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Data Visualization and Sales Prediction of PD. Asia Agung (Ajinomoto) Pontianak in 2019

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Abstract—**PD. Asia Agung Pontianak is the only official distributor of Ajinomoto in the West Kalimantan region. Every year this company needs to find out the amount of turnover that will be obtained in the coming year. Unfortunately, the company only makes predictions using the average income from each year which is very less accurate. This research is conduct to create visualizations and predictions using multiple linear regression methods to predict the turnover obtained in the coming year. Multiple linear regression is a regression analysis method that can use more than 2 variables in the prediction process which is divided into 2 parts, namely the dependent variable and the independent variable. The results obtained in this research are prediction results in 2019 using data from 2010 to 2018 as a basis. Prediction results show that the longer the data used the smaller the error rate obtained. The original data from the company is visualized using a dashboard on tableau software so that the data could be easier to analyze by the company.**

Index Terms—**data visualization, multiple linear regressions, prediction, tableau**

I. INTRODUCTION

PD. Asia Agung is the only official sole distributor that sells products from AJINOMOTO in the West Kalimantan region [1]. To find out the history of the company, interviews were conducted with the company. Based on the result of interview with one of the admin and finance heads, it is known that the company had financial information about company turnover data for 2010-2018. This company has been established since the 1960s and started marketing AJINOMOTO's official products in the 1970s. PD. Asia Agung is a family business and now the owner has entered the 3rd generation, under the leadership of Mr. Wiyan as the son of Mr. Agus Amin. Under the leadership of MrWiyan, the company is rapidly growing which make company's revenue increase quite rapidly too. Mr. Wiyan also wanted to find out the turnover for each year, where the admin and finance section made predictions based on the average

increase in total turnover each year but the company felt it was less accurate.

Therefore, research will be conducted in the form of visualization and prediction of sales turnover data from PD. Asia Agung Pontianak. Based on the data obtained from the company, this study will predict using the Multiple Linear Regression method which is usually used in prediction or forecasting which is prepared on the basis of the pattern of relevant data relationships in the past which is assisted by using SPSS tools in data processing [2]. In the regression method generally predictable variables such as the sale or demand for a product, expressed as the dependent variable, this variable is influenced by the magnitude of the independent variable [2]. In order to make data easier to analyze, this research will visualize using Tableau software.

II. THEORETICAL BASIS

A. Definition of Prediction

Prediction is a process of systematically estimating something that is most likely to occur in the future based on past and present information that is owned, so that errors can be minimized [3].

Forecasting is a combination of art and science in estimating the situation in the future, by projecting the data of the past into the future using mathematical models and subjective estimates [4].

Based on the techniques used to predict, predictions can be divided into two parts, qualitative predictions and quantitative predictions [5]:

1. Qualitative Prediction
   Qualitative predictions are based on qualitative data in the past. Qualitative methods are used if past data from variables that are predicted to be non-existent, not enough or less reliable. The results of predictions are very dependent on the

individual who composed them. This is important because the results of the prediction are determined based on judgment thoughts or opinions, knowledge and experience from the constituents. Therefore, this qualitative method is also called judgment, subjective, intuitive.

2. Quantitative Prediction

Quantitative predictions are based on quantitative data in the past. Predictions made are very dependent on the method used in the prediction. With different methods different prediction results will be obtained. The thing that needs to be considered from the use of these methods is whether or not the method used is very good and is determined from the deviation between the results of the prediction and the reality that occurs. A good method is a method that provides possible values of differences or deviations. Quantitative predictions can only be used if there are three conditions as follows: There is information about other circumstances, the information can be quantified in the form of data, it can be assumed that the previous pattern will be sustainable in the future.

B. *Prediction Methodology*

Multiple Linear Regression can be used in prediction or forecasting which is arranged on the basis of the pattern of relevant data relationships in the past. In regression methods generally predictable variables such as sales or demand for a product, expressed as dependent variables, this variable is influenced by the magnitude of the independent variable [2]. Multiple linear regression can be calculated based on:

$$\hat{Y} = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots + \beta_i X_i \qquad (1)$$

$\hat{Y}$ = Predict the value of dependent variable

β_0 = Constant (fixed value)

β_i = Regression weight (coefficient) for the I independent variable

X_i = I Independent variable

B.1 Decision Tree

Decision Tree is a tree structure, where each tree node represents the tested attribute, each branch is a distribution of test results, and leaf nodes represent certain class groups. The top level node of a Decision Tree is the root node (root) which is usually the attribute that has the greatest influence on a particular class. In general, Decision Tree performs a top-down search strategy for the solution. In the process of classifying unknown data, the attribute value will be

tested by tracking the path from the root node (root) to the end node (leaf) and then predicting the class that belongs to a certain new data [6].

B.2 Time Series

Time Series are events that occur based on certain times in sequence. Forecasting in time series is a prediction for the occurrence of events that will occur in the future based on previous data [7].

C. *Definition of Visualization*

Data visualization has three criteria, namely (1) the process is based on qualitative and quantitative data, (2) produces output derived from initial data, and (3) output can be read by use and supports the process of exploration, inspection, and data communication [8]. The main purpose of data visualization is to communicate information clearly and effectively in a graphical way. Not that the visualization of data must look boring so that it works or is very sophisticated in order to look attractive [9].

D. *Visualization Methodology*

Some methodologies that can be used to create dashboards developed by several vendors include:

1. Visualization of Data Mining

Visual Data Mining is a technique that can be done with repetitive processes [10]. Visualization of data mining has 3 stages, namely: [11]

a. Project Planning Phase

The stage will explain how visualization of this research can help in analyzing business, understanding of data and decision makers and explaining what tools to use.

b. Project Preparation Phase

This stage will explain how data were obtained, selected, processed, or changed. Data must be valid to be used.

c. Project Analyze Phase

The stage will explain how to choose the right tools based on the analysis that has been done and enter the visualization model analysis process.

2. Noetix

Noetix makes a methodology by trying to balance the needs of users with the capabilities of developers [12]. The stages in the noetix method [13]: a. Planning at this stage is the establishment of a project team and the determination of the parties who sponsor and are responsible for the project. b. Identify needs and design prototypes Identification of needs is done to determine the needs and desires of key stakeholders

on the dashboard to be built. c. The design complements the main aspects of the design needed such as smoothing the user interface, ensuring data sources, determining how to get data if data is not available in the database, defining queries, and determining drill-down paths. d. Implementation and validation of front end Implementation, which is the design of the form of a dashboard interface, such as graphs / charts, alerts, and navigation for drill-down paths. Query implementation, which is a query design to retrieve information from the database. Schedule configuration, update, and security. Queries are configured to be able to deliver information regularly, to ensure that the contents of information on the dashboard are always up-to-date. Security rules are also applied to ensure the security of the information presented. Dashboard validation is a testing process that is carried out to ensure that the dashboard produced is in accordance with the requirements specifications in the project plan. e. Deployment and Maintenance Implement the dashboard in its operational environment and subsequently the maintenance process to ensure that the dashboard functions remain in accordance with the needs of the organization.

3. Pureshare

This Pureshare methodology places an emphasis on the balance between business objectives and organizational technology needs as seen from the performance development metrics, the design of this system is done using a top-down and bottom-up approach [12].

The stages contained in the pureshare methodology [13]:

a. Planning and design stage highlights

This stage is led by a business analyst, focused on designing a top-down approach to business and meeting end user needs, as a metric interface and to identify how these metrics are used.

b. System and data review highlights

This stage is carried out by planning and designing a bottom-up implementation approach, namely by controlling the system and identifying data sources, by developing the quality of these metrics.

c. Prototype stage highlights

At this stage, top-down and bottom-up approaches are carried out together. The prototype is built as quickly as possible to provide a final picture that resembles the dashboard system that will be created.

d. Refinement stage highlights

At this stage, a series of prototypes that have been created will be reviewed together with users to gather feedback to be developed and adapted to the needs of users.

e. Release stage highlights

At this stage, the dashboard that has been implemented is socialized to all users through training. Continuous improvement is the key point. This stage is used to build dashboards in various organizational areas repeatedly.

f. Continuous improvement

At this stage the pure share methodology for proactive performance metrics has long been developed and has been disseminated to industries and companies, it is intended to obtain results directly and extend the life of metric management and project management performance of the project.

E. Prediction Tools

E.1 IBM SPSS Statistics

SPSS Statistics® is a leading statistical software that can be used to solve various business and research problems. SPSS provides a variety of techniques including ad-hoc analysis, hypothesis testing and reporting to make SPSS easier to manage data, select and do analysis, and share the results of calculations. New features include Bayesian statistics, graphs ready for publication and increased integration of third party software. SPSS Statistics offers a basic edition with optional add-ons to expand predictive analytic capabilities [14].

E.2 SAS Enterprise Miner

SAS Enterprise Miner is an integrated software system that makes it possible to create highly accurate predictive and descriptive models based on analysis of large amounts of data from all companies [15].

F. Visualization Tools

F.1 Microsoft Power BI

Power BI is one of the tools owned by Microsoft that can function to do Data mining, cleansing or visualization.

Power BI is a business analysis solution that makes it possible to visualize data and share your views across an organization, or put together in an application or website. And can be connected to hundreds of data sources and can create data in dashboards and reports directly [16].

F.2 Tableau Software

Tableau is the most powerful, safe and flexible end-to-end analysis platform for your data. Attract people with the power of data. Designed for individuals, but enhanced for companies, Tableau is the only business intelligence platform that turns your data into insights that drive action [17].

III. RESEARCH METHODOLOGY

A. Research Object

PD Asia Agung is a trading company engaged in selling food flavorings, PD Asia Agung is the sole distributor of products with the Ajinomoto brand in the West Kalimantan region. The form of the business is individuals. This individual business means the owner is responsible and fully controls the running of the business. In carrying out its business, PD Asia Agung has obtained a business license from the Regional Office of the Ministry of Trade of West Kalimantan with a Trade Business License (SIUP) No. 510.001/92/295/DPP.

B. Data Collection

Data collection is obtained directly from the Head of Admin and Finance of PD. Asia Agung (AJINOMOTO) Pontianak West Kalimantan. In detail the data obtained is as follows:

1. Sales revenue turnover of 5 products AJINOMOTO, MASAKO, Sajiku Tepung Bumbu, Sajiku Tepung Praktis, and SAORI per Regency or city on a monthly basis from 2010-2018.

2. Data Salesmen who work in each district in West Kalimantan.

3. Predictive target data from the company for each year starting from 2011.

C. Prediction Methodology

In this study we will use the Multiple Linear Regression method because the data is a series of data from previous years. Where data also has more than two interconnected variables. To predict the turnover value of PD. ASIA AGUNG (AJINOMOTO) Pontianak can use turnover variables and products which data will be included later using SPSS tools.

The variables used for the formula of multiple linear regression $\hat{Y} = \beta0 + \beta1X1 + \beta2X2 + \beta3X3 + ... + \beta iXi$ are:

1. Total turnover as dependent variable

2. 5 independent variables: Ajinomoto, Masako, Saori, Sajiku Tepung Bumbu, Sajiku Tepung Praktis

D. Visualization Methodology

Data visualization aims to determine what information will be visualized in accordance with the problem statement. In this study the information to be visualized is related to sales data and turnover of each product of the Asia Agung Trading Company (AJINOMOTO) Pontianak, using Tableau Software that will be visualized with graphical forms using the Visualization Data Mining method because VDM has a complete work process, clearly, and structured so that it is easy to understand.

E. Prediction Tools

The SPSS tool will be used to make predictions, because it is already widely used in universities and has a good display for documentation and is easy to use for people who are not experts in statistics.

F. Visualization Tools

Visualization will use Tableau tools, because it is more accessible and simpler to use, but has complex results on the results of visualization. It will use a number of charts to help with the translation of data using line charts and bar charts.

G. Framework of Thinking

The mindset is the flow of the author's thoughts which is used as the rationale to strengthen the indicators underlying this research so that the problems raised in the formulation of the problem can be resolved. The mindset in this study is divided into 2 parts, namely:

1. Prediction

   In the prediction framework, it is explained from where the data for predictions is obtained from where and in what form. After that, the data that has been obtained then the data is processed to simplify the process in SPSS then the results from SPSS can be used to predict by entering the results into the Multiple Linear Regression formula.

