Leverage and Earnings Persistence on Earnings Response Coeficient (ERC) (Study on Manufacturing Companies that Go Public on the IDX in 2008-2010)* . WRA Journal. Vol.1(1).

[15] Rahayu, LPAK, & Suaryana, IGNA 2015. *Effect of Firm Size and Risk of Default on Profit Response Coefficient.* E-Journal of Accounting. Vol.13(2), p: 665–684

[16] Kurniasih, T., & Sari, MM 2013. *Effect of Return on Assets, Leverage, Corporate Governance, Company Size and Fiscal Loss Compensation on Tax Avoidance.* Economic Studies Bulletin .

[17] Widmasari, NW, Arizona, IPE, & Merawati, LK 2019. *Effect of Investment Opportunity Set, Audit Committee, Leverage and Company Size on Earning Quality.* Collection of Accounting Student Research Results.

[18] Pitria, E. 2017. *The Effect of Growth Opportunity, Leverage and Profitability on Earning Quality* . Accounting journal.

[19] Marlinah, S. 2020. The Effect of Managerial Ownership, Institutional Ownership, and Independent Commissioner on Earnings Quality With Capital Structure As Moderating Variable. *Essay*. Semarang State University.

[20] Permatasari, I., Malikah, A., & Amin, M. 2020. *The Effect of Voluntary Disclosure, Timeliness of Financial Statements and Income Smoothing Practices on Earnings Response Coefficient*

[21] Silfi, A. (2016). *The Effect of Profit Growth, Capital Structure, Liquidity and Audit Committee on Earning Quality* . Currency Journal. Vol. 2(1), p:17–26.

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Profitability of Bank Muamalat Indonesia

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***Abstract*—Bank Muamalat Indonesia has the first islamic bank in Indonesia which has decreased very drastically in profit. This research aims to proved empirically the factors that affect the profitability of Bank Muamalat Indonesia. The method of analysis used multiple linear regression analysis with the help of SPPS software version 20. The level of confidence was 95%. The research data was taken from the Income Statement and Balance Sheet of Bank Muamalat Indonesia. The results of the research have show that the Capital Adequacy Ratio (CAR) and Operating Costs to Operating Income (BOPO) have a significant effect on the profitability (ROA) of Bank Muamalat Indonesia. Meanwhile, Non- Performing Financial (NPF) and Financing to Deposit Ratio (FDR) have no significant effect on Bank Muamalat Indonesia's ability to earn profit.**

***Keywords*—Profitability, Bank Muamalat**

1. INTRODUCTION

The banking industry was an industry that requires risk, especially because it involves managing public money and playing in the form of investments, such as providing credit, purchasing securities and investing other funds [4]. So that in its business activities, banks rely on public trust. One of the important indicators to assess the performance of a bank's management is to look at the profits generated by the bank in a certain period. Earnings information in general is a major concern in assessing the performance or accountability of management and helps in assessing the strength of the company's earnings in the future. Return on Assets (ROA) as an indicator of profitability indicates the company's ability to earn profits by utilizing its assets.

Profitability which is a ratio to assess the company's ability to seek profit [5][13] is the most important indicator to measure the performance of a bank. Based on PBI No. 13/1/PBI/2011 [8] banks are required to use the ratio of Return on Assets (ROA) in measuring the health of their profitability. This is because the value of a bank's profitability is measured by assets whose funds mostly come from public savings funds so that ROA is more representative in measuring bank profitability. The higher the ROA ratio of a bank, the higher the level of profit achieved by the bank which reflects the more effective the bank is in managing its assets [13].

PT. Bank Muamalat Indonesia, Tbk was established on November 1, 1991 or 24 Rabi'us Tsani 1412 H. It was the first Islamic bank in Indonesia which was established after the enactment of Law No. 7 of 1992 which was revised to Law No. 10 of 1998. As a pioneer Islamic banking in Indonesia, Bank Muamalat runs its operations in an effort to earn profits under the protection and guidance of Bank Indonesia, which operates in a sharia manner, has principles that must be adhered to, namely the practice of usury, maisir (speculation) activities, and gharar (unclearness).

Fig 1 below shows the net profit of Bank Muamalat Indonesia throughout 2016-2020. In the picture it is clear that the condition of Bank Muamalat's Net Profit from 2016-2020 which has decreased very drastically. In 2016 the Net Profit of Bank Muamalat reached 116 billion Rupiah, decreased by 48% in 2017 to 60 Billion Rupiah. Bank Mummalat's Net Profit continues to decline, even in 2020 Bank Muamalat Indonesia's Net Profit is only at 10 billion Rupiah.

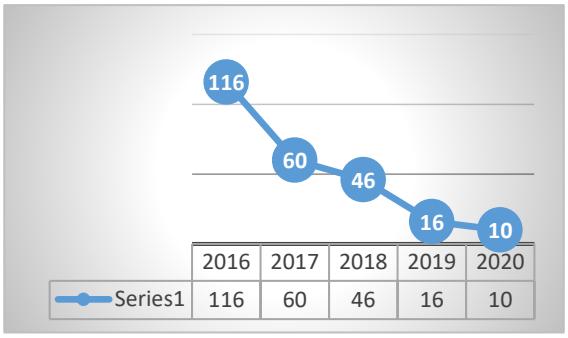

Fig 1. Profitability of BMI2016-2020

Fig 2. The Condition of Bank Muamalat Indonesia

Previously there were several studies conducted to look at various factors that affect profits in the banking industry in Indonesia. Internal factors such as liquidity, efficiency, capital, channeled financing, ratio level given, financing risk, share ownership [2][3][13]. The first factor is the Capital Adequacy Ratio (CAR). CAR reflects a bank's ability to recoup the risk of loss from its activities and the bank's ability to fund its operations. In accordance with Bank Indonesia regulation No. 10/15/PBI/2008 [8], the minimum capital that must be owned by the bank is 8%. A bank that has sufficient capital translates into higher profitability. This means that the higher the capital invested in the bank, the higher the profitability of the bank.

The second factor is non-performing financial (NPF). NPF is the level of bad credit at the bank which reflects financing risk, the higher this ratio, indicating the quality oIslamic bank financing is getting worse. Financing management is needed by banks, considering the function of financing as the largest contributor of revenue for Islamic banks. The level of health financing (NPF) also affects the achievement of bank profits. The increase in NPF will result in the loss of opportunities to obtain income from the financing provided so as to affect profit gains and adversely affect ROA [2].

The third factor is Operating Expenses to Operating Income (BOPO). Operating expenses are costs incurred by the bank in order to carry out its basic business activities (such as interest costs, labor costs, marketing costs, and other operational costs). Operating income is the main income of the bank obtained from the main placement of the bank in the form of credit and other operating income [1]. The level of efficiency of the bank in carrying out its operations affects the level of income generated by the bank. If operational activities are carried out efficiently then the revenue generated by the bank will rise [2]. So that the greater the efficiency ratio, the lower the financial performance of banking. Vice versa, if the ratio of operating expenses to operating income is getting smaller. So it can be concluded that the profitability of a company (banking) is increasing.

The fourth factor is financing to deposit ratio (FDR). FDR how much third-party funds islamic banks released for financing [7][14]. If the bank's FDR increases, it means that the distribution of funds to financing is getting bigger, so that profits will increase. The increase in profit resulted in the bank's performance as measured by ROA getting higher [15]. The management must be able to manage funds collected from the community to then be channeled back in the form of financing that can later increase bank revenue both in the form of bonuses and profit sharing, which means that islamic bank profits must also increase.

The importance of profitability of a bank and the importance of business continuity of Bank Muamalat Indonesia as a pioneer of Islamic Bank in Indonesia, purely Sharia. Then the Researcher will conduct research again, related to factors that affect the profitability of Bank Muamalat Indonesia.

II. LITERATUR REVIEW

Characteristics of Islamic

The following are the characteristics of Islamic banks that distinguish Islamic banks from conventional banks [2][13]:

1. The principle of Islamic sharia in property management emphasizes on the balance between the interests of individuals and society. Property should be used for productive things, especially investment activities that are the foundation of economic activity in society.
2. Islamic bank is a bank based among others on the principle of partnership, justice, transparency and universal and conduct banking business activities based on Sharia principles. Islamic bank activities are the implementation of Islamic economic principles with the following characteristics:
   a. Prohibition of riba in its various forms
   b. Not knowing the concept of time value of money (time value of money)
   c. The concept of money as a medium of exchange not as a commodity
   d. It is not permissible to carry out activities of a speculative nature
   e. It is not permissible to use two prices for one item.
   f. Not allowed two transactions in one contract
3. Islamic banks operate on the basis of the concept of revenue sharing. Islamic banks do not use interest as a tool to earn income or charge interest on the use of funds and loans because interest is prohibited riba.
4. It does not expressly distinguish the monetary sector and the real sector so that in its business it can conduct real sector transactions, such as buying and selling and renting.
5. Can get rewards for certain services that do not conflict with sharia principles.
   Carry out activities in accordance with sharia. A transaction in accordance with sharia principles when it has fulfilled all the following conditions: The transaction does not contain any element of tyranny, Not riba, Not endangering one's own party or any other party, There is no fraud (gharar), It does not contain

prohibited materials, Does not contain any element of gambling (maisyir)

Profitability

Profitability ratio is a ratio used to measure a company's ability to generate profits from normal business activities. Good performance will be shown through the success of management in generating maximum profit for the company [2].

The profitability ratio that the focus of this study is Return On Asset (ROA) which is a ratio that describes the ability of banks to manage funds invested in overall assets that generate profits. ROA describes the productivity of banks in managing funds so as to generate profits [2]. This ratio is very important, considering that the profits gained from the use of assets can reflect the level of business efficiency of a bank. In the framework of bank health assessment, BI will provide a maximum score of 100 (healthy) if the bank has a ROA > 1.5%

ROA can help companies that have carried out accounting practices well to be able to measure the efficiency of capital users who are sensitive to everything that affects the financial state of the company so that the company's position to the industry can be known. This is one of the steps in strategic planning.Based on PBI Annex No. 13/1/PBI/2011 [8] ROA is formulated as follows:

$$ROA = \frac{\text{Profit Before Tax}}{\text{Activa}} \times 100\%$$

Factors That Affect Profitability

With the analysis of ratios can be obtained a good picture of the bad circumstances or financial position of a bank, especially in assessing its profitability. Factors affecting rentability according to Brigham and Houston [3] are liquidity, asset management, and debt management. While according to Brigham in Wasis [3] actually states that the factors that affect rentability are the efficiency of capital use, sales volume, and the capital structure of the company. The factors that are an assessment of banking performance or profitability are as follows:

1. Capital Aspects

   Capital assessment is an assessment of the adequacy of bank capital to anticipate current and future risks. Capital is an important aspect of a bank's business unit. Capital adequacy is related to the provision of its own capital necessary to cover the risk of losses that may arise from the movement of bank assets which basically most of the funds come from third party funds or the public. The high capital ratio can protect depositors and have an impact on increasing public confidence in banks, thus impacting the increase in ROA. The presentation and increase in the role of bank assets as profit earners must pay attention to the interests of third parties as suppliers of bank capital [2]. Thus the bank must provide sufficient minimum capital to guarantee the interests of third parties. In this study, the capital aspect was projected with the Capital Adequecy Ratio (CAR) as an independent variable. If the value of CAR is high, then the bank is able to finance operational activities and contribute considerable to profitability. Based on SE BI 13/24/DPNP/2011 CAR can be formulated as follows:

$$CAR = \frac{\text{Capital}}{\text{ATMR}}$$

2. Asset quality aspect

   Quality assets are assets that can generate income and can cover costs incurred by the bank [4]. This aspect aims to assess the types of assets owned by the bank. The ratio used to assess the asset quality of a bank is used Non Performing Financial (NPF). Non Performing Loans (NPL) or Non Performing Financial (NPF) are non performing loans consisting of loans classified as Substandard Loans, Doubtful Loans and Bad Loans. The calculation of NPF in accordance with SE BI 13/24/DPNP/2011 [8] is as follows:

$$NPF = \frac{\text{Troubled Financing}}{\text{Total Financing}} \text{ x100\%}$$