2. Visualization

   The visualization framework is explained directly using the steps of Visualization Data Mining, namely starting from determining the type of project to be used, identifying problems, selecting data to be used for visualization, changing data so that it can be entered into tableau tools, ensuring data is correct, selecting tools that will be used, what will be displayed on the dashboard, and also display the results of the visualization.

IV. ANALYSIS AND RESEARCH RESULT

A. Data Collection for Prediction

PD Asia Agung (Pontianak) data was given by email after conducting an interview to the head of the admin and finance department, the data provided was in the form of excel data. The data contains sales turnover of 11 regions for 5 products, namely Ajinomoto, Masako, Sajiku Tepung Bumbu, Sajiku Tepung Praktis, and Saori in West Kalimantan from 2010-2018 and also predictive data from the company.

B. Change Data

The data is converted into data containing the total number of product turnover per month. Changing the data by adding up the income each month so that it will be easy to use later on SPSS.

C. Prediction

In this study, the level of accuracy was carried out first by comparing the prediction error rate using data every 1 year to 8 years. From research in looking for predictive error rates, Table I is obtained. Analysis of comparison is shown below:

TABLE I. ANALYSIS OF COMPARISON

Lots of Data Used	Prediction Error Average Results (%)
Data every 1 year from 2010-2018	9,17%
Data every 2 years from 2010-2018	8,52%
Data every 3 years from 2010-2018	8,55%
Data every 4 years from 2010-2018	8,35%
Data every 5 years from 2010-2018	7,64%
Data every 6 years from 2010-2018	8,12%
Data every 7 years from 2010-2018	6,07%
Data every 8 years from 2010-2018	4,33%

From the table above, can be concluded that if predicting using data with a long series of times can make the average error in predictions every year tend to be smaller or predictive, tend to be more accurate. Then from the results of the analysis obtained a comparison of the results of company predictions with the results of the analysis can be seen in Table II.

TABLE II. COMPARISON WITH COMPANY'S DATA

Lots of Data Used	Prediction Error Average Results	Prediction Error Average Result from

	(%)	PD. Asia Agung
Data every 8 years from 2010-2018	4,33%	5,10%

In the proses of predicting data for 2019, the data processing will be conducted using data from 2010-2018. The data will be processed using SPSS, and the result are shown below:

a. Table Variable Entered/Removed

The table below describes the variables that are inputted and deleted, in this variable entered / removed table can be seen there are 5 variables that were successfully inputted and 0 variables deleted.

Fig. 1. Variable entered/removed

b. Table Model Summary

The Model Summary table below explains the determination coefficients obtained by R-square = 1. This shows that 100 percent of the variation in dependent (Y) can be influenced by 5 independent variables, meaning that the influence of the independent variable is 100%.

Fig. 2. Table model summary

c. Table Coefficients

In the coefficients table below, we can see the constant value of -0.3371 which will become β_0 in the multiple linear regression formula and the value of 1 in the ajinomoto, masako, STB, STP, and Saori will be β_1, β_2, β_3, β_4, β_5 in multiple linear regression formulas.

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.371	72.200		-.005	.996
	Ajinomoto	1.000	.000	.411	53311970.99	.000
	Masako	1.000	.000	.457	39621545.35	.000
	STB	1.000	.000	.114	8892685.709	.000
	STP	1.000	.000	.027	2382506.290	.000
	Saori	1.000	.000	.023	2345839.740	.000

a. Dependent Variable: Omset Total

Fig. 3. Table coefficients

After that, a prediction calculation for 2019 is carried out using actual product data 2018.

The multiple linear regression equation is:

$$\hat{Y} = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots + \beta_i X_i$$

$$\hat{Y} = -0{,}371 + (1 * 112227257820) + (1 * 99048536549) + (1 * 21221374611) + (1 * 5035384039) + (1 * 4656462252)$$

Prediction calculation is done for 2019 by using 2018 product data as X Prediction turnover for 2019 after being included in the multiple linear regression equation using data from 2010 to 2018 above is Rp. 242,189,015,270.

d. Visualization

The visualization process will use visual data mining methods using Tableau tools software and data from Microsoft Excel.

1) Justify and Plan The Project

The first step is to determine the type of project that will be used for visualization. The type used is a pilot visual data mining project type which aims to analyze and answer the problem formulation of this research.

2) Identify The Top Business Questions

The second step is to identify the problem faced to get an answer. In this study we will find out the prediction of turnover in 2019 in PD. Asia Agung Pontianak and visualize turnover data for each product from 2010-2018 data.

3) Choose The Data Set

The third step is to select the data to be visualized, data obtained from PD. Asia Agung Pontianak and also the results of predictions that have been made before.

4) Transform The Data Set

The fourth step is the data used for predictions is the monthly data provided by the company but are combined into 1

sheet named "for tableau visualization" and also the data in the annual format.

5) Verify The Data Set

In the fifth step, check the data used for the application tableau software so that there is no error.

6) Choose Visualization Tools

At the sixth step is to choose the tools that will be used. In this study using the Tableau Software application obtained from the official tableau website for free.

7) Analyze The Visualization Model

In the seventh step is to analyze what will be displayed on the dashboard. The data that will be displayed at this stage is the development of each year each month and the annual turnover data growth.

8) Verify and Present The Visualization of Mining Model

After all data is entered and arranged in tableau, it will be used to create the dashboard using the chart available in Tableau, and produce the dashboard as shown below.
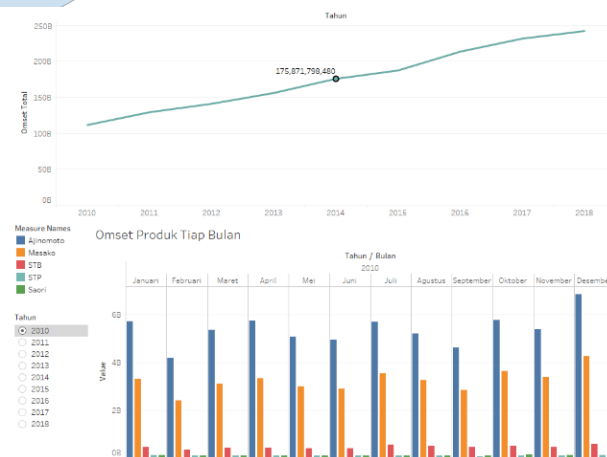

Fig. 4. Results of turnover data visualization dashboard in 2010-2018

V. CONCLUSION

This study aims to predict and visualize the turnover of companies using data from 2010-2018. The data consists of several columns consisting of months, places, total turnover, Ajinomoto, Masako, Sajiku Tepung Bumbu, Sajiku Tepung Praktis and Saori which are then converted to visualize in Tableau.

The results of the modified data are used for predictions using the Multiple Linear Regression method. The results of the research are:

1. Using the longer series of years data will make the results of error predictions decrease.

2. The result of the prediction amount for 2019 is Rp. 242,189,015,270.

3. Visualization is used to display how the development of turnover every month in each company in using real data from the company so that it can help facilitate the company in viewing and analyzing data on the company's turnover development each year.

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iBudaya: Indonesian Culture Portal Based on Software as a Service (SaaS)

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Abstract—The society of Indonesia faces problem of cultural crisis, especially the younger generation who prefer foreign culture rather than the local culture. This research aimed to find a way to conserve local culture by combining local culture with the development of information and communication technology. The method used in this study is content crowdsourcing because it requires the help of all society member to fill the content and data that will be managed later in large volumes. Therefore, it will use cloud computing, Software as a Service (SaaS). This research has successfully developed a portal called ibudaya that can accommodate cultural values and local wisdom in the form of multimedia content, such as in the format of video, pictures, pdf, Word, and Power Point. This research has successfully developed a portal that can accommodate cultural values and local wisdom in the form of multimedia content. The cultural portal can be accessed through the link address http://iBudaya.applikasi.online/. This portal will be further refined in terms of cultural content procurement, where the content is in the form of videos, pictures and folklore texts.

Index Terms—cultural portal, ibudaya, software as a service

I. INTRODUCTION

Minister of Home Affairs of Republic of Indonesia Tjahjo Kumolo stated that the Indonesian nation is currently facing a cultural crisis [1]. Additionally, if not immediately enforced efforts to 'form' explicit national identity and national awareness, then the Indonesian nation will face the destruction [1]. This opinion is also reinforced by Renita Sari Adrian, an observer of Indonesian culture. She said Indonesia does not have a place that Indonesia really in the center of Jakarta, whereas Indonesia is rich with culture [2]. Likewise with the opinion of an Indonesian entertainer, Irfan Hakim. Irfan regretted the lack of prestige of young generation towards indigenous culture of Indonesia [3]. Whereas foreign cultures are very easy to spread in Indonesian society, especially the younger generation [3].

According to a culturist Emha Ainun Nadjib, one of the serious problems of a nation is the faded and alienated culture of the nation itself. Related to the current cultural crisis in Indonesia, there are two groups of Indonesian society. First are those who easy to become western. Secondly, and the second are those who easily become Arabs. The culture of our nation seems to be a foreign things for our own nation, away from us. This nation is in a cultural crisis [4]. Yet according to the Minister of Home Affairs of pluralistic Indonesian people, it is a fact that must be seen as a national asset, not a risk or a burden. The people is a national potential that must be empowered, enhanced its potential and productivity of physical, mental, and cultural [1].

Professor of Anthropology Diponegoro University of Semarang, Agus Maladi Irianto assess information technology is very effective as a means of cultural politics, as did South Korea [5]. Former Chairman of the Arts Council of Semarang (Dekase) added that the existence of social media and television today is very influential to many people and has changed the centuries as anthropological studies first [5].

So this study aimed to develop an information and communication technology (ICT) that can introduce, conserve, and socialize cultural values and local wisdom, which can be video, photography and digital narration.

The development of information and communication technology is in the form of a cultural portal in its data collection using techniques of crowdsourcing and management of its digital media content based Software as a Service (SaaS). Crowdsourcing has become a promising paradigm for completing tasks that are beyond machine capability through outsourcing tasks to the crowds online [6]. Crowdsourcing has grown, such as Wikipedia and Turk Mechanical, to the techniques currently used by corporations and academics for different purposes [7]. Crowdsourcing enables good characterization and performance evaluation of today's large-scale

networks using distributed strength and intelligence [8].

Software as a Service (SaaS) as a trend in the information technology (IT) industry has attracted many interest from researchers and practitioners [9]. Software as a Service (SaaS) provides access to applications to end users over the Internet without any initial investment in infrastructure and software [10]. In a cloud computing environment, Software as a Service (SaaS) refers to the ability of a system on a single cloud provider to communicate with a system [11].

This research seeks to change the perception of old fashioned local culture by combining local culture with the development of information and communication technology which is now being used by the society of all circles.

II. LITERATURE REVIEW

A. Previous Research

Search found that the technique of crowdsourcing is very effective and efficient in engaging company employees to actively provide innovative ideas for the company [12]. However, this approach requires full attention in designing sociotechnical participation architecture. He added that for the sake of walking crowdsourcing techniques, it takes the element of incentives/bonuses to increase the competitive in the "crowd" [12]. But considers that portal or knowledge management is ineffective in use because of fluctuating and disturbing "crowds" [13]. Opposed by [14], his research concludes that knowledge management is an important issue for organizations.

The results suggest that crowdsourcing is still a relatively new concept for business and science, and therefore requires the development of a holistic ontology. Crowdsourcing can be a useful model for corporate activity and holistic ontology providing a new way of managing crowdsourcing operations. Therefore, crowdsourcing requires management, which can be based on a crowdsourcing management ontology. Crowdsourcing Ontology provides eight concepts that managers can use to manage crowdsourcing activities. Ontology includes the concept of openness, platform, management, resources, compensation, task, focus, and maturity. This concept influences the end result and the value the company receives from crowdsourcing activities [15].

Conducted a study of the Chinese government web portal where they used a new evaluation framework based on the principles of contemporary public administration and web evaluation theory. They found that different levels of e-government development in China and developed countries have narrowed, but some aspects of interaction between government and citizens are still in the early stages [16].

It can be concluded from existing studies that the portal website or knowledge management is widely used in order to improve the competitive advantages of an organization, especially business organizations. They engage users / "crowds" to provide content in their portal/knowledge management, even for up-to-date and up-to-date content, the management rewards/incentives for those actively involved [17].