3. Aspect of Income (Earning)

   This aspect is a measure of the bank's ability to increase profits or to measure the level of business efficiency and profitability achieved by the bank concerned (Muhamad, 2014). According to SE BI 13/24/DPNP/2011 [8], BOPO is measured by the comparison between operating costs and operating income. The increasing BOPO ratio reflects the lack of banks in managing their business. Bank Indonesia has determined the BOPO ratio is below 90%. BOPO can be formulated as follows:

$$BOPO = \frac{\text{Operating Cost}}{\text{Operating Income}} \times 100\ \%$$

4. Liquidity Aspect

   Financing to Deposit Ratio (FDR) is a ratio used to measure the liquidity of a bank in paying back withdrawals made by depositors by relying on the financing provided as a source of liquidity, namely by dividing the amount of financing provided by the bank against Third Party Funds. The standard used by Indonesia Bank for Financing Deposit to Ratio (FDR) is 80% to 110%. This ratio is formulated as follows

$$FDR = \frac{\text{Total Financing}}{\text{Third Party Fund}} \times 100\%$$

III. METHOD

The type of data used is descriptive quantitative secondary data. The object of research is done by taking data from the website of PT. Bank Muamalat Indonesia

Tbk. The stages of the research are in accordance with Fig. 3 below.

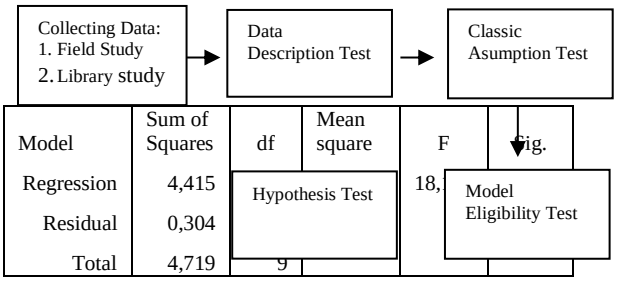

Fig 3. Research Stage

IV. RESULTS AND DISCUSSION

Descriptive Data Test

The data used in study is secondary data obtained from the financial statements of PT. Bank Muamalat Indonesia, Tbk. The data that became the object of observation in this study were capital, ROA, non-performing financing, total financing, operational costs and third party funds. In this study, researchers used a regression analysis model with the help of IBM SPSS Statistics version 20 to analyze the data.

	N	Minimum	Maxsimum	Std. Deviation
CAR	10	10,8	17,27	1,86978
NPF	10	1,4	6	1,59799
BOPO	10	79,52	99,46	7,23157
FDR	10	76,7	102,65	8,21453
ROA (Y)	10	0,1	2,39	0,72413

Fig 4. Descriptive Data Result Test

Descriptive testing of the data carried out showed that there were no deviations in the data on the variables studied.

Classic Assumption Test Results

Data Normality

Normality test of data using Kplmogorov-Smirnov Test. The results of the normality test of the data show that if the data is normally distributed, the level of Asymp.Sig. (2-tailed) of 0.998.

One-Sample Kolmogorov-Smirnov Test

		Unstandardized Residual
N		10
Normal Parameters[a,b]	Mean	0E-7
	Std. Deviation	,18375028
Most Extreme Differences	Absolute	,122
	Positive	,118
	Negative	-,122
Kolmogorov-Smirnov Z		,387
Asymp. Sig. (2-tailed)		,998

a. Test distribution is Normal.
b. Calculated from data.

Fig 5. Normality Test Results

Heterokedacity Test Results

The results of the Heteroscedasticity test show that the points do not describe a clear pattern or spread, the points of distribution are above and below 0 on the Y axis. Therefore, it can be concluded that there is no heteroscedasticity in the data to be studied. [5].

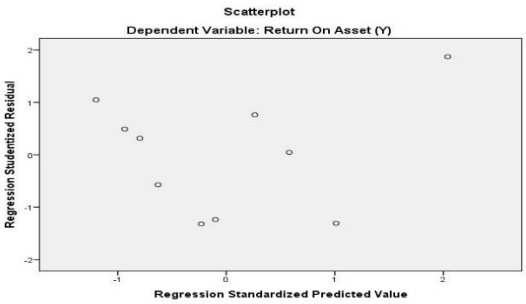

Fig 6. Heterokedasity Test Results

Model Feasibility Test Results

The results of the ANOVA test showed an F value of 18.163 and a significance level of 0.004, thus the model was said to be appropriate and the research was ready to continue.

ANOVA[8]

a. Dependent Variable: Return On Asset (Y)
b. Predictors: (Constant), Financial Deposit to Ratio (X4), Non Performing Financial (X2), Capital
Adequecy Ratio (X1), Biaya Operasional thd Pendapatan Operasional (X3)

Fig 7. Model Feasibility Test Result

Hypothesis Testing Results

Uji T

Model	Unstabdardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std.Error	Beta		
(Constant)	8,799	2,075		4,241	0,008
CAR	0,184	0,051	0,474	3,583	0,016
NPF	0,055	0,059	0,122	0,946	0,388
BOPO	0,075	0,014	0,75	5,297	0,003
FDR	0,011	0,12	0,121	0,865	0,427

[a] Dependent Variable: Return On Asset (Y

Fig 8. Hypothesis Testing Result

The test was carried out using the t test at a 95% confidence level or of 0.05 from the results of the SPSS

output obtained, as listed in table 4.7. The test results show that the Capital Adequacy Ratio (CAR) and Operating Costs to Operating Income (BOPO) show a value of Sig < 0.05, this shows that CAR and BOPO have a significant effect on the ability of Bank Muamalat Indonesia to earn profits. While Non Performing Financial (NPF) and Financial Deposit to Ratio (FDR) Sig value > 0.05, this indicates that NPF and FDR have no significant effect on Bank Muamalat's ability to earn profits.

Discussion

The results of the t-test sighted that capital (CAR) has a significant effect on ROA at Bank Muamalat Indonesia. So that the increase or decrease in CAR will affect the achievement of the bank's ROA. The fluctuation of Bank Muamalat's net profit could be caused by inappropriate policies in allocating the capital. Where the core capital of Bank Muamalat has decreased, while the complementary capital has increased which is the result of asset revaluation. Bank management must be observant and able to see opportunities to place their capital in more profitable sectors so that the capital encourages increased profitability [1][2][13].

The results of the second hypothesis test indicate that the NPF has no significant effect on the profitability of Bank Muamalat Indonesia, which means that the higher the NPF of a bank is not a measure of the success of bank management to earn profits. This result contradicts the theory that a high NPF will increase costs, thus potentially causing bank losses. The higher this ratio, the worse the quality of bank credit which causes the number of non-performing loans to be greater, and therefore the bank must bear losses in its operational activities so that it affects the decrease in profit (ROA) obtained by the bank [4][6]. This can be explained by using the uniqueness of Islamic Banks where Islamic banking has fundamental factors that can prevent the emergence of NPF from expanding; This is different from the conventional banking system, which provides a greater opportunity for the occurrence of NPLs. As a substitute for interest, Islamic banks focus on obtaining profits from transactions with their customers. The profit from the business is not determined in advance, but depends on the actual nominal realization [4][2]. In a murabahah contract, for example, the bank buys the goods needed, and then resells them to the customer at an additional price as the bank's profit. The customer can repay the purchase to the bank. In an ijarah contract, the bank rents out the goods purchased to its customers. In the mudharabah contract, the bank as shahibul mal provides capital to finance the business run by the customer as mudharib. In a musharakah contract, the bank and the customer finance and run a business together. In this contract, the profit is a common interest for the bank and the customer, which will then be divided based on the ratio determined at the beginning of the cooperation. This common interest can encourage more open transparency of information, and reduce the emergence of moral hazard, for each party in the transaction, thereby reducing business risk or financing/credit risk for the parties. Each contract contains an element of justice, namely the profits that are justified and shared are compensation for the business risks that are shared.

The results of the third hypothesis test show that there is a significant negative effect between BOPO on ROA at PT. Bank Muamalat Indonesia, which means the smaller this ratio means the more efficient the operational costs incurred by the bank. The test results indicate that every time the BOPO ratio increases, the ROA will decrease. This means that the more efficient these banks are, the profitability will increase. This indicates that efficiency is an important factor for banks to increase their profitability. Bank management operational policies that suppress or minimize unnecessary costs in operations will have a positive impact on the profits that the bank will generate [10]. Maximizing revenue by reducing expenses is the key to making banks more efficient in their operations. Banks must be able to innovate that can reduce costs and be more productive, such as the use of appropriate technology. Being able to maintain a good level of efficiency in a sustainable manner in the long term will significantly affect the profitability of the bank. Maintained efficiency makes banks more profitable so that banks are able to develop their business and be able to compete with competitors in the banking world [1].

The results of the fourth hypothesis test show that there is no significant effect between Financing Deposit to Ratio (FDR) on ROA at PT. Bank Muamalat Indonesia, meaning that in this study the higher or lower FDR at the bank is not a measure of the success of bank management to obtain high profits. High FDR has no effect on ROA, this can be because the amount of credit is supported by the ability to repay the loan. Good credit quality will reduce risk, especially if lending is carried out using the principle of prudence and expansion in controlled lending so that banks will not

V. CONCLUSION

Profitability which is a ratio to assess the company's ability to seek profit [5] is the most important indicator to measure the performance of a bank. Based on PBI No. 13/1/PBI/2011 [8] banks are required to use the ratio of Return on Assets (ROA) in measuring the health of their profitability. Bank Muamalat Indonesia was the first Islamic bank in Indonesia, it has decreased Net Profit very drastically along 2016-2020. This study aims to proved empirically the factors that affect the profitability of Bank Muamalat Indonesia. The method of analysis used multiple linear regression analysis with the help of SPPS software version 20. The level of confidence was 95%. The research data was taken from the Income Statement and Balance Sheet for Bank Muamalat Indonesia. The results of the research show that the Capital Adequacy Ratio (CAR) and Operating Costs to Operating Income (BOPO) have a significant effect on the profitability (ROA) of Bank Muamalat Indonesia. Meanwhile, Non- Performing Financial (NPF) and Financing to Deposit Ratio (FDR) have no significant effect on Bank Muamalat Indonesia's ability to earn profit.

REFERENCES

[1] Abdill R. (2015). Faktor-Faktor Yang Mempengaruhi Profitabilitas Dan Likuiditas Pada Bank Umum Syariah Di Indonesia (Periode 2008-2015). Tesis. *UIN SYARIF HIDAYATULLAH*.

[2] Angreini Dewi (2018). Kajian Faktor-Faktor yang Mempengaruhi Laba Bank Perkreditan Rakyat Syariah Di DKI Jakarta. Management & Accounting Expose e-ISSN : 2620-9314 Vol. 1, No. 2, Desember 2018, pp. 12-21

[3] Brigham and Houston (2015). Fundamental of Financial Mangement. Salemba Empat. Jakarta

[4] Fathya Khaira Ummah, & Edy Suprapto. (2015). Faktor-Faktor Yang Mempengaruhi Profitabilitas Pada Bank Muamalat Indonesia. *Sekolah Tinggi Ekonomi Islam SEBI*, Vol. 3. No.2.

[5] Ghozali, I. (2013). *Aplikasi Analisis Multivariate Dengan Program SPSS.* Semarang: Badan Penerbit Universitas Diponegoro.

[6] Kasmir. (2014). *Manajemen Perbankan.* Jakarta: PT Raja Grafindo Persada.

[7] Pupik Damayanti, & Dhian Andanarini Minar Savitri, SE., MM. (2012). Analisis Pengaruh Ukuran (SIZE), Capital Adequacy Ratio (CAR), Pertumbuhan Deposit, Loan To Deposit Rasio (LDR), Terhadap Profitabilitas Perbankan Go Public Di Indonesia Tahun 2005 – 2009 (Studi Empiris perusahaan Perbankan yang Terdaftar di BEI). *STIE Totalwin*, Vol. 3 No 2.

[8] Peraturan Bank Indonesia No. 13/1/PBI/2011 tanggal 25 Oktober 2011

[9] Surat Edaran Bank Indonesia No. 13/24/DPNP/2011

[10] Ummah, F. K., & Suprapto, E. (2015). Faktor-Faktor Yang Mempengaruhi Profitabilitas Pada Bank Muamalat Indonesia.

[11] Yusuf, M. Y., & Sri Mahriana, W. (2016). Faktor-Faktor Yang Mempengaruhi Tingkat Profitabilitas Bank Pembiayaan Rakyat Syariah (BPRS) di Aceh.

[12] Brigham and Houston (2015). Fundamental of Financial Mangement. Salemba Empat. Jakarta

[13] Abbas A, Azizah (2019). Marketability, profitability, and profit-loss sharing: evidence from sharia banking in Indonesia. Asian Journal of Accounting Research Vol. 4 No. 2, 2019 pp. 315-326 Emerald Publishing Limited

[14] Sitompul S, Nasution SK. (2019). The Effect of Car, BOPO, NPF, and FDR on Profitability of Sharia Commercial Banks in Indonesia. Budhapes International Research and Critic Institut Journal.

[15] Haris M et.al (2019). Intellectual Capital Performance and Profitability of Banks: Evidence from Pakistan. Journal of Risk and Financial Management

Analysis Of Emotional Intelligence For Lecturers Of Management Study Program In IIB Darmajaya

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***Abstract*— In academics, lecturers who have good emotional intelligence and good service to students can do something good in their work situations. In dealing with daily work routines, a lecturer must be able to perform well in harmony with the Tri Dharma of Higher Education. The purpose of this study was to analyze the emotional intelligence of lecturers in Management study program, Institute of Informatics and Business Darmajaya. The method in this study used descriptive quantitative with a sample of 42 lecturers of the management study program. The results of this study indicate that the emotional intelligence in Management study program, Institute of Informatics and Business Darmajaya had an average score range of 151.9. It was in the vulnerable range of values 145.8 - 179.4 in the high category. It showed that the component of emotional intelligence, namely self-awareness: being able to introspect oneself well into the high category. in Management study program, Institute of Informatics and Business Darmajaya who were committed to their work in intelligent emotions, for those who were emotionally intelligent was able to motivate themselves, motivate others and control their emotions, for those who have insight when making decisions, for those who empathize with understanding the psychology of others and build and maintain good social relations..**

Keywords—Emotional Intelligence, Lecturer

I. INTRODUCTION

Employees are an important resource for the company because they have the energy and creativity needed. In this case, employees are directed to want to work as much as possible and are given policies that can encourage employee performance improvement. The ability of employees is certainly not only seen from perfect work results, but also can be seen from the ability to master, manage themselves, and the ability to build good relationships with others. The process for good management must be supported by the presence of intelligence, one of which is emotional intelligence.

Emotional intelligence is defined as an individual's awareness of his emotions and those of others and the ability to recognize and control them as well as the ability to express sympathy for others. EQ is concerned with evaluating aspects of the situation (positive or negative) and making appropriate solutions in stressful situations (Lee and Nietfeld, 2017). Individuals high in EI have certain emotional abilities and skills related to assessing and regulating emotions in themselves and others. Therefore, it is argued that individuals high in EI can accurately perceive certain emotions in themselves and others (e.g., anger, sadness) and also regulate emotions in themselves and others to achieve various adaptive outcomes or emotional states. (eg, motivation and creative thinking) (Peter et.al, 2019).

According to Goleman (2018) Emotional intelligence or emotional intelligence refers to the ability to recognize our own feelings and the feelings of others, the ability to motivate ourselves and in relationships with others. Emotional Intelligence is a new discourse in the field of psychology because after many years people believe that the determining factor for the success of a person's life is a high IQ. Based on psychological research, a person's abilities are not only measured in logical and linguistic intelligence but there is other intelligence that can open a person's thinking about success factors in life, one of which is emotional intelligence. Someone who has good emotional intelligence is able to make the right decisions even under pressure and can make someone show his integrity. Emotional intelligence means using emotions effectively to achieve the right goals, build productive working relationships, and achieve success at work.

Based on Deri's Research (2020) explains that employee performance is not only seen from perfect abilities but can also be seen from the ability to master and manage oneself, as well as the ability to foster good working relationships with others. This ability by Daniel Goleman is called Emotional Intelligence. Goleman through his research said that emotional intelligence can contribute 80% of the determinants of a person's success in an organization, while 20% is determined by IQ (Intelligence Quotient).

The role of lecturers in tertiary institutions is a liaison between the education system and human resources when the impact of an educational innovation program applies through lecturers. The role of universities has challenges and requires careful planning in an effort to carry out the educational process with the output of issuing quality human resources who have the knowledge, intelligence, and skills that are relevant to life and times and contribute to the achievement of higher education goals in Indonesia in 2010.

Lecturer work is a profession carried out by every lecturer and is a source of life that requires expertise, skill, or creativity and innovation in accordance with certain values, ethics, and norms by requiring educational professional education. Therefore, the existence of lecturers at universities in Indonesia is required to build and collaborate in a quality work team to solve educational problems and find educational and teaching reform strategies that are in accordance with national education goals, to seize opportunities and deal with global challenges.

A person's ability to accept challenges is always changing by following and adjusting to situations and conditions, this is related to the skill and emotional stability of a person who makes adjustments. In an effort to maintain and improve the quality of learning, lecturers are expected to be able to direct students to seize opportunities and deal with global challenges. Institute of Informatics and Business Darmajaya, management study program currently has 42 lecturers, most of whom are certified.

Table 1. Data of IIB Darmajaya Management Lecturer

No.	Status	Total
1.	Permanent Lecturer	37
2.	Home-based Lecturer	5
Total		42

Based on the data from management lecturers, there are 42 people and 37 people who have the status as permanent lecturers and 5 people have the status as Home-based lecturers. Some lecturers also have additional duties to occupy positions at the study program level or at the directorate level.

This condition certainly adds to the diversity of lecturer characteristics and assumes to affect the lecturer's emotional intelligence and determine the quality of the resulting performance. Based on the phenomena, an analysis of the emotional intelligence of lecturers in Institute of Informatics and Business Darmajaya has never been carried out. In essence, it can be used as a foundation in forming a conducive work culture in Institute of Informatics and Business Darmajaya. This study was very crucial to be carried out in order to improve the quality of lecturer performance as an indicator of the performance quality of Institute of Informatics and Business Darmajaya and it proved for the fulfillment of students' rights to quality education services.

II. THEORITICAL FRAMEWORK

A. Emotional Intelligence

Nowadays, the concept of emotional intelligence is divided into two main models: the capability model and the mixed model (Hughes, et al., 2015). The capability model was proposed by Mayer and Salovey, while the mixed model was proposed by Goleman and Bar-On (Boyatzis, 2018). Emotional intelligence is a group of mental abilities that help people recognize their feelings and those of others and use those feelings to guide their thoughts and actions (Noermijati and Sunaryo, 2018).

According to Goleman (2018) Emotional intelligence or emotional intelligence refers to the ability to recognize our own feelings and the feelings of others, the ability to motivate ourselves and in relationships with others. According to Stephen P. Robbins and Timoty A. Judge (2017) Emotional Intelligence is a person's ability to assess emotions in oneself and others and understand the meaning of these emotions and regulate one's emotions on a regular basis in an organization flow model.

B. Characteristics of Emotional Intelligence

An analysis of the emotional intelligence of thousands of men and women shows that women are, on average, more aware of their emotions. This means that the emotional intelligence possessed by men and women are different and women are better able to control their emotional conditions. Women are more empathetic, and more skilled at interpersonal relationships, while men are more confident and optimistic, adaptable, and better at handling stress. Individuals with high emotional intelligence according to (Goleman, 2018) have the following characteristics:

1. Able to motivate yourself.
2. Able to survive frustration.
3. Able to control impulses.
4. Do not overestimate the fun.
5. Able to set the mood.
6. Able to located and.
7. Able to pray.

C. Emotional Intelligence Indicators

Indicators that affect emotional intelligence can be measured from several aspects, Goleman (2018:313) suggests five basic skills in emotional intelligence, namely:

1. Self-awareness: It is a person's ability to know the feelings in himself and their effects and use them to make decisions for themselves, have realistic benchmarks, self-efficacy, and have strong self-confidence, and then associate them with the source of the cause.

2. Self-control: It is the ability to handle one's own emotions, to express and control emotions, to have sensitivity to one's conscience, to use in relationships and daily actions.

3. Motivation: It is the ability to use the desire to at any time generate enthusiasm and energy to achieve a better state as well as being able to take the initiative and act effectively, able to withstand failure and frustration.

4. Empathy: It is the ability to feel what other people feel, to be able to understand the perspective of others, and to create a relationship of mutual trust and to be able to align oneself with various types of individuals.

5. Social Skills: This is the ability to handle emotions well when dealing with other people and create and maintain relationships with others, can influence, lead, deliberate, resolve disputes and work together in teams.

III. METHODOLOGY

The type of study was analytical survey research. This type of study was to assess a condition. The result can be used to improve the planning of a program. Operational Definition of Emotional intelligence was the ability of lecturers in Institute of Informatics and Business Darmajaya to recognize one's own emotions, motivate oneself, recognize other people's emotions, and the ability to build relationships with others. The sample in this study was all 42 lecturers of Institute of Informatics and Business Darmajaya in the management study program.

The method in collecting data used the emotional intelligence scale method, aspects of self-awareness, self-control, empathy motivation, and social skills. They were useful for measuring the extent to which the emotional intelligence of lecturers of Institute of Informatics and Business Darmajaya.

IV. RESULT AND DISCUSSION

A. *Validity Test*

The validity of the instrument was done by correlating the score obtained for each question or statement with the total score. The formula used to find the correlation value of Product Moment.

Table 1. Validity Test

Statement	r-count	r-table	States	Note
Statement 1	0,456	0,3494	r count > r table	Valid
Statement 2	0,471	0,3494	r count > r table	Valid
Statement 3	0, 547	0,3494	r count > r table	Valid
Statement 4	0, 374	0,3494	r count > r table	Valid
Statement 5	0, 577	0,3494	r count > r table	Valid
Statement 6	0, 446	0,3494	r count > r table	Valid
Statement 7	0,404	0,3494	r count > r table	Valid
Statement 8	0,595	0,3494	r count > r table	Valid
Statement 9	0,611	0,3494	r count > r table	Valid
Statement 10	0,369	0,3494	r count > r table	Valid

Based on table 1, the results of the validity test was above for the Emotional Intelligence variable as many as 10 statements, the value was r count > r table, so it concluded that all statements of the Emotional Intelligence variable were declared valid.