This approach can be implemented also in a large "crowd" where there is a need for good management in crowdsourcing. Because the success of crowdsourcing method is not seen from the size of the "crowd" owned but how the management can manage the "crowd". Therefore, this study uses crowdsourcing method so that the content on the cultural portal can be crowded and up-to-date.

B. Software as a Service

Cloud computing offers various types of IT resources in the form of web services, such as Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS) as can be seen in Figure 3.1 [18]. Cloud Computing, Software as a Service (SaaS) is getting more and more attention from researchers and practitioners. Regardless of the relevance and potential to increase IT flexibility and reduce costs, but concerns are still on the user side [18].

In research it was found that Cloud Computing and Enterprise Systems had an impact on value creation and organizational performance [19]. Also, ensure that Software as a Service (SaaS) is very suitable for large organizations/companies that do need to manage data with a large volume [19]. Cloud computing, Software as a Service (SaaS) is performed by customers on hardware or software that they do not own [9].

Software as a Service (SaaS) as a trend in the information technology (IT) industry has attracted many interest from researchers and practitioners [9]. Software as a Service (SaaS) provides access to applications to end users over the Internet without any initial investment in infrastructure and software [10]. In a cloud computing environment, Software as a Service (SaaS) refers to the ability of a system on a single cloud provider to communicate with a system [11].

SaaS also developed in Indonesia, proved in 2006 one of the providers of IT Indonesia to provide SaaS to the people of Indonesia [9]. Asia Cloud Computing Association (2015) found that the use of cloud computing in Indonesia is still very small, only 14% of companies in Indonesia are using this service. It has also been proven in 2014 (Asia Cloud Computing Association, 2014) that Indonesia is at the 12th level of 14 Asian countries that adopt cloud computing

technology. The existence of regulatory factors and the Indonesian government that led to the adoption of cloud computing is still less desirable [9].

C. Crowdsourcing

Crowdsourcing has become a promising paradigm for completing tasks that are beyond machine capability through outsourcing tasks to the crowds online [6]. Crowdsourcing has grown, such as Wikipedia and Turk Mechanical, to the techniques currently used by corporations and academics for different purposes [7]. Crowdsourcing enables good characterization and performance evaluation of large-scale networks using distributed strength and intelligence [8].

The concept of crowdsourcing has been around for centuries, a recent study shows that over 40 different definitions of this term are in the literature and there is a need to learn the applications, challenges, and benefits of crowdsourcing [20]. According to many organizations use crowdsourcing as a way to discover the various tasks a "crowd," a group of people that can be reached through the Internet [21]. The main goal of crowdsourcing is cost savings or the possibility of handling difficult tasks without human support [21].

The semantic mix of social media faces new challenges, such as the following [22]: (1) Source of knowledge, where social media information is obtained from different channels, such as censorship, program generation, user generation, and other shared resources. (2) The heterogeneity of storage, in which the semantics of social media originates from a cross-fusion of forms, including text, images, audio, and video, which do not use the same storage format. (3) Multimodal expressions, where semantic data obtained in a crowdsourcing environment have the ability to convey knowledge. However, due to data complexity, there are a number of problems with different semantic data modes when analysed, such as multi-feature spatial expression, multi-correlation, and large amounts of noise. (4) Dissemination socialization, where semantic information is not considered in the dissemination process. In short, computing based crowdsourcing provides a viable way to combine semantics efficiently but finds many problems due to the above characteristics. Crowdsourcing ontology has eight concepts that managers can use to manage crowdsourcing activities. Ontology includes the concept of openness, platform, management, resources, compensation, task, focus, and maturity. This concept influences the end result and the value the company receives from crowdsourcing activities [15].

III.   RESEARCH METHODS

The semantic mix of social media faces new The development of the Indonesian Culture Introduction

portal begins with a study of the library regarding the multimedia trends that fit this cultural portal. Plus this portal brings cloud computing base, Software as a Service (SaaS) where more in-depth understanding of the service is needed. In addition, it is also necessary to learn/survey about user interface in accordance with the interests of the people of Indonesia, especially the younger generation who will be active in the cultural portal. The next stage after studying theory and field studies, then the next step is to analyse and design the cultural portal. From this stage, then the design is realized by writing the computer program. The next step is testing the program. And finally the program is hosted in the server with the domain nama called iBudaya.applikasi.online as a temporary domain name.

IV.   RESULTS AND DISCUSSION

This article focuses on using the portal as a result of second-year research, which focuses on uploading cultural contents. The cultural portal is given the domain name iBudaya.id.

The first time we enter the portal website ibudaya.id then we will have a display as above picture in Figure 1. There are some menus at the upper right of the display, such as Register and Login.

Fig. 1.   Example of a figure caption

If the user just want to see the contents in the portal, then the user can directly view the screen, or scroll the screen to see some contents there, so the user can find some contents by their titles. And then the user can click one of the content icon to see the content completely, as shown in Figure 2.

Fig. 2.   Playing the content

The viewer can see the content without making Registration. But if the viewer want to have access to

upload contents, then the viewer must register his/her self first.

If a user want to join, then the user must register first. To register, the user should click the Register menu at the upper right of the display. After clicking Register menu, then appear Registration display as Figure 3.

Fig. 3. Register page of ibudaya.id

In this Registration menu, the user must fill: email address, user name chosen, password, Name, capcha code. And to confirm, the user must click Register button. After clicking the Register Button, the user will be informed that he/she will get an email, contains notification to activate her/his account. In the email, there is an address to be click to activate the user account, as shown in Figure 4.

Fig. 4. Notification e-mail for user account activation

After clicking the link to activate in the email, then the user will go to the Home page of the ibudaya.id, as shown in Figure 5.

Fig. 5. User view of home page of ibudaya.id after login

From the Home page screen of ibudaya.id the user can Login to the system. After Login, the user will go to Home Page find a diplay with some menus: Control Panel, Login as UserName, and Logout. The

Control Panel menu consist of sub-menu like Home (to go to Home again), Upload (to upload document), My Files (to view the list of uploaded files), and Message (to the comment from other users).

From Home Page menu, the user can upload a document by clicking the Upload Menu, as shown in Figure 6.

Fig. 6. Menu for user to upload document

The user then must choose file to be uploaded, give the name of the document, and also give the description about the document, and also give the Tag. After finish filling the form, then the user click submit.

After the user upload a document, then the system will display all the documents uploaded in My Files Menu. In this Menu, the user can delete file that is not wanted, by clicking the cross (X) icon, as shown in Figure 7.

Fig. 7. My files menu

Also in this My Files Menu, the user can view or play the document for him/her self. To see all of the document uploaded by all of the users, the he/she can go to Home page Menu. iBudaya.id also provide menu to communicate with other user, it is like e-mail mechanism. The menu is called Inbox Menu.

Fig. 8. Messaging menu for communications

When we click the Messaging Menu, then appear Messaging display as shown in Figure 8. In this Messaging Menu, a user can compose a message that will be sent to other user, by clicking Compose Menu. And also the user can check whether he/she get a message from other user(s), by clicking Inbox Menu. He/she also can check what messages that he/she has sent to others, by clicking Sent Menu.

V. CONCLUSION

This research has successfully developed a portal that can accommodate cultural values and local wisdom in the form of multimedia content. The cultural portal can be accessed through the link address http://iBudaya.applikasi.online/. This portal will be further refined in terms of cultural content procurement, where the content is in the form of videos, pictures and folklore texts.

FUTURE WORK

The follow-up of this study is to collect content that can be entered into the portal of culture. It was only in the collection of content using crowdsourcing techniques. Crowdsourcing techniques are expected to make it easier to gather volunteers who want to create content.

ACKNOWLEDGMENT

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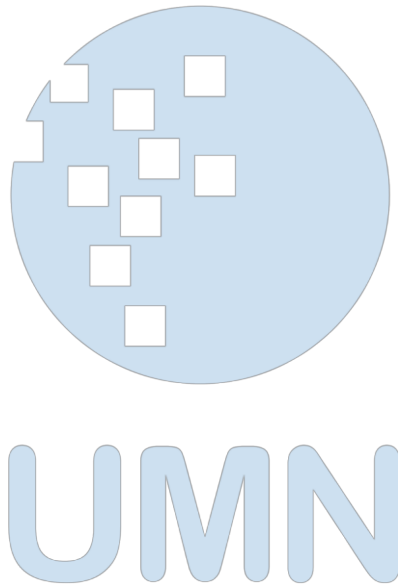
You Are What You Sing:
Folksong Tone Pattern Feature Correlation to Geographical Distance with Gabor Filter and OLS Linear Regression

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Abstract—**Cultural diffusion occurs. This is evidenced by the existence of cultural heritage artifacts. There are many types of artifacts, tangible or intangible. Folksongs are one of the intangible cultural artifacts. Songs have tone, tone patterns are a unique feature of a song. Regional province songs are the identity of each region, because songs are images of the culture of an area. This study uses folk songs from each province in Indonesia which are extracted features by applying Gabor filters and then differences in output and geographical distance are put into linear regression. The results show that the tone pattern feature have a correlation relationship with the distance between regions throughout Indonesia. When observing the scope per large island, there is also correlation between the number of tone patterns with the distance of province. However, this has less confidence result for Sumatra island.**

Index Terms—**cultural diffusion, folk song features, Gabor filter, geographical distance, tones**

I. Introduction

Cultural diffusion happens. This process is naturally occurred and has proven to give major advances to human [1]. These advances are catalyzed more by the advancement of technology in communication. Despite of advances in digital communication, Liu's study [2] on intercultural communication point out the fact that there are many cultural differences between east side and the west side of the world. This implies that geographical distance is a factor in spreading culture. Furthermore, there are studies comparing artifacts to geographical distance such as rituals [3], language [4], archaeological data [5] or even human DNA.

In [5], Kovacevic investigates relation between different bead types and the geographical distance of the site it's found history events by using bead. In [3], Amati differentiate between different rituals and geographical distance. In [4], Kathy did an analysis of language by its history and how they migrate. These studies show that artifacts are used to refer cultural diffusion. If language is an example of why cultural diffusion happens, this also means that songs created by certain language are also an artifact. This argument supported by Sterne study on audio as cultural artifact. However, Sterne's study doesn't have empirical evidence.

There are some studies using songs for classifying certain group, such as genre [6], composer [7], instrument [8], or general city environment sound [9]. They have same method in common which is visualize audio signal and extracting features from the visualized audio. Some of these studies uses gabor filter as their method of extracting features. Bammer [10] explicitly said that gabor filter's result has certain signal features, such as tones or pitch.

This study goal is to explore whether music has potential to be used as artifact in studying cultural diffusion by evaluating the relationship between music features and geographical distance.

This study has contribution in:

1. Identifying the possibility to use music in studying cultural diffusion.

2. Exploring music features that are useful in relating music and geographical distance.

II. Data Description

This study use folksongs from 34 regions in Indonesia. The music is taken from YouTube. The data is validated by MUSIKA group book and searched on YouTube. Data criteria are:

1. From the most popular Indonesian Folk Song channel called "Lagu Daerah Indonesia" which literally translated to Indonesian Folksongs.

2. Song chosen by the most viewed from each province.

Data is taken from YouTube, by referencing book from MUSIKA group which is used as standard music curriculum for schools throughout Indonesian school. These are the data statistics.

TABLE I. DISTRIBUTION OF DATA TAKEN

Data count	34 folksongs
Mean	234.089 sec
Std dev	41.463 sec

These data are converted from YouTube as file wav file format via saveclipbro.com. The stereo wav file the converted to mono, with specification of sample rate of 44100khz and bit rate of 705kbps.

Geographical distance is calculated by using longitude latitude data from Google Maps, which use the middle point of an area for each province. Longitude and latitude between 2 provinces then calculated using Haversine formula for providing distance in km.