B. *Result of Respondents*

Table 2. Result of Respondents

No	Statements	SS	S	N	TS	STS	Total	Ave
Self-Awareness								
1.	Able to control thoughts and actions in any situation	7	17	10	6	2	42	158
		35	68	30	12	2	147	
2.	Always Introspect	20	11	5	4	2	42	
		100	44	15	8	2	169	
Self-Control								
3.	I immediately finished the work and I had planned without stalling for time	12	8	4	11	7	42	135
		60	32	12	22	7	133	
4.	Able to respond and respect criticism and suggestions	10	10	8	8	6	42	
		50	40	24	16	6	136	
	effectively							
Motivation								
5.	Interested in work that provides new ideas/new experiences	12	12	10	2	6	42	156
		60	48	30	4	6	148	
6.	Interested in work that provides new ideas/new experiences	18	12	5	4	3	42	
		90	48	15	8	3	164	
Empathy								
7.	When friends have problems, they ask me for advice.	13	17	10	1	1	42	170
		65	68	30	2	1	166	
8.	When friends have problems, they ask me for advice.	17	15	9	1	0	42	
		85	60	27	2	0	174	
Social Skills								
9.	I have limited options when I leave the company	13	9	15	5	0	42	141
		65	36	45	10	0	156	
10.	I still work in the company because I'm not sure that other companies can provide better benefits	10	5	9	11	7	42	
		50	20	27	22	7	126	
Total							1.519	
Average							151.9	

Source: Data Processing, 2021

Based on table 2, the results of respondents' answers from several statements submitted to 42 respondents regarding the Emotional Intelligence variable, have an average score of 151.9. From the five indicators of emotional intelligence, the average value of the highest indicator was the empathy indicator. It was the ability to feel what other people feel, be able to understand other people's perspectives, and create a trusting relationship and be able to align themselves with various types of individuals. It stated that it had been implemented well by Institute of Informatics and Business Darmajaya in the management study program. Meanwhile, the lowest average value comes from indicators of self-control. It was the ability to handle their own emotions, express and control emotions, have sensitivity to conscience, to be used in relationships and daily actions. It stated that it had not been implemented properly so it was necessary to increase or improve by a lecturer Institute of Informatics and Business Darmajaya in the management study program.

C. *Determination the Range*

This survey uses a Likert scale with the highest score in each question is "5" and the lowest score is "1". With the number of respondents as many as 42 people:

$$Range = \frac{Highest\ Score - Smallest\ Score}{Score\ Range}$$

Note:

Highest range: 42*5 = 210

Smallest range: 42*1 = 42

The range for the survey results were:

$\frac{210 - 42}{5} = 33{,}6$

Table 3. Score Range

Point	Category
42 - 75,6	Very low
76,6 - 110,2	Low
111,2 - 144,8	Fair
145,8 - 179,4	High
180, 4 - 214,0	Very High

D. Discussion

Based on the results of respondents' answers from several statements submitted to 42 respondents regarding the Emotional Intelligence variable, it had an average score of 151.9. It indicated that Emotional Intelligence was a high score because it stated that it was 145.8 to 179.4. The management study program's lecturer in the Institute of Informatics and Business Darmajaya had high empathy. It stated that the interval was 170 at the interval 145.8 to 179.4. The value of this empathy can be seen when colleagues had problems. They did not hesitate to share stories with each other so this needs to be maintained. Self-control had an average value of 135 in the interval between 111.2 – 144.8. It was the lowest value when compared to other indicators so this needed to be improved so that lecturers did not feel burdened to work because they were not sure other companies to provide benefits better.

V. CONCLUSION

Based on the results of the study, it concluded that the emotional intelligence of management study program lecturers in Institute of Informatics and Business Darmajaya had an average score range of 151.9. It was in the vulnerable range of values 145.8-179.4 that included in the high category. This showed from the component of emotional intelligence, namely self-awareness: being able to introspect oneself well into the high category. Self-control: being able to respond to criticism and suggestions effectively falls into the moderate category. Motivation: interested in work that provides new ideas/new experiences into the high category. Empathy: when friends have problems, they ask me for advice in the high category and social skills: have limited options if leaving the company into the high category. However, emotional intelligence was not optimal, therefore it needed to be maintained and improved. Especially, on the indicators of self-control where the total of these indicators had the lowest average value when compared to other indicators.

The implication of this study is the management study program's lecturers in the Institute of Informatics and Business Darmajaya who were committed to their work for those who had intelligent emotions, for those who were emotionally intelligent was able to motivate themselves, motivate others and control their emotions, for those who have insight when making a decision, for those who empathize with understand the psychology of others and build and establish good social relationships. In addition, the management study program's lecturers in the Institute of Informatics and Business Darmajaya had the high emotional intelligence to be more open to communicating and accepting other people's views, attention, and empathy for their colleagues. Therefore, lecturers must have a good understanding and use of social skills in carrying out task activities with full responsibility. The dimension of social skills had a role in shaping individuals who were desired to be successful in dealing with work both individually and in groups. Apart from the dimensions of social skills, the dimensions of self-motivation, self-awareness, maturity, and spirituality also had a significant contribution to the work commitment of lecturers. Lecturers behaved and acted as motivators, mentors in academic activities such as learning, seminars, workshops, research guidance. This means that lecturers must provide space for students to communicate with lecturers with familiarity, provide opportunities to think creatively, critically, and innovatively without fear through interaction with students from various backgrounds, making lecturers had the ability to understand, motivate, manage and control their emotions.

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REFERENCES

[1] Goleman.D,2018. Emotional Intelligence. Jakarta: Gramedia

[2] Firmansyah, Deri. (2020). Pengaruh Kecerdasan Emosional dan Komitmen Organisasi Terhadap Kinerja Karyawan Pada PT. Rismawan Pratama Bersinar Sukabumi. Jurnal Ekonomi Bisnis Manajemen Prima, 60.

[3] Robbins, S. P., & Judge, &. T. (2017). Perilaku Organisasi . Jakarta: Salemba Empat.

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Marketing Strategy through Swot Analysis on the Puncak Mas Tourist Attraction in Bandar Lampung

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***Abstract*— The tourism sector in Indonesia is currently considered to have an effective role in increasing the country's foreign exchange. The Covid-19 pandemic has an impact on tourism sector activities and recorded losses of up to IDR 10 trillion during the implementation of the Large-scale social restrictions or LSSR (Indonesian: Pembatasan Sosial Berskala Besar or PSBB). The 2020 report states that the number of tourists has decreased by 75% compared to 2019. In this study, data was obtained through distributing questionnaires to visitors in Puncak Mas tourist attraction. It was processed using a SWOT analysis technique. The result of this study showed that Puncak Mas tourist attraction had strength in Internal Factors and there were various threats of quite inhibiting. Diversification must be carried out so that there was development in tourist areas and tourism renewal that provides innovation, security, and comfort for Puncak Mas tourist attraction.**

Keywords— Marketing Strategy, SWOT, Tourism

I. INTRODUCTION

Indonesia has great potential in tourism development. it was because of the diversity of culture, language, customs, and natural conditions as a tourist attraction. The development of the tourism sector is currently growing in Indonesia. directly, it has an impact on the community to improve the local economy. However, the Covid-19 virus hit all human activities including Indonesia in 2020. In Indonesia, the first case of Covid-19 was confirmed on March 2, 2020 and spread to all provinces. The government uses the term of Large-scale social restrictions or LSSR (*Bahasa: Pembatasan Sosial Berskala Besar or PSBB*) to break the spread of Covid-19 in Indonesia and close various public accesses, including in the tourism sector..

The Indonesian Chamber of Commerce and Industry (*Bahasa: Kamar Dagang dan Industri Indonesia or Kadin*) claims that the tourism sector has losses of up to Rp. 10 trillion due to the implementation of the Large-Scale Social Restrictions (PSBB) policy. Total foreign tourist visits to Indonesia in 2020 amounted to 4.02 million. On the contrary, compared to 2019, the number of foreign tourists decreased by 75.03 percent.

Lampung Province has a variety of decline tourist attractions in the pandemic era. The Bandar Lampung City Government has implemented restrictions on community activities in an effort to prevent the increasing spread of the Covid-19 virus so that some public access is temporarily closed. There has been a rate decrease in the spread of COVID-19. The government has reopened public access by implementing COVID-19 Health and Safety Protocols including in the tourism sector. Although the implementation of the COVID-19 Health and Safety Protocols has been carried out, the number of tourist visits is not as significant as before the pandemic. To increase visits and maintain existing tourism potential, it is necessary to carry out an evaluation from tourists and tourism managers to be taken into consideration in taking the next step.

It is a challenge to the government and tourism managers in Lampung to try to carry out the proper marketing strategy to increase the number of tourist visitors in the pandemic era outbreak while still following the health protocols set by the government to increase visitor confidence and maintain the existence of tourism in dealing with problems. One of them is the Puncak Mas tourist attraction which has decreased. As ecotourism in Lampung Province, "Puncak Mas" is one of the tourism products that utilize natural resources in beautiful natural panoramas combined with various tourism aspects. Thus, it produces a blend that has economic value.

Table 1. Number of Visitors to Puncak Mas Tourist Attraction

Month	Visitor in 2019	%	Visitor in 2020	%
1	10.137	9	9.121	-
2	9.693	9	8.985	-2
3	9.753	9	Lockdown	-
4	10.330	10	Lockdown	-
5	8.538	8	2.458	-26,6
6	8.456	8	2.501	2
7	7.472	7	2.476	-1
8	8.175	9	2.629	6
9	7.341	7	2.583	-2
10	7.854	7	2.702	4
11	8.486	8	2.863	6
12	10.659	10	3.203	11
Total	106.894		39.521	

Based on the observations and interviews with Puncak Mas management and visitors, there has been a decline of 26.6 percent since it reopened in May 2021. The management needs to make strategic planning by taking into the factors that affect the tourists to visit again beside the impact of the COVID-19 pandemic. The factors were internal and external factors from Puncak Mas Tourist Attraction. By analyzing these factors, Puncak Mas can determine what marketing strategy is appropriate to develop sustainable tourism with its advantages and disadvantages so that it can continue to survive in the face of tough competition in a developing era.

Previous research has shown that a strategy is needed to develop and increase the number of visits to tourist objects (Sadeghi, 2021) where the results show that the tourism object has development constraints, an appropriate marketing strategy based on SWOT is needed. In another study, a SWOT analysis showed that the potential of coastal and marine natural resources in Kotania Bay is very likely to be developed as marine ecotourism (Lelloery, 2021). The purpose of the research conducted is to find out the right marketing strategy at Puncak Mas Tourism, so it is expected that it will have an impact on increasing the number of visitors.

II. THEORITICAL FRAMEWORK

A. Tourism

Yoeti in Utama (2017) tourism comes from Sanskrit, consisting of two words, namely "Pari" which means full or all, and "Wisata" which means to travel. A trip is called a tourist trip if (1) The trip is carried out from one place to another, (2) The purpose of the trip is for pleasure, (3) As a consumer in the place visited.

B. Marketing Strategy for Tourism

In marketing activities, it is necessary to have a strategy to achieve the objectives of holding marketing activities. Marketing strategy is an arrangement of processes starting from research, planning, preparation, to implementing a tool that is used to assist the information process, improve management, solve problems that are being faced by management, make strategic decisions, and control the marketing process both by utilizing the internal environment. and the external environment of a company or organization (Kurniawati, 2020).

C. Strategic Management

Strategic management is the art and knowledge of formulating and evaluating decisions so that an organization achieves a goal and strategic management is used to refer to the formulation and implementation and evaluation. According to Suwarsono in Yusendra (2015), strategic management is an attempt to managerial growth of company strength and exploit emerging business opportunities to achieve company goals. According to Rangkuti (2015), a company can develop strategies to overcome external threats and seize opportunities through a process of analysis, formulation and evaluation of various strategies.

III. METHODOLOGY

The method in this study used a case study method (observational case study) with a quantitative approach. It was combined with qualitative and quantitative data input (Mix Method). This study produced qualitative data input (human perception) with a questionnaire to obtain descriptive data namely: finding data, analyzing root causes, and formulating alternative strategies to be a basis for the development of Puncak Mas. Qualitative data was processed into quantitative data using SWOT analysis. The parties specified in conducting the assessment were 1) Puncak Mas Tourism Operations Manager; 2) visitors to tourist attractions; 3) surrounding community.

Data processing and data analysis methods were used EFAS (External Factors Analysis Summary) and IFAS (Internal Factors Analysis Summary) and followed by a SWOT matrix for determining strategic positions in certain quadrants.

IV. RESULT AND DISCUSSION

A. EFAS and IFAS Identification

From the results, it stated that the current condition of Puncak Mas Tourist Attraction through IFAS (Internal Strategic Factors) and EFAS (External Strategic Factors). This result was to view, identify, and evaluate the main strengths, weaknesses, opportunities, and threats in the business functionality area to identify and evaluate the relationships between these areas. Some important internal and external factors (IFAS and EFAS) were as follows:

Table 2. Matrix of IFAS

Internal Factor Strategy	**Weight**	**Rating**	**Rating X Weight**
Strengths			
Interesting and unique tours with natural beauty	0.18	3.73	0.653
Natural beauty coupled with photo spot facilities that attract tourists	0.15	3.40	0.516
The location is close to Bandar Lampung	0.13	3.03	0.389
Affordable prices	0.13	3.27	0.436
Natural panorama for the sunrise in a tourist attraction	0.14	3.00	0.415
Accommodation provided	0.14	3.40	0.487
Natural beauty combined with views of the city of Bandar Lampung	0.13	3.20	0.416
Sub Total	**1.00**		**3.312**

Table 3. Matrix IFAS (Cont'd)

Weaknesses			
Lack of tourism promotion	0.15	2.10	0.323
Lack of the Villa Gardenia Management system	0.14	2.43	0.333
No insurance in covering the safety of tourists visiting tourist attraction locations	0.15	2.40	0.354
Does not collaborate with online-based hotel lodging and travel agents	0.10	2.27	0.216
There are no updated packed of the tour so visitors feel bored	0.16	2.73	0.433
The lack of human resource capabilities in managing tourism objects	0.15	2.53	0.385
Does not have a well-written business plan for the long-term continued development of tourism	0.16	2.10	0.328
Sub Total	**1.00**		**-2.372**
TOTAL			**0.940**

Table 4. Matrix EFAS

External Factor Strategy	Weight	Rating	Rating X Weight
Opportunities			
Increasing number of tourists visiting Lampung province every year	0.17	3.20	0.554
The strategic tourist objects for other tourist objects	0.15	2.90	0.435
The friendliness of society around the tourist attraction to tourists	0.13	2.97	0.372
Lampung provincial government in supporting tourism	0.15	2.80	0.407
Online media as a support for the promotion of business activities	0.18	2.83	0.500
There are many travel agencies as business partners	0.11	2.80	0.314
The location of the tourist attraction is close to the city and shopping	0.12	2.67	0.312
Sub Total	**1.00**		**2.895**
Threats			
Natural disasters that occur suddenly	0.16	3.47	0.564
There are many competitors with the same tourism concept	0.16	2.73	0.428
The growth of new tourist objects by relying on different uniqueness	0.16	3.07	0.499
Inadequate road access leading to tourist attractions	0.12	2.77	0,324
Lack of public facilities available around the attraction	0.09	2,67	0,253
Lack of public transportation that supports tourists to tourist objects	0.15	2.57	0,379
Tourist perceptions related to the safety and comfort of tourist objects	0.15	3.07	0,466
Sub Total	**01.00**		**-2.931**
TOTAL	**-0.035**		

From the tables, it stated that Puncak Mas had a power factor with a total of 3,312. Meanwhile, the weakness with a total of 2,372. It concluded that Puncak Mas tourism had higher strength, compared to its weakness factor. Furthermore, the total weight was multiplied by rating on opportunities with a total of 2,895 and threats with a total of 2,931. It showed that Puncak Mas had not been able to take full advantage of existing opportunities in dealing with various threats.

The SWOT analysis was divided into 4 quadrants. In determining the quadrant, the coordinates of Puncak Mas Tourism must be known. to determine the coordinates used the value of each factor that had been calculated in the IFAS and EFAS tables.

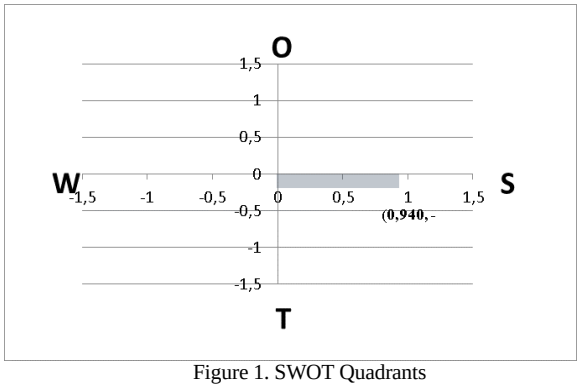

Figure 1. SWOT Quadrants

The figure showed that the results of the SWOT analysis of the Puncak Mas tourist attraction were in quadrant 4, namely the diversification quadrant. It described that Puncak Mas tourist attraction faced threats, but it had internal strength.

The strategy was to use strength to avoid or reduce the impact of external threats by doing a diversified strategy (product/market). Seeing these conditions, it was necessary to diversify from developing and updating more attractive tourism, preserving nature by beautifying the natural beauty of the Puncak Mas tourist attraction, and cooperating with various parties. so, Puncak Mas tourist attraction was ready to face threats and keep pace with other competitors. Based on the analysis above, it showed that the performance of the Puncak Mas tourist attraction was determined by a combination of internal and external factors. The combination of these two factors with the following strategic plan namely:

ST Strategy (Strengths-Threats)

1. Promoting safety and health insurance for visiting tourists
2. Adding photo spot areas to create the characteristic of tourist attractions
3. Promoting the uniqueness of the restaurant menu, live music entertainment, and scenery in the tourist attraction location
4. Empowering the society around the tourist attraction as a local transportation agency to shuttle tourists through an online system.
5. Holding interesting attractions as innovations.

V. CONCLUSION

The result of this study found that Puncak Mas Tourism Object was in the Diversification Quadrant position using the SWOT matrix. It meant that Puncak Mas Tourism Object already had strong internal factors. Nevertheless, Puncak Mas faced a quite problem in external factors. Diversification must be carried out in developing the tourist areas and the tourism renewal to provide innovation, safety, and comfort for the Puncak Mas tourist attraction. Puncak Mas can be done with local communities and make the surrounding attractions that are different fromother. Also the potencial of natural resources around the Puncak Mas is strongly encouraged to be developed as ecotourism.

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REFERENCES

[1] Andayani, Ni Luh Henny. 2014. Manajemen Pemasaran Pariwisata. Yogyakarta. Penebit Graha Ilmu

[2] Fitriani, Dyah And Hendro Setyono. Stretegi Pengembangan Objek Wisata Gembira Loka Zoo Melalui Pendekaan SWOT Analysis. 2021. Jurnal Muhammadiyah Manajemen Bisnis. Vol. 2 No.2.

[3] Kong, Xiao Xiao. Zhang, Lei And Renjuan Tan. 2021. Design of Tourism Marketing Management system Based on SWOT Analysis. China. International Conference on Intelligent Transportation, Big Data & Smart City (ICITBS).

[4] Kotler, Philip And Kevin Lane Keller, 2016 Marketing Managemen 15 Th Edition Pearson Education, Inc.

[5] Kurniawati, Rizky And Novi Marlena. 2020. Analisis SWOT Sebagai Dasar Perencanaan Strategi Pemasaran Pada Agrowisata Belimbing Karangsari Kota Blitar. Surabaya: Jurnal Manajemen Dan Bisnis Indonesia Vol. 6 No.2 Desember 2020 Hal. 191-203.

[6] Lelloltery, Henderina, Rumanta, Maman And Rony Marsyalkunda.202. Strategy for Marine EcotourismDevelopment Based On Natural Resource Management: Case study in Kotania Bay,Western Seram District, Maluku, Indonesia. Nusantara Bioscience. Vol. 13, No. 1, pp. 91-99

[7] Masrin, Indra And Octary Khalis Akmalia. 2019. Strategi Pemasaran Untuk Meningkatkan Kedatangan Wisatawan. Jawa Timur: Jurnal Manajemen Dan Bisnis Indonesia. Vol. 5 No.2

[8] Parta, I Nyoman. 2019. Strategi Pemasaran Paket Wisata Pulau Komodo, Oleh PT. Komodo Cipta Wisata Tour And Travel Di Kuta Bali. Jawa Tengah: Jurnal Rekomen. Edisi April. Volume.2 No.2. Issn 2580-8893 (Print) 2614-2953 (Online)

[9] Sevinç, Sultan And Banu Çiçek. 2021. Evaluation of Amasya City Tourism Planning Using SWOT Analysis. Artvin Coruh University Journal of Forestry Faculty. Vol: 22, Issue:1, Pages: 88-96

[10] Shadegi, Marjaneh Kharra. 2021. A presentation of SWOT strategies for the sustainable tourism development on the Caspian Sea coast of Gilan province, Iran. Anthropogenic Pollution Journal, Vol 5 (2).

[11] Swangjang, Kanokporn And Phitwalan Kornpiphat. 2021. Does ecotourism in a Mangrove area at Klong Kone, Thailand, conform to sustainable tourism? A case study using SWOT and DPSIR. Environment, Development and Sustainability (2021) 23:15960–15985. Springer Nature B.V

[12] Utama, I Gusti Bagus Rai. 2017. Pemasaran Pariwisata. Yogyakarta: Andi Offset

[13] Yan, Zihan And Xiujuan Wang. 2021. Research on the Tourism Development and Countermeasures of Nishan Town—Based on SWOT Analysis. Journal of Service Science and Management . Vol.14 No.4

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Analysis of Factors Affecting Tourists' Visiting Decision on Tourist Destinations in Lampung Province

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Abstract—Lampung was one of the provinces in Indonesia that had great natural, cultural developed tourist attraction potentials. These potentials were seen on beautiful natural panoramas and geographical features including seas, rivers, hills, and mountains that had their own uniqueness and characteristics. Moreover, the diverse cultures and customs were also unique and different from the other provinces in Indonesia. With these conditions, Lampung was able to be developed as a tourist destination, particularly its location that was also very close to the Java Island and the other cities of Sumatra Island. Some of the natural and cultural beauty in Lampung had been developed and successfully became a tourist destination. Tourism spots commercialized in Lampung included beaches and seas with high waves, traditional customs, mountainous nature, forests, rivers with diving and fishing facilities and the other potentials. The problem of this research was the decreasing number of tourists visiting the tourist destinations in Lampung Province. The objective of this research was determining the factors affecting the tourists' visiting decision on the tourist destinations in Lampung Province. In this research, a research model was developed with seven hypotheses that had been formulated. The number of sample of this research was 110 respondents as tourists visiting the tourist destinations in Lampung Province. The method of this research was the PLS-SEM method. The result of this research showed that the the Advertising, the service quality, and the tourist attraction had a significant effect on the tourists' visiting decision; moreover, the variables that had a significant effect on the tourism image were the Advertising and the service quality. In addition, the variable affecting the tourist attraction was also the service quality.