III. METHODOLOGY

This study use Short-Time Fourier Transform (STFT) and Gabor filter as music extraction as in [11] but with some changes. The extraction consists of five steps:

1. Audio signal representation using Short-Time Fourier Transform (STFT).

2. Applying binarization to the image.

3. Applying gaussian filter to the image.

4. Put the image into 19 different gabor filter and sum all the output signal

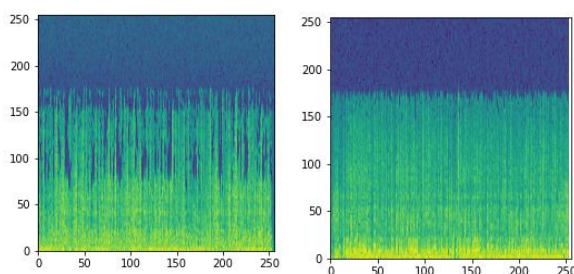5. Ordinary Least Square linear regression

Fig. 1. The difference between 2 different songs from different province

To get the proper song features, 19 orientation is used to resemble how fast or slow the pattern of notes gets high or low.

Second, the spectrogram binarized to emphasize the representation and the tones features, whether the tone is or is not there.
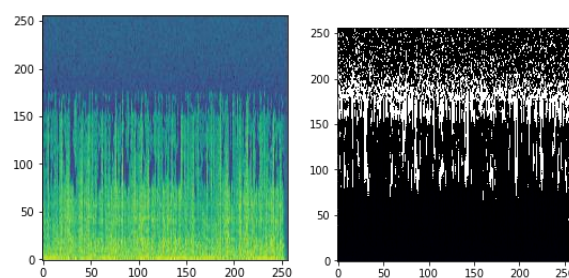

Fig. 2. Binarized image emphasizing tones feature

A gaussian filter then applied to the modified spectrogram to further reduce noises [12].
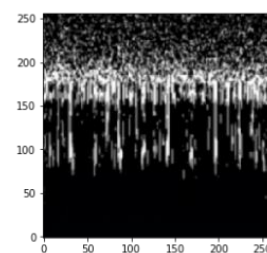

Fig. 3. Spectrogram after gaussian filter application

Gabor filter then applied to get the folksongs tones pattern. Parameters for the gabor filter are chosen by trying to make each data more unique and different [13]:

TABLE II. PARAMETERS FOR THE GABOR FILTER

Spatial Harmony	0.05
λ (Lambda)	20 pixels
θ (Theta)	0 to 180 deg, 10-degree increment
Offset	0.5

These are the output from the gabor filter. Each of the orientations for the different 10 increment of θ theta/orientation, this will bring up result of how fast tones changes whether the tones going up or down. Each of the gabor filter output are summed up to one dimension to collect how much information on each orientation has.

Data from 19 orientation and geographical distance then put into OLS linear regression to test the significance of this feature and what tone fluctuation pattern relation to geographical distance.

IV. RESULTS AND DISCUSSION

Observation on whole Indonesia on 34 folksongs with total of 1536 distance data, has r square of 0.12 and p-value of 1.81e-20. This means the tone feature has significance to distance while having very wide distribution of data. Upon further look, there are 6 specific tone patterns has significance to distance on Table 3.

TABLE III.   SPECIFIC ORIENTATION OF SIGNIFICANCE TO GEOGRAPHICAL DISTANCE

Filter Orientation	p-Value
10	0.01
50	0.02
60	0.00
70	0.00
90	0.00
100	0.00
150	0.02

Another observation is having the geographical distance by not the province but which island the province is located. With the same data but different geographical distance shows r square value of 0.11 with p-value of 1.17e-18. This shows significance too which conclude to province identity, has similar trait with island identity. With further look, has:

TABLE IV.   SPECIFIC ORIENTATION OF SIGNIFICANCE TO GEOGRAPHICAL DISTANCE

Filter Orientation	p-Value
0	0.00
10	0.00
40	0.05
50	0.02
60	0.01
70	0.00
90	0.03
110	0.00
150	0.04
180	0.04

More features have significance for island distance data. This made assumption of observation inside island should have high significance with distance. Another OLS with only scope of 4 big islands shows result:

TABLE V.   RESULT OF OBSERVATION PER ISLAND

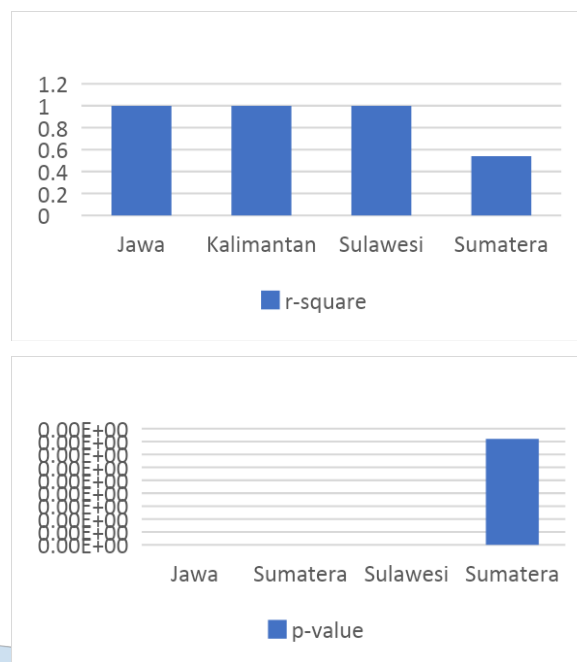| Island	r-Square	p-Value
Jawa	1	4.30E-259
Kalimantan	1	1.95E-180
Sulawesi	1	1.70E-235
Sumatera	0.54	4.10E-05

Fig. 4.   Result of observation per island

V.   CONCLUSION

Folksongs, has tones. There are patterns on tones fluctuation or flatness. With result positive relation between tones fluctuation and distance, but only on the scope of one island. Observations between islands with larger scopes gives negative result. Sea might be a factor of cultural diffusion.

Some of the tone patterns are emphasized by the filter throughout the song, so there is no analysis on specific timing or frequency band. There is anomaly found on Sumatera Island observation might have something to do with culture spread pattern on the island. There might not be enough data for comparison each province 1 data. There is limitation on how to get the data, and YouTube as fastest channel to get music.

The proposed procedure of the study are more data, add another feature. With enough feature, there is enough information to dig deep and explore the relation of songs to linguistic, cultural, historical, musical aspect.

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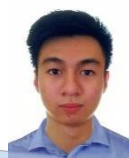
Is Co-working Increase Survivability?
Study on How Collaborating and Networking Facilitates Open Innovation Process for Startups

Lesson Learned from Co-working Spaces in Jakarta

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Abstract—**Startups, as they are bounded to their liabilities of newness and smallness, need to collaborate extensively with their external partners through the open innovation process. This study aims to depict Co-working space's pivotal role in building up a working innovation ecosystem that facilitates open innovation for startups. To get a more deep understanding of the phenomena, this study used an exploratory study based on three case studies of Co-working spaces operated in the Jakarta region. The study shows that the open innovation process among startups is not naturally existed, but instead, it is purposefully designed by the role of a community manager who acts as the ecosystem catalyst. The community manager becomes the ecosystem enablers that facilitate the networking process by connecting members. As a result, these activities will help the emerging of mutual connection and collaboration processes among members that empower open innovation among startups members. The multiple-case design makes the study conclusions might be difficult to generalize. Future research, including quantitative studies, will help the conclusions examination and the knowledge enrichment of start-ups' open innovation process. This paper will enrich the knowledge concerning how Co-working spaces member seizing opportunities that lead to the open innovation process.**

Index Terms—**Co-working space, inter-organizational collaboration, inter-organizational networking, open innovation, startups**

I. INTRODUCTION

Startups play an important role in Indonesia's recent business and industries. As an example, we can see the latest development of digital startups in Indonesia. They are not only become the leverage for the birth of high-quality new ventures that are positively impacting and solving problems in our community but also plays a crucial role in providing new job opportunities to the community. Indonesian Minister of Communication and Information had said that the digital economy in Indonesia would reach US $ 130 billion or Rp 1,831 trillion in 2020. This would contribute to 11% of Indonesia's gross domestic product (GDP) [1].

Startups are a company, a partnership, or a temporary organization that is designed to create a scalable and repeatable business model [2] In general, they have several characteristic such as The age of the company is less than 3 years, the number of employees is less than 20 people, generate income of less than $ 100,000 annually, In the developing stage of their business, operates in technology and Products made in the form of applications in digital form in general and usually operates through a website. Startups in Indonesia are classified into three groups namely game creator startups, educational application startups and trade startups such as e-commerce and information [3]. Since their liability of newness and smallness bounded startups, they tend to have limited access to adequate resources [4]. To be survived in their scarcity of resources, these startups need to form cooperation with external partners in both, development stage and commercialization stages of their ideation process or technological development [5][6]. Therefore, "open innovation" plays a vital role for them [4] to overcome both the newness and smallness liabilities [7].

In contrast to "closed innovation," the open innovation has been described as an innovation process that goes beyond organizational boundaries and orchestrates the active involvement of multiple parties or organizations. The successes of open innovation depend on the core competencies and skills-sharing activities among collaborative organizations. The open innovation was being initiated after the identification of entrepreneurial opportunities by a partner organization, known as "broker," and shares the entrepreneurial opportunities with other

partner organizations that finally form the business network [8][9].

Like other business organization, entrepreneurial activities for startups also demands a physical working environment that enables them to increase creativity and innovation performance by facilitating a productive and supportive business ecosystem. Thus, this working environment exist to help business, not only to generate knowledge but also to develop social and business network[10][11]. Even though business creation can take anywhere, Co-working space is as a shared working space that facilitated both intangible and social entrepreneurial support that fosters entrepreneurial networking and social interactions for generating new entrepreneurial opportunities for small firms and startups [10]. Moreover, the social interaction opportunities that Co-working space offer also enables collaboration opportunities [12][13][10][14] temporarily in which business outcomes are achieved from exchanging a combination of complementary skills and social relations among peers working in the space [12][15]. This collaboration then accommodates each member to exchanging knowledge [16], new ideas that could trigger innovation performance, and increase productivity.

In number, the growth of Co-working spaces in Indonesia has reached 400 percentages within two years. Based on the association record, in 2016, there were only 45 Co-working spaces in Indonesia, the number then multiplied become almost 200 in June 2018 [17]. Moreover, in Indonesia, Co-working space growth has occurred as a result of digital startup and micro-business development. Quoting the statement of Rudiantara, Indonesian Minister Communication, and Information, there were approximately 1.720 startups in Indonesia. This number puts Indonesia as the fourth nation with the most significant startup number after the United States, India, and the United Kingdom [1]. Thus, the growth of startup's development in Indonesia then also seen as one of the opportunities that could be seized by Co-working space business owners.

II. RESEARCH QUESTIONS

The firm, like Start-ups, as they are bounded with liabilities of newness, would looking out for resources and knowledge with others through the resources sharing process, in which they can develop complementary and reciprocal complementary advantages. The sharing process will enable them to create network behavior that can be used as a learning medium to strengthen entrepreneurial activities [18][19]. Hence, social relations are becoming the main factors of productivity across Co-working spaces that provide a collaborative environment for startup and digital nomads to deploy new production opportunities in non-hierarchical situations [15].

The open innovation process could facilitate the process of network maximizing through the collaborative environment for mutual benefits. In contrast to the close innovation that bounded by internal organization context, open innovation has exceeded the boundary of an organization by mutual identification and shares of business opportunities among partner organizations from the business network. This business network then nurtures innovative ideas that could be utilized for the new product or new business creation that could fit with the market needs [8] Thanks to the advancement of information and communication technology (ICT) that accelerates the creation of collaborative business networks in which the startup's open innovation is being initiated.

Previous research has shown how startups explore, absorb and exploit knowledge from larger firms through open innovation practices to enhance their entrepreneurial process and activity [20] [4] However, there are very few studies on open innovation among startups, especially in regards to Co-working . This paper aims to fill a part of this gap. Our main objective is to analyze how co-working space collaborative environment embraces the open innovation process. We would like to answers the following questions:

RQ1. How Co-working space members collaborate to increase their mutual performance?

RQ2. How Co-working space members utilize networks to foster the open innovation process?

III. RESEARCH OBJECTIVES

1. In general, this research will be useful for Co-working facilitators and Co-working users. The research findings will give practical insight into how the Co-working space ecosystem could facilitate inter-organizational collaboration and networking processes for the user.

2. Since there is still little academic research about Co-working space, especially in Indonesia, this paper aims to deliver a comprehensive understanding of co-working phenomenon as an entrepreneurial ecosystem, in where the member could seizing opportunities throughout the social interaction process (collaborating and networking) that lead to the open innovation process.

IV. LITERATURE REVIEW

A. Co-working

Kubatova [21] defines Co-working as a modern form of work or individual enterprise realized in a shared work environment, so-called Co-working center, together with other people who independently perform their respective tasks, usually using information and communication technologies.

Co-working combines various elements of home-office concepts, office communities, telecenters, telework, virtual work, virtual teams, incubators, and communities of practices. However, it also offers flexibility, autonomy, and social interaction opportunities that the cross-sectoral working community usually has. In contrast to project teams or virtual teams which often bound in a rigid hierarchies of established firms, Co-working -users can be more flexible in choosing teams, work processes [16] and shared office settings (where furniture such as desks can rent on a daily, weekly, or monthly base) [22] [23].

Co-working space is defined as workplaces that shared by workers who are not members of the same organization [24]. In this sense, Co-working space also accommodates an "community-based sociocultural ecosystem of exchange," where networks of people are linked together by shared social networks and shared resources [25] that enabled their members to share valuable networks and resources that importance that hence perceived as a strategic tool in attaining innovation [26].

Co-working spaces can provide high levels of autonomy. This kind of autonomy includes access to use office infrastructure and amenities at self-regulated working hours. Different from how regular hierarchy-based working settings worked, Co-working -users have the autonomy to work and communicate to whom, where, when, how, and how long, even how intense and open the communication is. Co-working -users may deliberately take the opportunity—to interact with others, whether on loose terms or very intense, strictly only related to job matters or open for personal issues too, to receive feedback and to provide feedback, and also to intensify private and business relationships. Social interaction may have diverse forms and intensities, that leads to new inspiration and knowledge. This inspiration and knowledge may be shared among Co-working users not only during the physical presence in the Co-working space but also afterward [16].

B. Inter-organizational Networking

The relationship that occurs among the Co-working members facilitates the socio-cultural networks, which will sustain real communities [27], and it can significantly improve productivity [28]. Aaboen study [19]found that inter-organizational network enables new ventures to expand their network more efficiently to create beneficial value. With networking, new ventures can build up their capacity to expand their complementary business.

At the early stage, Co-working spaces can provide the opportunity to develop sophisticated networks for the entrepreneurs, over and above the common social ties which they usually begin with [29] [30]. A network with lots of potential knowledge, skills, and contacts will become a vital force for the 'incubation' of the new and young firm or founder teams to achieve the value they create [18]. Thus, Co-working -users shape a new venture that may improve innovation, growth, and performance, when they can utilize the network advantages in the Co-working -space [29] [18]. Every social network capital is unique, and It has diverse effects on the success of the Co-working -users as for other entrepreneurs [18].

C. Inter-organizational Collaboration

Collaboration has been one of Co-working core features, as they accommodate a collaborative environment that facilitates new ideas exchange processes between members. As part of communities, Co-working space members developed a working relationship that can be facilitated with connections, networking, and collaboration through co-working space [31][32].

Capdevila study of different Co-working spaces in Barcelona [33] found three type of a distinctive complementary collaborative approaches which are : 1) Cost-based collaboration that aims to reduce operation or transactional cost; 2) Resource-based collaboration which is the result of that aims to gain valuable learning or open access to new resources and knowledge; 3) Relational collaboration that aims create synergistic results, investing actively in the community building dynamics. This finding is aligned with Bueno et al research findings in 2018 [24] which stated that social interactions in the Co-working spaces are proper places to initiate collaborative activities with aims to producing highly productive work, based on the opportunities offered by some of the core features of these spaces, such as social interactions, new opportunities, and knowledge sharing. The collaboration concept also aligns with Lange, who concludes Co-working spaces as bottom-up spaces participated by workers who strive for independence, collaborative networks, and politic, this shares a set of values in a 'collective-driven, networked approach of the open-source idea translated into space.' The idea that underlying this assumption is that social relations are the main factors of productivity across Co-working spaces, conceived as collaborative environments where microbusinesses and freelancers deploy new production opportunities in non-hierarchical situations [15].

D. Open Innovation

Recently, innovation is perceived as one of the key survival factors needed to be succeeded in a competitive business environment [34]. For startups that are considered as a new venture that bounded with technical and financial resources limitation, these resources limitation were usually be labeled as the liability of smallness, which encouraged small

companies like startups to innovate in collaboration with other firms [4] The innovation process involving the collaboration process with external factors to improve firm competitive advantage and performance is called open innovation.

From the business perspective, the open innovation process can be defined as the new idea initiative of a product or process, which occurs outside individual firm‟s boundaries [8]. Moreover, Chesbrough [35] saw open innovation as a system where innovation is not exclusively developed internally within a company but also utilize external sources. External knowledge sources may include clients and users, suppliers, competitors, universities, or public institutions. Participants in open innovation activities agree to contribute to the development of a new product or service that will be sold to the market [36].

This kind of innovation initiates after identification of business opportunities by a partner organization, known as "broker‟ and shares the business opportunity with other partner organizations that finally form the business network. This business network nurtures innovative idea to develop new products or new business processes according to the market needs. Today's advancement of Information and Communication Technology (ICT) contributes to create such a collaborative business network, where the initiation of an open innovation starts up. This open innovation culture among the business network helps organizations to keep pace with competition and to retain sustainability [8].

V. RESEARCH METHODOLOGY

A. Research Design

To get valuable insights into the phenomenon, the researcher use case studies as the qualitative approach., as described by Stake [37], qualitative case study as the elements combination of naturalistic, holistic, ethnography, phenomenology, and biographical research methods [38].

In terms of definitions, Case study is defined as the investigation and analysis of single or collective cases that are meant to seize the complexity of research object [37] as cited in [38]. Case Studies is one of the research method that combines individual and or group interviews with technical analysis and observation records. Case studies allow researchers to explore individual or organization, via a complex intervention, relationships, community, or program [39] and support further deconstruction and reconstruction of various phenomena. Moreover, Creswell [40] defines case study as an exploration of a real-life, contemporary bounded system (a case) or multiple bounded systems (cases) over time, through detailed, in-depth data collection involving multiple sources of information. To get a better understanding

of how Co-working spaces ecosystems become catalysator for startup survival than the researcher using case studies methodology. Case studies methodology linking relationship within and among cases into the development of core values, intentions that particularistic, descriptive and heuristic [38] The multiple cases study is used to understand the differences and the similarities between the cases [37] [38] that in turn will provide the literature with an important influence from the contrasts and similarities among cases [41].

In this paper, the researcher using an explanatory Case Study approach. The explanatory case study is used when the researcher attempt to answer questions to clarify the causal relationship in real-life phenomena (cases), which too complex to be described via surveys or experimental strategies. In this paper, the unit of analysis of this research is the collaboration and networking process among Co-working members in ways to increase startup survivability.

Data Collection is done by using several methods like triangulation research strategy, which means using different types of materials, theories, methods, and research in the same study [42] [43]. The primary source data consists of open-ended questions (open questions) that were asked by the researcher through in-depth interviews with Co-working spaces stakeholders in Jakarta Besides, in-depth interviews, the researcher also conducted on-site observation by sitting in a Co-working space member for weeks during the data collection.

B. Data Collection

Primary data collection for the research was obtained through a snowball sampling technique where the researcher asked for informant referrals that suit well with the research object. By applying this, the researcher conducts direct observation and in-depth interviews with three Co-working spaces in Jakarta, which facilitating business incubation for startups. The interviews were conducted in May until July 2019. The primary respondents of the research were the Co-working space co-founder, community managers as co-working spaces providers, and startups as co-working spaces users. The selections of informants both form Co-working space providers, and the users' side is chosen to facilitate the triangulation and validation process on how Co-working spaces ecosystems become catalysator for startup survival for this case study.

TABLE I. CO-WORKING SPACES AND INFORMANTS DESCRIPTION

Co-working Spaces/ Location	Informants	Informants Description
U in Jakarta, established	D	D is a community manager in U since November 2018. Before

Co-working Spaces/ Location	Informants	Informants Description
in 2017 and running only in 1 location		becoming a community Manager, D was working in one of the co-working space in Semarang. D responsibility is to maintenance members by providing, creating and exploring community event that fit with members needs
	F	F is a community officer in U since October 2018. F responsibility is to manage member's administrative matters likewise contract and invoices
	R	R is CEO of Startup that has been using U space since December 2018. R has just come back from Canada and established Startup, which focused on providing Human Capital Information System solutions.
	L	L is Program Director of Startup that has been using U space since December 2018. L is running a startup that provides soft skills learning and development solutions.
S in Jakarta established on 2nd April 2016 and has two locations	B	B is the co-founder of S Co-working space. He had studying Co-working spaces business model and design through more than a hundred youtube videos since 2015 before opening up his own.
	M	M is Co-working Space S, community manager. M' main responsibility is to develop community program and events
	W	W is Director of Startup that has been using S space since the end of 2017. W is running a startup that provides IT and financial and tax management solutions.
C in Jakarta, established in 2015 and has more than 10 locations that spread from Bandung to Bali	J	J has been working as the community manager in C Co-working space
	A and D	A is working as the community manager, and D is working as a graphic designer at V Start-up, a platform community influencer.

Source: Researcher's primary data, 2019

VI. CASE STUDY ANALYSIS

Startups as a lean business are constrained with their liabilities of newness and smallness [4]. This adversity of adequate resources is compelled startups (especially at their early stage) to manage and optimize the resources efficiently, including for their facility management. Therefore, Co-working space has become one of the best working space solutions for startups due to cost efficiency and accessibility. Besides, affordable and accessible working space,

This research found that members of co-working space cooperate and collaborate to improve their mutual performance and foster the open innovation process through intangible value-added service offered by the co-working space in the form of collaborative working space that is intentionally designed to create a supportive and productive working ecosystem.

A. Community Manager Role as Catalyst Entrepreneurial Ecosystem

Even though the collaborative working space that is found in all the cases are physically well designed to create both social and business interaction among the members, but it is not immediately configured the expected interaction as expected. For all the cases, the opportunity to collaborate does not happen naturally but are crafted design by human intervention, which is conducted by the community manager.

Community manager's role in the Co-working spaces is to maintaining the community members in their Co-working space by creating events or media that, as much as possible, can support and adding values for the community. In case of startups member, the community manager is designed and provided event's content and media that could help startups to get more knowledge about business insights and thus enhance their business performance like ideation process, digital marketing optimization, how to create impactful content marketing, financial management for startups and many more. These events are created by collaborating internally with the community member that has expertise in related issues or with external expertise party by exchanging values.

Besides providing insightful events, in all the cases, the community manager also creates by designed bonding events that could grow members' interaction like potluck. The aim of the bonding events is to embracing members to get to know each other as the initial steps to do business networking. By this sense, the community manager acted as a business catalyst for the member as proposed by J and M as community manager as follows:

"Our position is like a matchmaker. We gather the members. Introduce members to each other. We facilitate them to know each other" (M, S Co-working Space)

"...I think what differentiates foreign people with Indonesian is that in here, we have to be more proactive. I meant we try to connect members here. Get them to know each other. Then, we, C, tried to be the connector for our members. We have a different culture. Outside, maybe, networking occurs by nature. Here, we have to be a connector, facilitator. C try to be more proactive, we asked member's needs, what we can help or provide......" (J, C Co-working Space)"

B. Social Interaction and Networking in Open Innovation Process

Co-working is a recent phenomenon. What differentiates Co-working with formal working space is the possibility do interaction with other organizations that overcome distractions, self-motivation problems, and feelings of isolation as a limitation of working alone at home [12]. In the cases, the need for socialization with other people is the advantage of doing Co-working, as emphasized by W as follows:

"I think Co-working space uniqueness lies in social interaction. If the only work was alone. Everybody work alone. No interaction. Only work then goes home. Ya, it'll look less attractive… The basic of Co-working is the interaction among members. Without interaction, it'll become the same as the formal office. It has no advantages…here we learn to socialize with other members." (W, S Co-working Space)

However, social interaction among members not automatically emerges just because of the flexible working space design. In cases, the stimulation of social interaction among members is socially created by the role of community manager. Most of the time, social interaction emerges as the results of bonding events. Moreover, the development of social interaction among member becomes a prior process for business networking. Through social interaction, members able to exchange their business general information, business ideas or even exchange and expand the possible business network that could be suitable to each business, as proposed by J and L as follows:

"We have Kudapan (Snacking in English) program. Its like lunch program among members. They bring their own foods. We put it into the dining table then we shared it. In the middle of the sharing time, they begin to start the conversation. It might begin with a simple question, like, what are you bring? How are you? Kind of question, and it might evolve to more serious talks like each other's business interests. Sometimes, they continue the agenda after Kudapan. Through there, business matching often happens." (J, C Co-working Space)

"…In U we have a community manager, which is D, who gathered us together. D always said, come on – come up. She initiates potluck. We end up having lunch together at the rooftop. Start from there; I begin to meet new friends from the other tenant's members here, like F form MZ. If I not mistake, they have seven members already. Because it has been a routine agenda here, we become closer as friends, Start from chit chat we began to share a glance of our business." (L, U Co-working space)

C. Inter-organization Collaboration in Open Innovation Process

In all cases, networking accessibility could trigger further inter-organizational collaboration among startups members. In this case, collaboration refers to the interaction among different organizations that works together to achieve a clear and shared aim in a specific context. Like networking, the collaboration among members also prior initiate by the role of community manager.