Keywords—*Service Quality, Visiting Decision, Tourism Image, Advertising, Tourist Attraction*

I. INTRODUCTION

The tourism sector was the sector that held an important role in supporting not only the economy of a certain region but also that of the national development. The tourism sector was expected to become a main foreign exchange revenue, other than the non-oil and gas sector. The Directorate General of Culture and Tourism asserted that the development of tourism had to be continued and improved in order to improve the welfare of the people in the context of national development by developing and utilizing national tourism resources and potentials into the economic activities relied upon to increase foreign exchange revenues, expand and equalize the business opportunities from employment (especially for the local community), encourage the regional development, and introduce the nature, values, and culture of the nation."

The tourism activities needed to be increased because it also expanded the employment opportunities and introduced a variety of Indonesian culture and beautiful nature, aside from increasing the country's foreign exchange. Indonesia had a great potential in tourism development because it had a variety of cultures and customs and had a beautiful nature, (Ani et al., 2013).

This tourism sector had a multiplying effect on the industries seen on its capacity in moving and supporting the tourism sector. The other industries were able to move forward on condition that the tourism sector developed well (Bursan, 2006). The industries that were affected by the tourism sector included the hotel, restaurant, handicraft, transportation, and the other industries. As the 18th tourist destination in Indonesia, Lampung province must prepare the tourist facilitations as a tourist destination for both International and domestic tourists. Lampung Province was located near to Jakarta - one of the main entrances for the International and domestic tourists - so that Lampung Province must take advantage of its regional existence. For this reason, a good strategy was needed to introduce this tourism potential to the tourists. The strategy was a tool to achieve company goals in terms of long-term goals, followed-up programs, and resource priorities. In terms of strategic planning, it had the aim of looking at the internal and external conditions objectively so that the company was able to anticipate changes in the external environment. The strategic planning was very important to gain competitive advantages and had products that were in accordance with consumer desires and the support of existing resources (Rangkuti, 2011).

One of the preparations to promote the Lampung Province was through promoting the tourism industry sector because the tourism industry had an important role in the development of the Lampung Province. It showed that the tourism industry was able to boost the underdeveloped areas in Lampung Province as a main source of the regional revenues.

There are seven leading tourist attractions in Lampung Province e.g., Mount Krakatau, Bandar Lampung City (Teluk Betung City and Tanjung Karang City), Kiluan Gulf (a sea gulf with lots of dolphins in Tanggamus Regency), Southern Bukit Barisan, Way Kambas, Tanjung Setra, and

the Siger tower. Teluk Betung and Tanjung Karang that had been merged into a part of the Capital city of Lampung Province had a excellent tourism potential e.g., the regional museum located in the city center, the traditional craft center (Tapis craft), traditional culinary sales center (banana chip), and various art studios. This leading tourism development became well packages of a tourist destination. Moreover, the beaches, seas, traditional houses, lakes, and mountainous natures were usually located far from the capital of Lampung and became an alternative tourism. This alternative tourism was the choice of the other tourist attractions that were able to be the other destinations (Isaac, 2010).

In Lampung Province, there were a lot of alternative tourist attractions, but they were not yet fully explored even though there were adequate, available infrastructures and facilities e.g., taxis, buses, trains, restaurants, lodging, and shopping centers. With these conditions, Lampung had natural and cultural potentials for tourism purposes (Ani et al., 2013)

Table 1
Data of Tourists Visiting Tourist Destination 2016-2020

Type of Visitors	2016	2017	2018	2019	2020
International Tourists	155.053	245.372	274.742	298.063	1.531
Domestic Tourists	7.381.774	11.395.827	13.101.371	10.445.855	2.548.394

Source: Data released by the Regional Office of Tourism and Creative Economy of Lampung Province, 2021

The table 1 informs about the fluctuating number of the tourist visiting each year in Lampung Province. The tourism marketing strategy needed to be prepared to increase the interest and the figure of the tourist visiting the Lampung Province. The Government Regulation No. 50 of 2011 concerning the National Tourism Development Master Plan 2010 - 2025, the tourism marketing was a series of the processes to create, communicate, and deliver the tourism products as well as to manage relationships with the tourists with the aim of developing the tourism and all its stakeholders. The local government had made a strategy for the regional tourism development. On the other hands, this strategy had not been able to provide significant progress in optimizing the existing potential due to the factors affecting the public interest in visiting Lampung Province had not be evaluated. It was expected that the evaluation must be done to get the existing potential optimization and to increase the tourists' visit.

Based on the phenomenon of decreasing number of the tourist visiting the tourist destinations in Lampung Province, it was concluded that the tourists' visiting decision was very low. The problem of this research was "the tourists' visiting decision was decreasing". Therefore, the problem statement was "how could the tourists' visiting decision increasing so that the number of tourists visiting the tourist destinations in Lampung Province increased".

The objectives of this research were:

a. To analyze the effect of the service quality on the tourists' visiting decision tothe touristattraction in Lampung Province.
b. To analyze the effect of the service quality on the tourism image of the touristattraction in Lampung Province
c. To analyze the effect of the service quality on the tourist attraction in Lampung Province
d. To analyze the effect of the tourism image on the tourists' visiting decision to the touristattraction in Lampung Province.
e. To analyze the effect of the tourist attraction on the tourists' visiting decision to the tourist attraction in Lampung Province.
f. To analyze the effect of the Advertising on the tourism image destinationsin Lampung Province.
g. To analyze the effect of the Advertising on the tourists' visiting decision to the tourist attraction in Lampung Province.

II. Review of Related Literature

The visiting decision to the tourist destinations was the decision made by the consumers to determine their intention to purchase the most preferred products so that the consumers truly made a purchase (Kotler and Keller, 2012). Moreover, the indicators to measure the visiting decision were a) the need or desire to travel; b) the information and assessment search;. c) the decision to travel; d) the travel preparation and tourism experiences; and, e) the evaluation of travel satisfaction (Mathieson and Wall, in Sari and Saputra, 2019).

The service quality was the level of expected excellence used to control this level of excellence itself so that customer desires were fulfilled (Moeis and Fahmi, in Tjiptono (n.d); Wyekeoff, 1998). Gronroos (2000) defined that the service quality was divided into two dimensions e.g.,the technical quality (what was delivered to consumers) and the functional service quality (how it was delivered). Besides, Brady and Cronin (2001) stated that the perceived service quality was determined by three dimensions e.g., the outcome quality, the interaction quality, and the physical environment quality.

According to Crilley (2005:97), the quality of tourism services directly depended on hospitality, location attractiveness, local products, and others. The dimensions of the tourism services quality included security, comfort, atmosphere, privacy, respect, friendliness, competence, empathy, reliability, responsiveness, courtesy, and honesty. Rukuiziene (2009:136) mentioned that the perceived tourism service quality was affecting the tourist satisfaction and it always provided the best things for the tourists so that it eventually affected the tourists' intention to re-visit. From the statement above, it concluded that the services quality in the tourism sector was felt from the friendliness, security, comfort, atmosphere, and responsiveness of the public services so that it was able to affect the level of the tourist satisfaction.

Valarie, et al (n.d) and Zeitham et. Al (1996) mentioned that there were five dimensions in determining the service quality e.g., Tangibility, Reliability, Responsiveness, Assurance, and Empathy. The tangibility was defined as a physical form of buildings, front office spaces, the parking spaces, the clean, neat, and comfortable rooms, the complete communication equipment, and the employee appearance. The reliability was defined as a form of the available services that were related to the offered promises. The responsiveness was defined as a response of the employees in helping customers and providing quick and responsive service including the adroitness in handling transactions and

customer needs. The assurance was defined as an ability of employees to foster the consumer belief in the company e.g., competence, courtesy, and credibility. The empathy was defined as a true sense of caring given to consumers e.g., the ease of contacting the customers, the ability to communicate with customers, and the efforts to understand the customer wants and needs (A Parasuraman, 2000).

Effect of Service Quality on Visiting Decision

In Kuntjara's research (2007), the research data was processed through multiple linear regression. The result of this research showed that the service quality had a positive, significant effect on the re-purchase interest. In Adhi's research (2009) the research data was processed through the multiple regression test. The result of this research showed that the service quality had a positive, significant effect on the re-purchase interest. In Fen and Lian's research (2006), the research data was processed through the multiple linear regression. The result of this research showed that the service quality had a positive, significant effect on the re-supporting interest.

Tourism Image

According to Herbig and Milewicz (in Sugihartono, 2009), the image was an award obtained by the company because of the existing advantages within the company e.g., the capabilities possessed by the company so that the company continued to be able to develop and to continue creating things to meet consumer needs.

Dobni and Zinkhan (1990) defined the brand image as a rational and emotional perception of a particular brand. Brand image arose from consumer belief in a particular brand seen on functional and symbolic matter. In addition, Park and Sinivasan (1994) stated that it was necessary to pay attention to the unique characteristics of a product in order to understand better on the brand image. Pitta (195: 54) said that a good brand image was the main thing to determine the target market, define the product position, and explain the market response.

Low and Lamb (in Hendiarti (2009) mentioned that the brand image indicators included friendliness/unfriendliness (easy to recognize), modern/outdated (up to date or outdated models) useful/useless), popular/unpopular (familiar), gentle/harsh (containing smooth texture), artificial/natural (authentic forms). Moreover, Keller (1993:3) also mentioned that factors forming the brand image were the type of brand association, the advantages of brand associations, the strength of brand associations such as friendliness/unfriendliness (easy to recognize), modern/outdated (up to date or outdated models) useful/useless), popular/unpopular (familiar), gentle/harsh (containing smooth texture), artificial/natural (authentic forms).

According to Keller (in Nurmiyati, 2009), the dimensions of the corporate image effectively affected the brand equity - product attributes, benefits and general behavior, people and relationships, values and programs, and company credibility.

Effect of Service Quality on Tourism Image

In Ramadhan's research (2016), it was concluded that the effect of the service quality and the Advertising simultaneously on the visiting decision was 0.604. It meant that the service quality and the Advertising simultaneously had a strong, positive effect on the visiting decision by 60.4%. The remaining variables were affected by the other factors outside of this research by 39.6%.

Tourist attraction

According to Spillane (in Suharsono et al., 2015), the tourism attractiveness was the things emerged from the tourist destination that were able to attract the tourists' attention. There were five important elements in the tourist attraction e.g., (1) attraction or things that attracted the tourists' attention, (2) facilities, (3) infrastructure, (4) transportation, and (5) hospitality. Furthermore, Karyono (1997) mentioned that the tourist destination should also have three attractiveness requirements e.g., (1) there was something to see, (2) there was something to do, and (3) there was something to buy.

Effect on Service Quality on Tourist Attraction

Oliver (in Kusumahadi, 2002) explained that the impression of the service quality received by customers affected the customer behavior. One of the methods that was able to be done was a price collaboration from which the offered price will be more competitive with better service quality so that it was able to attract customers.

Service attractiveness was the starting point to make customers to do purchases on the service products. Powel (2000) described that the principles of the service attractiveness was regarded as an excellent product quality, very competitive prices, and satisfactory service. Furthermore, Kusumahadi (2002) added that the higher the service quality that the customers received, the more attractive the overall service would be. Therefore, it was concluded that the excellent product quality existence, very competitive prices, and satisfactory service was a means for offering value to increase customer acquisition and satisfaction so that it was able to bind customers to remain loyal and attract new customers.

In Susilowati's research (2009) with its title "Building Service Attractiveness and Brand Reputation through Service Quality and Market Alliances at EMKL Companies", the SEM analysis of this research showed that the service quality had a positive effect on the service attractiveness.