"As a program and community manager, it's my responsibility to develop a partner's collaboration. Moreover, I also have to develop collaboration with the external party in the form of in house programs for partners or public." (M, S Co-working Space)

In this sense, the inter-organizational collaboration between startup aims to maintain startups' business sustainability by overcoming their adversity of newness and smallness. The social interaction and networking that prior develop enable the member to explore potential opportunities possibility with other organizations. In most cases, the members collaborate by exchanging business ideas, knowledge, and exchanging expertise that can complement each other's competitive advantages. Inter-organizational collaboration enables startups to get complimentary resources they need. In this sense, inter-organizational collaboration plays an important role in resource integration [33] among startups members.

"… For example, V and F. They both by chance are the digital agency. One is a digital influencer platform, and the others are online platforms for freelancers. They are exchanging expertise and benefits. They are matching the business together. They collaborate with each other." (J, C Co-working Space)

"…Here we collaborate, We complement each other, exchanging our expertise. Together we are fighting for life. The important thing is our business survival." (W, S Co-working Space)

"Each member already has its own market. So we should collaborate. We can complement each other's expertise. As much as possible, we can refer the prospective client is to the meeting in S Co-working space so that we can provide a better solution for them. As an entrepreneur is our nature to always seeking business opportunities. Are opportunities can be taken? Are opportunities can be captured? We explore the opportunity together." (W, S Co-working Space) "… We are like families here. We sometimes exchange ideas. Start with simple ideas…. Like, if we talked about ICT development or Human Capital latest issued, for example, we somehow can collaborate. Based on mutual business needs…" (L, U Co-working Space)

The process of open innovation that facilitate by the Co-working space happens both inbound and outbound. In inbound open innovation, external ideas (or technology) entering the organization, while in outbound open innovation organization's internal ideas (or technology), are used by another organization that is better poised to develop further and commercialize it [35]. Encourage by the same spirit to make their business survive, Startups member in Co-working spaces are exchanged and share the business idea, knowledge, potential networking to create possible inter-organizational collaboration to improve their business, product or even expand the business opportunities can be described as follows:
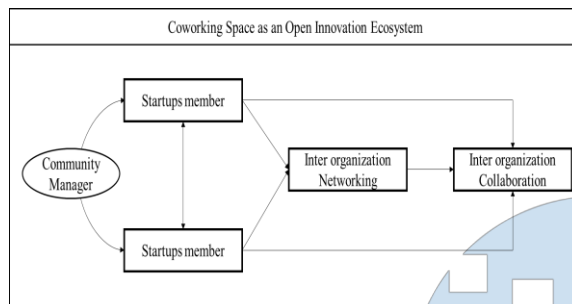
Source: Researcher's own work, 2019

Fig. 1. Open innovation process in co-working ecosystem

However, the speed of the open innovation process also depends on the personal characteristic of the startup's members. The open innovation process happens faster for Co-working space members that have extrovert personalities rather than the introvert one. Also, the culture shyness also limits the possibilities of open innovation in the Co-working spaces, even though already social designed by the community manager.

"The speediness to blend very depends on the person. Some person is very easy to socialize, good in developing the relationship (Type of an easy-going person). It is effortless for those kind people to blend. On the contrary, I am an introvert person. For me, it is very hard at the beginning to start the conversation." (W, S Co-working Space)

VII. CONCLUSION

This article discussed the process of open innovation in co-working spaces ecosystem for startups businesses. Based on observation and in-depth interviews with three co-working spaces in Jakarta, our research found that these co-working spaces facilitate the working ecosystem that supports the open innovation process of startups, especially during their early stage. The innovation ecosystem is purposefully designed by the community manager. The community manager acts as a catalyst by creating frequent social interaction events to open up business opportunities. This social interaction among members

may empower the development of inter-organizational networking and collaborate. Driven by their passion to overcome resources adversity in their early phase, startups utilize the social interaction to exchange their business ideas, both inward and outward that empower the process of open innovation to take place. However, the open innovation process also depends on the personal characteristic of the startup members. These research contributes to the literature of open innovation process, by offering some clues on how co-working space, entrepreneurial ecosystem and the community managers' performance can positively influence the development of social interaction, inter organizational networking and collaboration practices that will lead to startup's open innovation process.

VIII. LIMITATION AND FUTURE RESEARCH

Our study limitation lies in what Yin (2003) defined as an analytic generalization. Therefore, the findings only apply for the three co-working space's entrepreneurial ecosystem that became the subject of the research. Moreover, our study only focused on the co-working practices in Jakarta; while in fact, co-working spaces also mushrooming in other big cities in Indonesia such as Bali, Bandung, Surabaya, Medan, and Makassar. Furthermore, our study also underlined the important role of community managers, who act as the catalyst for open innovation process among startups member. They initially designed community's events that could empower the social interaction which may lead to networking and collaborating. With this findings, future research can explore the possible antecedents for the open innovation process in co-working space ecosystems, such as the system of knowledge sharing, inter-organization learning and the effect of collaborative space design. Besides the antecedents, future research could also investigate the further effects of open innovation processes, such as collaborative process on new product development.

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Decision Support System for Home Selection in South Tangerang City Using Topsis Method

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Abstract—The desire to have a dream house makes people consider of the criteria of the house they will be lived. Many developers offer a variety of house alternatives ranging from price, location, design, building area and land area. Customers are pleased to choose their dream house as their desired. Based on that situation, this research is conduct to create a web-bases application for home selection that consider the useful criteria to help consumers choose a decent home by using the Technique for Order of Preference by Similarity To Ideal Solution (TOPSIS) method. The TOPSIS method has the concept that the best alternative has the shortest distance from a positive ideal solution and also has the farthest distance from a negative ideal solution. This TOPSIS method is applied to provide recommendations on the choice of home decisions in the South Tangerang area based on predetermined criteria. The results obtained in the TOPSIS calculation are the housing recommendations that are closest to the value of the calculation result.

Index Terms—Decision Support System, housing, home selection, TOPSIS method, web-based application

I. INTRODUCTION

Houses are one of the basic needs of humans. House is a place to live and is used to protect human against climate disturbances and other living things. Houses are one of the residential buildings that must meet the comfort, safety and health criteria so it may support residents to work productively and be able to use them as healthy and safe dwellings for their residents [4].

Currently the development of housing, especially in the South Tangerang area is growing rapidly. South Tangerang itself is a relatively young city in the Banten area that has a very good city development. Realizing it all, currently many developers offer a variety of home alternatives ranging from prices, locations, designs, and ways of payment [1]. In general, promotions from housing developers are done by placing advertisements on paper or electronic media, as well as on websites. Home has already led to changes in business behavior, especially in the Property business [5]. Developments in the field show that consumers in choosing homes in housing have at least several aspects that are taken into consideration [1].

Reviewing the research that has been done before about the decision support system in the selection of houses, then the main criteria have been chosen based on analysis in several studies to find out a criteria that is a factor when someone wants to find a house that consists of price, location, building area, land area, facilities general, bedroom and bathroom [1][2][3][8]. Criteria used in decision support systems (DSS) have a role in system design as a decision-making process, processing data and information carried out aims to produce a variety of alternative decisions that can be taken [3].

The method used in this decision support system is the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) method. TOPSIS was chosen because this method is often used in making decision support systems and TOPSIS also uses the principle that the chosen alternative must have the closest distance from the positive ideal solution and the farthest from the negative ideal solution [11].

Therefore, it is necessary to design a web-based application of home selection by considering the criteria to support a property agent in the process of selling a house and also to help prospective buyers to determine the choice of housing in the South Tangerang area [2].

II. THEORETICAL BASIS

A. House or Home

Home is everyone's primary need. Usually, to be able to meet the needs of a house or residence, someone will buy it to the developer or housing developer. Many housing developers provide alternatives regarding housing. The house is also a building that functions as a place to live that is used for house room, family facilities, and assets for the owner. The house is also a place to rest after doing

various activities and the house must be able to accommodate the activities of its residents [8].

B. Decision Support System

Decision Support System is an interactive computer-based information system, by processing data with various models to solve unstructured problems so that it can provide information that can be used by decision makers in making a decision [4]. The concept of a decision support system is characterized by an interactive computer system that helps make decisions using data and models to solve unstructured problems [9].

Decision Support System is a specific information system aimed at assisting management in making decisions relating to issues that are:

1. Structures, which are related to problems that have been known before with the completion of predetermined rule standards.

2. Semi structured, which is related to problems that have not been known before with existing parameters.

3. Unstructured, which is related to new problems that are quite complicated because of the large amount of data that is not yet known.

C. Decision Support System Technique for Order Preference by Similarity to Ideal Solution (TOPSIS)

According to Hwang and Zeleny in TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) based on the concept that the best chosen alternative not only has the shortest distance from a positive ideal solution, but also has the longest distance from the ideal solution negative [3].

In general, the TOPSIS procedure follows the steps as follows [3]:

1. Calculate normalized decision matrices.

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} x_{ij}^2}}, \quad with \; i = 1,2,\dots,m \; and \; j = 1,2,\dots, \tag{1}$$

2. Calculating the weighted normalized decision matrix.

$$y_{ij} = w_j r_{ij}, \; with \; i = 1,2,\dots,m; \; and \; j = 1,2,\dots,n$$
$$A^+ = (y_1^+, y_2^+, \dots, y_n^+) \; ;$$
$$A^- = (y_1^-, y_2^-, \dots, y_n^-);$$
with
$$y_j^+ \begin{cases} max_i \, y_{ij} & ; if \; j \; is \; benefit \; attribute \\ min_i \, y_{ij} & ; if \; j \; is \; cost \; attribute \end{cases}$$
$$y_j^- \begin{cases} min_i \, y_{ij} & ; if \; j \; is \; benefit \; attribute \\ max_i \, y_{ij} & ; if \; j \; is \; cost \; attribute \end{cases} \tag{2}$$

j = 1,2,…,m.

3. Calculating the matrix of positive ideal solutions and matrix ideal negative solutions.

4. Calculating the distance between the values of each alternative with a matrix of positive ideal solutions and a matrix of negative ideal solutions.

$$D_i^+ = \sqrt{\sum_{j=i}^{n} (y_i^+ - y_{ij})^2}$$

i = 1,2,…,m

$$D_i^- = \sqrt{\sum_{j=i}^{n} (y_{ij} - y_i^-)^2}$$

i = 1,2,…,m   (3)

5. Calculate preference values for each alternative.

$$V_i = \frac{D_i^-}{D_i^- + D_i^+}$$

i = 1,2,…,m   (4)

D. Previous Studies

Some journals from previous study are as follows:

TABLE I. JOURNALS FROM PREVIOUS STUDY

Title	Author, Journal
Analisis dan Perancangan Sistem Pendukung Keputusan Rekomendasi Pemilihan Rumah dengan Metode TOPSIS [4]	Fatima, Anggraini, Jasmir.,Jurnal Manajemen Sistem Informasi Vol. 1, No. 5, Desember 2016
Aplikasi pemilihan rumah di kota pontianak menggunakan metode TOPSIS berbasis *website* [6]	Alpaniam, Dwi Marisa Midyanti. Jurnal Coding, Sistem Komputer Untan, Vol 6, No. 3 (2018)

III. RESEARCH METHODOLOGY

A. Data Collection Techniques

The method used in this data collection is library research, observation and distribution of questionnaires. Literature study is used to get basic references that are strong enough to be used as research while the observation method is done by surfing the internet to get information about a house and the last questionnaire is used to get the main criteria from the user.