Effect of Attraction on Visiting Decision

In Ko and Liu's research with descriptive statistics, the result of this research showed that the tourist attraction had a positive effect on the visiting decision. From this theory and research, the following hypotheses were formulated as follow:

Advertising

Advertising was one of the marketing mixes used by companies to communicate with their market. Advertising was also regarded as a continuous process because it lea to a series of further activities of the company. Soekadijo (In Ramadhan, 2016) said that the tourism marketing had various activities whose purpose was to influence, encourage, and persuade potential tourists as consumers to make decisions to travel. The success or failure of tourism

Advertising was measured by the amount of requested information and the large volume of tourist arrivals who actually bought the promoted tourism products. The indicators that characterized the Advertising were reach of Advertising, quantity of broadcasting the advertisement in Advertisingal media, and quality of advertisement message on Advertisingal media (Kotler and Armstrong, n.d; Kotler, 1996)

Effect of Advertising on Tourism Image

One of the functions of advertising in Advertising activities was creating an image so that people had a certain image about the advertisement (Natalia & Mulyana, n.d.). Likewise, Imaniar (2019) analyzed her research through the quantitative descriptive method. The result of this research was that the Advertising was the most affecting variable on the particular brand images. From this theory and research, the following hypotheses were formulated as follow:

The effect of the Advertising on the customers' visiting decision from Mardiyani & Murwatiningsih's research in 2015 with the title "Effect of Facilities and Advertising on Visitor Satisfaction through Visiting Decision as an Intervening Variable at Tourism Objects in Semarang City" showed that the Advertising had a direct effect on the customer satisfaction at Semarang tourism objects; the decision had a direct effect on the customer satisfaction; and, the facilities and the Advertisings affected the customer satisfaction with the visiting decision as an intervening variable. The conclusion of this research proved that the decision was able to be mediated and it affected the facilities, Advertising, and satisfaction.

In Sarjono's research (2012) with the title "Analysis of the Effect of Marketing Mix Strategy on Purchase Interest of New Product"with the product strategy, the price strategy, the Advertising strategy, and the distribution strategy as the research variables through multiple linear regression, it showed that the Advertising strategy had a positive, significant effect on the re-purchasing interest.

EMPIRICAL THINKING METHODS

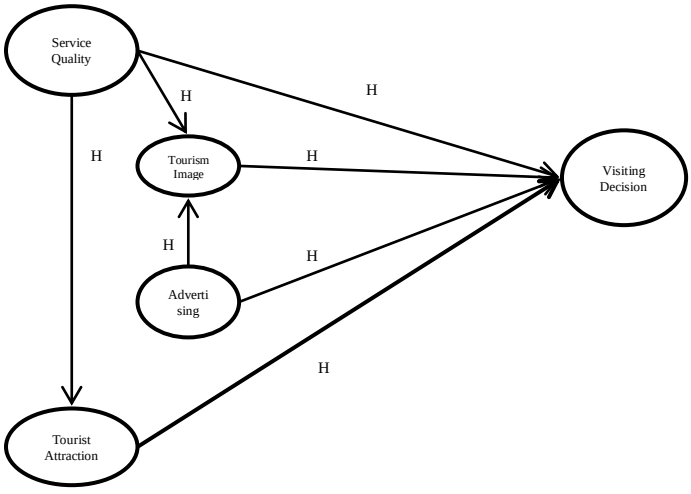


Figure 1 Method of Empirical Thinking
Analysis of Factors Affecting Tourists' Visiting Decision into Tourist Destinations in Lampung Province

III. RESEARCH METHOD

A. Population and Sample

The population in this research were the visitors visiting the tourist destinations in Lampung Province. The number of samples of this research was 110 respondents. These 110 respondents were obtained from the number of questionnaires that had been filled and received from the respondents. The sampling technique used in this research was the Non-Probability Sampling. The type of this sampling was purposive sampling. The criteria of this sampling were: (1) the visitors visiting the tourist destination who had visited at least once, (2) the visitors who were 17 years and above.

B. Data Collecting Techniques

The data was collected by doing observation and distributing questionnaires.

C.Data Analyzing Technique

The data analyzing technique used in this research was PLS-SEM. The analysis stages used PLS-SEM and must at least go through a five-step process from which each stage affected the next stages e.g., 1) Conceptualizing Model, 2) Analyzing Algorithm, 3) Re-sampling Method, 4) Drawing Path Diagram, 5) Evaluating Model (Ghozali and Laten, 2012).

IV. DATA ANALYSIS AND DISCUSSION

A. Descriptive Data of the Respondents

According to the result of the collected data, the number of respondents was 110 with 36 of male respondents and 64 of female respondents. Most of the respondents were graduated from the secondary and tertiary education as a private workers.

B. Validity test

Convergent Validity

The result of all convergent validity values for all variables was that the service quality, the tourism image, the Advertising, the tourist attraction, and the visiting decision had met the requirements with a loading value > 0.50.

Table 2
AVE Value

	***Average variances Extracted* (AVE)**
Service Quality	0,520
Tourism Image	0,584
Advertising	0,756
Tourist Attraction	0,569
Visiting Decision	0,670

Source: WrapPLS Data Processing, 2013

From the table, it was seen that the AVE values for all constructs was greater than 0.5. This meant that all constructs met the AVE requirements and showed a good measure of convergent validity.

Discriminant Validity

According to the output from the Table 3, it was seen that the correlation of the construct of the service quality with its indicators was greater than the correlation of the

indicator of the service quality with the other constructs. Furthermore, the correlation of the construct of the tourism image with its indicators also showed a greater result than the correlation of the indicator of the tourism image with the other constructs. Moreover, the correlation of the construct of the Advertising with its indicators also showed a greater result than the correlation of the indicator of the Advertising with the other constructs. Besides, the correlation of the construct of the tourist attraction with its indicators also showed a greater result than the correlation of the indicator of the tourist attraction with the other constructs. In addition, the correlation of the constructs of the visiting decisions also showed a greater result than the correlations of the indicator of the visiting decision with the other constructs. Therefore, this showed that all constructs had met the discriminant validity criteria which meant that all latent constructs predicting the indicators at their block better than that the indicators of the other blocks.

Table 3
Cross-loading Indicators among the constructs

	Service Quality	Tourism Image	Advertising	Tourist Attraction	Visiting Decision
X1	(0,684)	0,391	0,350	0,372	0,319
X2	(0,847)	0,462	0,415	0,414	0,444
X3	(0,615)	0,398	0,363	0,325	0,484
X4	(0,731)	0,426	0,398	0,300	0,275
X5	(0,696)	0,412	0,378	0,365	0,432
X6	(0,735)	0,529	0,414	0,444	0,447
X7	0,484	(0,810)	0,600	0,489	0,444
X8	0,518	(0,770)	0,415	0,468	0,412
X9	0,452	(0,768)	0,518	0,313	0,423
X10	0,392	(0,705)	0,366	0,405	0,430
X11	0,435	0,515	(0,808)	0,483	0,527
X12	0,476	0,558	(0,894)	0,491	0,550
X13	0,485	0,558	(0,904)	0,544	0,532
X14	0,328	0,453	0,517	(0,825)	0,582
X15	0,468	0,305	0,325	(0,553)	0,203
X16	0,409	0,464	0,456	(0,848)	0,452
X17	0,524	0,532	0,496	0,533	(0,868)
X18	0,370	0,443	0,527	0,493	(0,869)
X19	0,469	0,390	0,494	0,364	(0,707)

Source: WrapPLS Data Processing, 2013

C. Reliability Test

After testing the construct validity, the following test was the construct reliability test measured by two criteria e.g., composite reliability and Cronbach's alpha from the indicator block that measured the construct, a construct was declared reliable if the composite reliability and Cronbach alpha values were more than 0.7.

Table 4
Result of Reliability Test

Construct	Reliability	
	Composite Reliability	***Cronbach's Alpha***
Service Quality (KP)	0,866	0,812
Tourism Image (CW)	0,848	0,761
Advertising	0,903	0,837
Tourist Attraction (DTW)	0,793	0,606
Visiting Decision (MKU)	0,858	0,749

Source: Data processed, 2021

D. Evaluating Structural Model or Inner Model

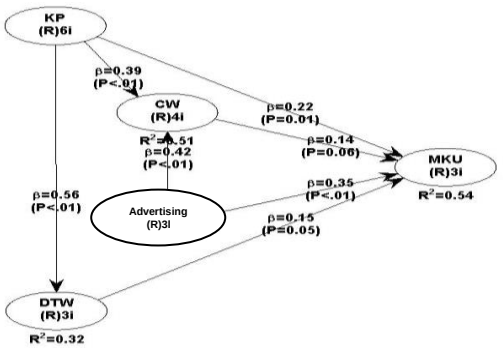
According to the output from the table 5, it was seen that the APC value and the ARS value met the APC and ARS criteria because the p-value ≤ 0.05. In addition, the VIF value was also < 5. Therefore, it was concluded that the overall research model was fit to the data and able to be continued in the next test.

Table 5
***Fit Indices* Model**

	Index	P-value
APC	0,320	< 0,001
ARS	0,457	< 0,001
AVIF	1,910 **(Good if <5)**	< 5

Source: Data processed, 2013

The following below was the figure of the research model with the obtained result through the WrapPLS program:



Source: Data processed, 2013

Figure 2
Empirical Research Model

E. Hypothesis test

Hypothesis Test I

H1: If the service quality was higher, so the visiting decision was greater.

According to the result of the testing hypothesis I through WrapPLS 2.0 between the service quality on the visiting decision, it was found that the service quality (KP) had a positive effect on the visiting decision (MKU) with a regression coefficient of 0.22 and a significant value of 0.01 with an R-squared value of 0.54. It meant that the service quality was able to classify the variations of the visiting decision by 54%. From the result of this test, it was concluded that the hypothesis I was accepted.

Hypothesis Test II

H2: If the service quality was higher, so the tourist attraction image was better.

According to the result of the testing hypothesis II through WrapPLS 2.0 between the service quality and the tourism image, it was found that service quality (KP) had a positive effect on the tourism image (CW) with a regression coefficient of 0.39 and a significance value of < 0.01 with an R-value squared of 0.51. It mean that the service quality was able to classify variations of the tourism image by 51%. From the result of this test, it was concluded that the hypothesis II was accepted.

Hypothesis Test III

H3 : If the the tourist image was better, so the visiting decision was greater.

According to the result of the hypothesis testing III through WrapPLS 2.0 between the tourism image on the

visiting decision, it was found that the tourism image (CW) had a positive effect on the visiting decision (MKU) with a regression coefficient of 0.14 and a significant value of 0.06 with an R-squared value of 0.54. It meant that that the tourism image was able to classify the variations of the visiting decision by 54%. From the result of this test, it was concluded that the hypothesis III had a positive effect, but did not meet the requirements for probability of < 0.05. Therefore, it was concluded that hypothesis III was rejected.

Hypothesis TestIV

H4 : If the service quality was higher, so the tourist attraction was better.

According to the result of the testing hypothesis IV through WrapPLS 2.0 between the service quality and the tourist attraction, it was found that the service quality (KP) had a positive effect on tourist attraction (DTW) with a regression coefficient of 0.56 and a significant value of <0.01 with a value of R-squared of 0.32. It meant that the service quality was able to classify the variations of the tourist attractions by 32%. From the result of this test, it was concluded that the hypothesis IV was accepted.

Hypothesis Test V

H5: If the tourist attraction was better, so the visiting decision was greater.