B. System Development

B.1 Flowchart

Fig. 1.   Flowchart user
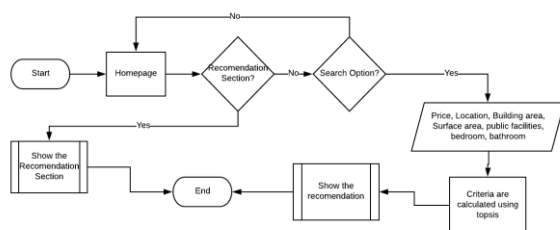
Flowchart which is used as a reference for how each stage and process will be carried out by the system. Flowchart can be interpreted as a tool or suggestion that shows the steps that must be taken in solving a problem for comparison by discussing it into tracking special graphic symbols [10]. Figure 1 shows the flow of the front-end user part of the system. when first accessing the website, the user will display a home page in which there is a recommendation page that is immediately presenting the house and also the user can use the function of the website to do a home search by filling in several types of criteria.

B.2 Data Flow Diagram (DFD)

Data Flow Diagrams are diagrams used to describe the processes that occur in the system to be developed, with this model, the data involved in each process can be identified [7]. The next stage is a context diagram that is used to describe the flow of data and the processes carried out by the system that will be created. In Figure 2 it can be seen that there are 2 entities that are connected with the decision support system, admin and user.

Fig. 2.   Context diagram of web-based application
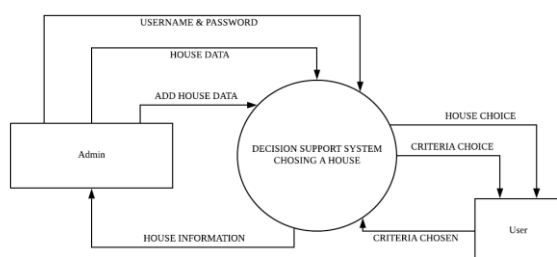
In Figure 3, it can be seen that the system will be divided into 4 main processes, login, manage data, TOPSIS calculations, and check alternatives.

Fig. 3.   DFD level 0 of web-based application
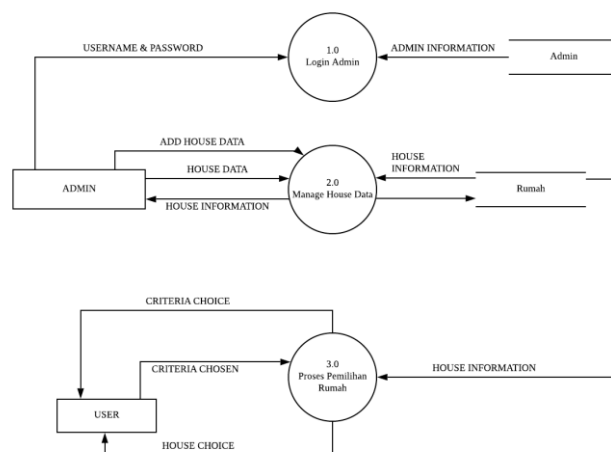
B.3 Entity Relationship Diagram (ERD)

Fig. 4.   ERD of web-based application
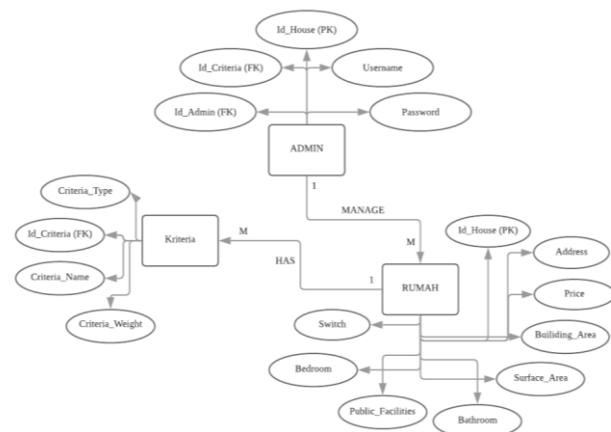
In Figure 4, the relationship of entity in the database of web-based application of home selection is shown.

C. Coding

To build a system that has been designed, a place is needed to display the system. The system is based on a website and also uses the PHP and MySQL programming languages as its database. The website has a responsive form and can follow how the shapes and sizes are provided [6].

IV.   ANALYSIS AND DISCUSSION

A. Analysis of The System

In building the system, the required identification needs to be a system built to run well. Data needed by the system from solving problems that have been formulated previously.

1. Data needed in research:

   - Criteria and weight for decision making. the weight specified is as follows: W = [1 0.5 0.5 0.75 0.75 0.5 0.5].

   - Input data from users in the form of prices, building area, land area, public facilities, location, bedrooms and bathrooms.

   - Changing data from the user is processed into fuzzy values based on the process written in chapter 3.

2. Simulation is done by taking 5 alternative choices of houses randomly to be given an assessment from each house that has its own criteria.

TABLE II.   DATA SAMPLE OF HOUSE

	House 1	House 2	House 3	House 4	House 5
Price	1	0.9	0.6	0.45	0.3
Building area	0.4	0.6	0.6	0.8	1
Surface area	0.3	0.45	0.75	0.75	0.9
Public facilities	0.4	0.6	0.6	0.8	1
Location	0.9	0.3	0.9	0.75	0.45
Bedroom	0.4	0.6	0.6	0.6	0.8
Bathroom	0.2	0.4	0.4	0.6	0.6

The values in table 1 have been changed into a previously determined form so that data can be processed through the system. After that, the calculation are made to find the matrix value normalized as seen on Table 3.

TABLE III.   NORMALIZED MATRIX

House 1	House 2	House 3	House 4	House 5
0.6372	0.5735	0.3823	0.2867	0.1911
0.2519	0.3779	0.3779	0.5039	0.6299
0.2010	0.3015	0.5025	0.5025	0.6030
0.2519	0.3779	0.3779	0.5039	0.6299
0.572	0.191	0.572	0.477	0.286
0.292	0.438	0.438	0.438	0.582
0.192	0.385	0.385	0.577	0.577

After getting the matrix value then the value is given a predetermined weight. After that the determination of the positive ideal and also the negative ideal is determined by looking for the maximum and also minimum values of the data. The next step is to calculate the distance of the positive ideal solution and also the distance of the negative ideal solution as seen on Table 4 below.

TABLE IV.   IDEAL SOLUTION DISTANCE

SI +	SI -
0.4635	0.5299
0.4181	0.4198
0.3656	0.4106
0.3856	1.0653
0.495	0.4689

The last stage is to determine the preference value for each alternative that has been calculated using the formula. The final result consists of various numbers and to equalize the user then the value of the user will be calculated and the value will be compared with the closest distance to the result.

$$P1 = \frac{0,53}{0,53 + 0,463} = 0.533$$

$$P2 = \frac{0,42}{0,42 + 0,418} = 0.37$$

$$P3 = \frac{0,411}{0,411 + 0,366} = 0.63$$

$$P4 = \frac{1,065}{0,386 + 1,065} = 0.494$$

$$P5 = \frac{0,469}{0,469 + 0,495} = 0.476$$

Fig. 5.   Calculation of P
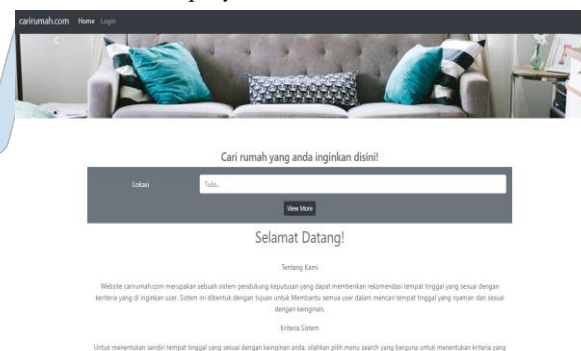
B. *Website Display*

Fig. 6.   Homepage

Figure 6 shows the homepage that will be displayed when the user or admin first accesses the website. On the homepage, a button is displayed to log in to the admin and the user can search the house based on the criteria.

Fig. 7.   Search

In Figure 7, the search option consists of choices that have been designed based on priority interests and the criteria consist of price, building area, land area, public facilities, location, bedroom, bathroom. When the user will fill in the selection criteria, there are several choices that the user can choose so that the user is not confused when filling in the criteria.
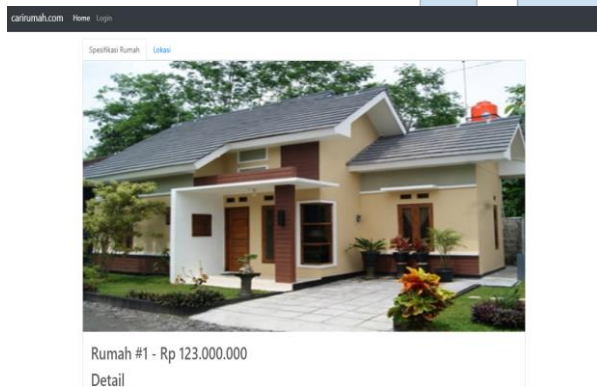

Fig. 8.   Recommendation

In figure 8, the recommendations given by TOPSIS to the user are in the form of a photo of a house, the price of a house, the location of the house, the size of the building, the number of bathrooms, the number of bedrooms, and a description of the house and the location that can be used by the user to see where the house is located.

Fig. 9.   Login

Figure 9 displays the Admin Login page. Admin can access the Admin (back-end) view by logging in first, this page has a form for admin to enter username and password. Next, if the admin has entered into the admin home screen, then the admin can see the navigation that points to home data and logout. Figure 9 shows how after the admin logged into the back-end and there is home data and logout.

Fig. 10. Back-end

It can be seen in Figure 10 that there is a table of home data lists containing the house code, address, location, facilities, building area, land area, price, bedroom, bathroom. In addition there are buttons to change data or add data and an "on / off" button. When the "edit" button is pressed, the admin can access the edit home page which is useful for changing information about the house. Add home page that contains the form for the new data is loaded into the system so that it can be used.

V.   CONCLUSION

The result of this research is a web-based application to supports decisions making about choosing a home by assessing the results of the score that has been given by the user. The research use TOPSIS calculation method that provides results with an ideal solution according to the criteria selected. This web-based application can be used by a property agent to help them in selling houses and by users in

terms of providing home recommendations that match the criteria.

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Recommendation System for Determining Micro, Small and Medium Enterprise Business Locations

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Abstract—From entreprenurship perspective, determining the right business location is, of course, will become a significant factor for the business's growth in the future. Therefore, a system to facilitate prospective and strategic business locations, for achieving the right selling targets is sure needed. Android mobile based system with GPS technology features can make it easier to determine business location. In our application, we try to tackle this problem by using Simple Additive Weighting (SAW). We took several criteria for strategic business location decision making in our SAW implementation, which comprehend of rental rates, accessibility, location crowd, target market, security, and the number of competitors. Then, by evaluating the finished application, we concluded that the development of an application for Micro, Small and Medium Enterprises (MSMEs) recommendations is to facilitate prospective entrepreneurs to determine a strategic business location to build an entrepreneur.

Index Terms—Android, GPS, MSMEs, Recommendation, Simple Additive Weighting

I. INTRODUCTION

The use of information technology in the form of the internet by the community is beneficial in improving in terms of economic growth in a region. Many people have been able to transact buying and selling a product from the creative industry through the internet so that the industry players need media for the promotion and marketing of products from the creative industries [1].

Location recommendation system for establishing a business built to help entrepreneurs in making decisions to establish business locations. One method used is Simple Additive Weighting (SAW), with the recommendation system to determine the location of this business the criteria that will be the priority for selecting business locations are rental prices, accessibility, crowd, location, target market, security, and number of competitors [2] [3].

Previous research has carried out to make a decision support system using the Simple Additive Weighting (SAW) method of selecting a place of business, a selection decision support system for new branches and other locations. Some studies that use the SAW method in making decisions include choosing the establishment of a place of herbal medicine business [4], selecting the location of a new branch of a fish food store [5], determining the location of a business [6], determining a new location for a cafe [7] and determining the location of a branch Brown Cottage [8].