According to the result of the testing hypothesis V through WrapPLS 2.0 between the tourist attractions on the visiting decision, it was found that tourist attraction (DTW) had a positive effect on the visiting decision (MKU) with a regression coefficient of 0.15 and a significant value of 0.05 with an R value-squared of 0.54. It meant that the service quality was able to classify the variations of the visiting decision by 54%. From the result of this test, it was concluded that the hypothesis V was accepted.

Hypothesis Test VI

H6: If the Advertising was better, so the tourism image was greater.

According to the result of the testing hypothesis VI through WrapPLS 2.0 between the Advertising on the tourism image, it was found that the Advertising had a positive effect on the tourism image (CW) with a regression coefficient of 0.42 and a significant value of < 0.01 with an R-squared value of 0.51. It meant that the service quality was able to classify the variations of the visiting decisions by 51%. From the result of this test, it was concluded that the hypothesis VI was accepted.

Hypothesis Test VII

H7: If the Advertising of a tourist attraction was better, so the visiting decision was greater.

According to the result of the testing hypothesis VII through WrapPLS 2.0 between the Advertising and the visiting decision, it was found that the Advertising had a positive effect on visiting decisions (MKU) with a regression coefficient of 0.35 and a significant value of < 0.01 with an R-squared value of 0.54. It meant that the service quality was able to classify the variations of the visiting decision by 54%. From the result of this test, it was concluded that the hypothesis VII was accepted.

Discussion

The result obtained from the data processing using the WrapPLS 2.0 program showed that promoting the tourist destination was able to be done in order to increase the visiting decision to the tourist destination. This was in line with the Soekadijo's research (2000: 253) that the success of the Advertising and the publication was seen on:

(1) the greater flow of tourist arrivals, (2) the longer duration of the tourists staying in the promoted area, (3) the greater expenditure of the tourist, (4) the greater tendency of the tourists to re-visit the same tourism spots, and (5) the improvement of the quality, quantity, and the reach of the Advertising of the tourist destinations in Lampung Province. Furthermore, the visiting decision was also be improved directly through improving the service quality itself which was in line with Li and Lee's research (2001) that the customers had an interest in reusing the services of the same provider through high quality."

The improvement process of this service quality was able to be done by improving the security system, providing convenient spaces, being friendly and polite, and being more responsive and empathetic to the tourists who visited the Lampung Province. In addition, the visiting decision was also improved through the existence of the tourist attraction. The more attractive of the tourist attraction was, the higher the visiting decision of the tourists would be. It was in line with Ko and Liu's research that the tourist attraction had a positive effect on the visiting decision.

V. Conclusion and Implication

There are seven hypotheses proposed in this research, the six hypotheses was accepted and one hypothesis was rejected. The conclusions of the seven hypotheses were as follow

A. Conclusion on Hypothesis I

From the result of this research, it showed that the service quality had a positive, significant effect on the increasing tourists' visiting decisions. It was supported by Ramadhan's research (2016) that the service quality had a significant, positive effect on the visiting decision to the tourist attraction.

B. Conclusion on Hypothesis II

From the result of this research, it showed that service quality had a positive, significant effect - it was able to improve a good image of the tourist spots. It was because the high service quality led the tourist satisfaction and encouraged the tourists to reflect the positive things so the tourism image improved. It was supported by Wibowo, Gaffar, and Yuniawati's research (2006) that the service quality affected the image of the Jakarta Recreation Park. Moreover, it also supported Rahma's research (2007) that service quality had a positive effect on the brand image.

C. Conclusion on Hypothesis III

From the result of this research, it showed the tourism image had no positive, significant effect on the visiting decision. This hypothesis was not in line with the research finding belonging to Adhi (2009); Andriadi and Untarini

(2013) that the company image had a positive, significant effect on the visiting decision.

D. Conclusion on Hypothesis IV

From the result of this research, it was found that the service quality had a positive, significant effect on the tourist attraction. This finding was supported by Powell's research (2000) that the service attractiveness principles was an excellent product quality embodiment, very competitive prices, and satisfactory service.

Furthermore, it was also in line with Kusumahadi's research (2002) that the higher the service quality that the customers received, the more attractive the overall service would be. Therefore, it was concluded that the excellent product quality existence, very competitive prices, and satisfactory service were a means for offering values to increase the customer acquisition and satisfaction so that it was able to bind the customers to remain loyal and attract new customers.

Moreover, this finding was also supported by Susilowati's research (2009) that the service quality had a positive effect on service attractiveness.

E. Conclusion on Hypothesis V

From the result of this research, it was found that the tourist attraction had a positive, significant effect on the visiting decision. This meant that the attractiveness led to the higher visiting decisions. This hypothesis was supported by Ko and Liu's research with the results that the tourist attraction had a positive effect on visiting decisions.

F. Conclusion on Hypothesis VI

From the result of this research, it was found that the Advertising had a positive, significant effect on the tourism image. This was because a good Advertising created a good tourism image among the people.

This finding was not supported by Sudarmiatin's research (2008) with the result that there was no significant effect between the natural tourism object advertising on the consumer image due to internal factors and external factors. The Internal factors were inappropriate type of the Advertising, the Advertisingal media, the duration of the Advertising, the frequency of the Advertising, the content of the Advertisingal messages, the Advertising actors, and the others. External factors were consumer characteristics.

G. Conclusion on Hypothesis VII

From the result of this research, it showed that the Advertising had a significant effect on the visiting decision. It was supported by the Kurniawan, et al's research (2008) that the Advertising intensity had a positive effect on the re-purchasing interest. Moreover, it was also supported by Sarjono's research (2012) that the Advertisingal strategies had a positive, significant effect on the higher repurchasing interest.

Furthermore, the obtained result using the WrapPLS 2.0 program also answered the problem statement of this research as follow:

Firstly, the visiting decision was able to be improved by increasing the Advertising activities in terms of improving quality, quantity and reach activities. The questionnaire result of the Advertising of the tourism destination showed that there was still a lack of Advertising carried out by the Lampung Province in terms of introducing the tourism potential as a tourist destination. This was because the Advertisings that had been done so far had not reached all circles of society so that there were still a few of people who did not know more about the tourist destinations in Lampung Province.

Secondly, the visiting decision was able to be improved in line with improving the service quality as well through the evaluation of the security, comfort, friendliness, courtesy, responsiveness, and empathy of the tourist destination managers in Lampung Province. The questionnaire result on the service quality of the tourist destinations showed that the service quality at the tourist destinations was good and able to influence the tourists' visiting decision.

Thirdly, the visiting decision was able to be improved through the tourism image by boosting the service quality. From the result of the analysis, it showed that the good service quality created a good image. However, the image did not necessarily increase the tourists' visiting decision because there must be an initial direct influence that was felt by tourists so that the visiting decision was increasing.

Fourthly, the visiting decision was able to be improved through the tourist attraction by boosting the service quality. The result of the analysis showed that the good service quality was an attraction from the tourist attraction. The attractiveness of the tourist destinations was quite good, but it still did not show the personality of the Lampung Province.

Future Research Agenda

The result of this research has the limitations so that it is expected that there is further researches to develop this research for the future. Moreover, this study is able to be used as a source of ideas and input for the researchers. The suggestions of this research were:

1. The future researches are able to continue this research by looking at the limitations of this research through eliminating or replacing variables, especially from the rejected hypothesis of this research.
2. The future research can add intervening or intermediate variable which had a greater impact.

REFERENCES

[1] Parasuraman, D. G. (2000). The impact of technology on the quality-value-loyalty chain: a research agenda. *J Acad Mark Sci*, *28*(1), 168–174.

[2] Ani, O., Balai, R., Nilai, P., & Bandung, B. (2013). POTENSI WISATA DI LAMPUNG DAN PENGEMBANGANNYA THE POTENCY OF TOURISM IN LAMPUNG AND ITS DEVELOPMENT. *Maret*, *5*(1), 148–162.

[3] Bursan, R. (2006). Analisis Pengaruh Dimensi Wisata Terhadap Loyalitas Wisatawan (Studi Kasus Di Propinsi Lampung). *Bisnis Dan Manajemen*, *3*(1), 1–13.

[4] Isaac, R. K. (2010). Alternative tourism: New forms of tourism in Bethlehem for the Palestinian tourism industry. *Current Issues in Tourism*, *13*(1), 21–36. https://doi.org/10.1080/13683500802495677

[5] *Kotler On Marketing - Philip Kotler - Google Buku*. (n.d.). Retrieved December 27, 2020, from https://books.google.co.id/books?hl=id&lr=&id=iHWxeT7X5YYC&oi=fnd&pg=PT7&dq=marketing+philip+kotler&ots=ei4TvX3FJ

R&sig=ru7AoIULDGlW9aV_BdheUsy3vVY&redir_esc=y#v=onepage&q=marketing%20philip%20kotler&f=false
[6] Mardiyani, Y., & Murwatiningsih, M. (2015). Pengaruh Fasilitas dan Promosi terhadap Kepuasan Pengunjung melalui Keputusan Berkunjung sebagai Variabel Intervening pada Objek Wisata Kota Semarang. *Management Analysis Journal*, *4*(1). https://doi.org/10.15294/MAJ.V4I1.7220
[7] Natalia, P., & Mulyana, D. M. (n.d.). *Pengaruh Periklanan Dan Promosi Penjualan Terhadap Keputusan Pembelian*.
[8] *Principles of Marketing - Philip Kotler, Gary Armstrong - Google Buku*. (n.d.). Retrieved December 27, 2020, from https://books.google.co.id/books/about/Principles_of_Marketing.html?id=ZW2u5LOmbs4C&redir_esc=y
[9] *Problems and Strategies in Services Marketing - Valarie A. Zeithaml, A. Parasuraman, Leonard L. Berry, 1985*. (n.d.). Retrieved January 2, 2021, from https://journals.sagepub.com/doi/full/10.1177/002224298504900203
[10] Ramadhan, F. (2016). PENGARUH KUALITAS LAYANAN DAN PROMOSI TERHADAP KEPUTUSAN BERKUNJUNG KE TEMPAT WISATA PANTAI SAMUDERA BARU. *Value : Journal of Management and Business*, *1*(1). https://journal.unsika.ac.id/index.php/value/article/view/459
[11] Rangkuti, F. (2011). *Swot Balanced Scorecard; Teknik Menyusun Strategi Korporat yang Efektif plus cara Mengelola Kinerja dan Resiko*. http://r2kn.litbang.kemkes.go.id:8080/handle/123456789/63940
[12] Sari, N., & Saputra, M. (2019). Pengaruh Intensity, Valence Of Opinion, Conten Terhadap Keputusan Wisatawan Berkunjung Ke Objek Wisata Di Provinsi Lampung. *Ekuivalensi*, *5*(1).
[13] Suharsono, S., Prasadja, H., & Pong, T. (2015). UPAYA MENINGKATKAN KUNJUNGAN WISATAWAN KE OBYEK DAN DAYA TARIK WISATA (ODTW) DI TANJUNG PASIR, TANGERANG, BANTEN. *Prosiding SNaPP: Sosial, Ekonomi Dan Humaniora*, *5*(1), 261–268. http://proceeding.unisba.ac.id/index.php/sosial/article/view/353
[14] Tjiptono, F. (n.d.). *Pemasaran Jasa*. Retrieved December 28, 2020, from http://repository.pelitabangsa.ac.id/xmlui/handle/123456789/1727
[15] Yeni Imaniar, H. (2019). POTENSI MEDIA SOSIAL SEBAGAI SARANA PROMOSI INTERAKTIF BAGI PARIWISATA INDONESIA. *Pusat Penelitian Dan Pengembangan Kebijakan Kepariwisataan Kementerian Pariwisata Dan Ekonomi Kreatif*, *1*(1).