Based on preliminary research through surveys and interviews with the community as potential entrepreneurs, it was found that in starting MSME businesses, many prospective business actors had difficulty finding strategic locations in placing their MSMEs businesses.

Prospective business actors must go directly to visit one location to another to find information related to the business location, cause difficulties and require a long time in making decisions. Not a few also that after opening a business, it turns out that the location used is not still the target as expected before.

This research aimed at resolving these problems, so that prospective business people who would open a business, were facilitated in determining the location of their business under their wishes. This research uses the android platform so that it can help in positioning with a global positioning system (GPS). The current research located in the city of Bandung, West Java.

II. LITERATURE REVIEW

Micro, Small and Medium Enterprises (MSMEs) have a vital role in economic growth and development, not only in developing countries but also in developed countries. MSMEs in Indonesia is expected to continue to play an optimal role in the

absorption of labor to combat unemployment. According to BPS data, the number of MSMEs continues to increase and continues to dominate the number of companies.

Already since the beginning of the new order era until now the Indonesian government has run many programs to encourage the development of MSMEs. However, until now, compared to developed country, MSMEs in Indonesia are still weak in many ways, including still more focused on low-tech production, such as food, apparel, furniture, and crafts.

Based on existing secondary data, especially from BPS and literature studies, this book discusses the development of MSMEs in Indonesia with an emphasis on several important issues, such as export performance, competitiveness, significant constraints, technology transfer, and the level of involvement of women as entrepreneurs [9] [10].

The Simple Additive Weighting (SAW) method is often also known as the weighted sum method. The basic concept of SAW mode is to look for weighted sums of performance ratings on each alternative on all attributes. The SAW method requires the process of normalizing the decision matrix (X) to a scale that can compare with all existing alternative ratings [11].

Below are the steps to calculate the SAW method:

1. Determine the candidate, namely Ai.

2. Determine the criteria that will use as a reference in decision making, namely Cj.

3. Provide a match rating value of each candidate on each criterion.

4. Determine the preference or interest weight (W) for each criterion.

$$W = [W_1\ W_2\ W_3\ ...\ W_j] \qquad (1)$$

5. Make a match rating table of each candidate on each criterion.

6. Make an X decision matrix that is formed from the match rating table of each candidate on each criterion. The x value of each candidate (Ai) in each criterion (Cj) has been determined, where i = 1,2, ... m and j = 1,2, ... n.

$$X = \begin{bmatrix} x_{11} & x_{12} & \cdots & x_{1j} \\ \vdots & & & \vdots \\ x_{i1} & x_{i2} & \cdots & x_{ij} \end{bmatrix} \qquad (2)$$

7. Normalize the X decision matrix by calculating the normalized (rij) performance rating value of candidate Ai in the Cj criteria.

$$r_{ij} = \begin{cases} \dfrac{x_{ij}}{Max_i(x_{ij})} \\ \dfrac{Min_i(x_{ij})}{x_{ij}} \end{cases} \qquad (3)$$

8. The results of the normalized (rij) performance rating values form a normalized (R) matrix.

$$R = \begin{bmatrix} r_{11} & r_{12} & \cdots & r_{1j} \\ \vdots & & & \vdots \\ r_{i1} & r_{i2} & \cdots & r_{ij} \end{bmatrix} \qquad (4)$$

9. The final result of preference value (Vi) is obtained from the sum of the multiplication of normalized matrix elements (R) with preference weight (W) corresponding to the matrix column elements (W).

$$V_i = \sum_{j=1}^{n} w_j r_{ij} \qquad (5)$$

The results of the calculation of a larger Vi value indicate that the candidate Ai is the best candidate [12].

In February 2005 and was a revolution in how maps were on the web by allowing users to draw maps so they could navigate. This map using Google Maps solution at the time was still new and needed a particular server [13]. Google Maps used in this application to display a map of the location.

The recommendation system is a system designed to predict an item that matches the user's interests, which item will recommend to the user. Prediction of user interest information can be obtained based on user behavior action patterns or often said as user profiles. One way that does to form a user profile is, for example, when a user makes a loan transaction, the loan data will be stored as a user profile. Based on the user profile that has formed, it will be known the interest of the book that is liked by the user [14] [15].

III. RESEARCH METHOD

This research method has two stages, namely the data collection stage and the software development stage. The following is the flow of research that can be seen in Fig. 1.
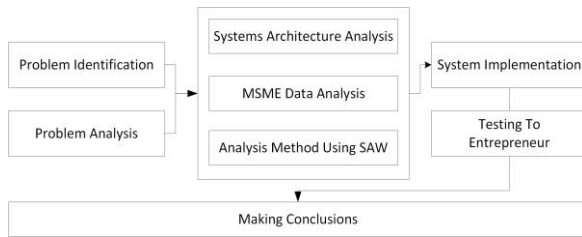
Fig. 1. Stage of research

System architecture analysis aims to describe how a system sends data requests and sends a response to the requested data up to the user, the system architecture can be seen in Fig. 2.
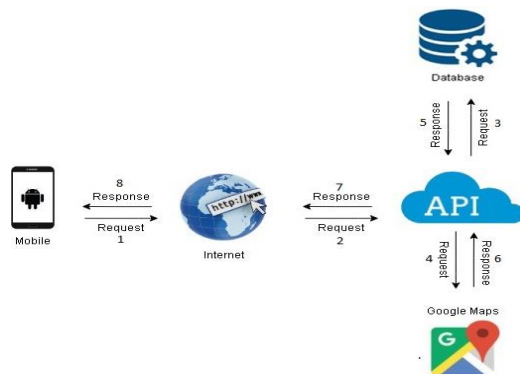
Fig. 2. System architecture

From the Fig. 2 above, it can be seen the flow of data requests that occur from application users to obtain information from a recommendation system to determine a strategic business location.

Analysis of MSMEs recommendations uses the SAW method to determine the location recommended by the system. At this stage, it aims to analyze the data obtained at the data collection stage to determine the details of each of the criteria. The recommendation flow from SAW can see in Fig. 3.
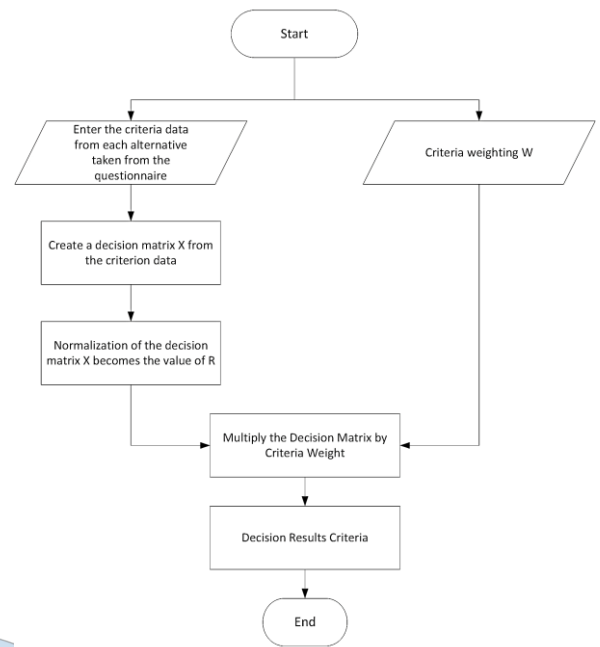
Fig. 3. Stages of SAW recommendations

IV. RESULTS AND DISCUSSION

After conducting interviews with entrepreneurs, there are six criteria used in this research, including:

1. Rental Price

2. Accessibility

3. Location Crowd

4. Target Market

5. Security

6. Amount of Competitors

A. Recommendation Method Analysis

Direct interviews with 30 entrepreneurs determine decision-making attributes (criteria), decision-making criteria and values. This value can be changed in the application based on the conditions desired by the user.

C1 = Rental Price = 15%

C2 = Accessibility = 20%

C3 = Location Crowd = 30%

C4 = Target Market = 15%

C5 = Security = 10%

C6 = Amount of Competitors = 10%

There are 30 alternative decision making namely:

A1= Kec. Andir, A2= Kec. Antapani, A3= Kec. Arcamanik, A4= Kec. Astana Anyar, A5= Kec. Ciparay, A6= Kec. Bandung Kidul, A7= Kec. Bandung Kulon, A8= Kec. Bandung Wetan, A9=

Kec. Batununggal, A10= Kec. Bojongloa Kaler, A11= Kec. Bojongloa Kidul, A12= Kec. Buahbatu, A13= Kec. Cibeunying Kaler, A14= Kec. Cibeunying Kidul, A15= Kec. Cibiru, A16= Kec. Cicendo, A17= Kec. Cidadap, A18= Kec. Cinambo, A19= Kec. Coblong, A20= Kec. Gedebage, A21= Kec. Kiaracondong, A22= Kec. Lengkong, A23= Kec. Mandalajati, A24= Kec. Panyeulikan, A25= Kec. Rancasari, A26= Kec. Regol, A27= Kec. Sukajadi, A28= Kec. Sukasari, A29= Kec. Sumur Bandung, A30= Kec. Ujungberung.

From each criterion the value determined: low= 2, medium= 3, high= 4 and very high = 5. The following is a table of criteria that have determined rental prices can see in Table I.

TABLE I.   RATING OF RENTAL PRICES

Rental Price (Rp)	Nominal
10.000.000 – 30.000.000	Very cheap
30.000.000 – 50.000.000	Cheap
50.000.000 – 60.000.000	Medium
60.000.000 – 100.000.000	Expensive

It is said to be very cheap if the price of Rp. 10,000,000 up to Rp. 30,000,000. It is cheap if the price is Rp. 30,000,000 to Rp. 50,000,000, medium from Rp. 50,000,000 up to Rp. 60,000,000. Expensive from Rp. 60,000,000 up to Rp. 100,000,000. With a weight of rental price, the value can see in Table II.

TABLE II.   RENTAL PRICES VALUE (C1)

Rental Price	Value
Expensive	2
Medium	3
Cheap	4
Very cheap	5

Accessibility is the route of public transportation that passes in a strategic business location. If there is public transportation that passes through that location, it said that access to that location is very easy to reach. If it can be accessed using a car and motorcycle, but there is no public transportation, it said that access to that location is easy, whereas if it can only be accessed using a motorcycle, then it is said to be medium. If the location is only accessible on foot, it is said difficult. Accessibility (C2) with a weight, the value can see in Table III.

TABLE III.   ACCESSIBILITY VALUE (C2)

Accessibility	Value
Difficult	2
Medium	3
Easy	4
Very Easy	5

Following is the criteria table of the location crowd criteria, the crowded location can see in Table IV.

TABLE IV.   LOCATION CROWD LEVEL

Crowd	Criteria
20.000 – 50.000 people	Not crowded
50.000 – 70.000 people	Pretty Crowded
70.000 – 100.000 people	Crowded
100.000 – 150.000 people	Very crowded

The number of sub-district residents in the city of Bandung said not too crowded. The population is 20,000 souls up to 50,000 souls. It said to be quite crowded, with 50,000 souls up to 70,000 souls. It is said to be 70,000 souls up to 100,000 souls. It is said to be very crowded. 100,000 souls up to 150,000 souls. (C3) with weight, values can see in Table V.

TABLE V.   LOCATION CROWD VALUE (C3)

Location Convenience	Value
Not crowded	2
Quite crowded	3
Crowded	4
Very crowded	5

The following is a criteria table of the target market criteria. The intended target market is the target market from these locations, such as schools or offices. The target market (C4) can see in Table VI.

TABLE VI.   TARGET MARKET VALUE (C4)

Target Market	Value
5 Km≤ 6 Km	2
3 Km ≤ 4 Km	3
1 Km ≤ 2 Km	4
200 M ≤ 500 M	5

The following is a criteria table of security criteria, and security records are said to be low if a crime occurs more than twice a month. One to two crimes a month are said to occur. It is said to be high if there is a crime once in a month. It is said to be very high if there has never been a crime in one month. Security (C5) with weight, values can be seen in Table VII.

TABLE VII.   SECURITY VALUE (C5)

Security Level	Value
Low	2
Medium	3
High	4
Very High	5

The following is a criteria table of the amount of competition. The amount of competition around the location is said to be Low if similar business competitors amount to 1 to 5. It said that medium 5 to 10. It said high 10 to 20. It is said to be very high from 20 to 30. Amount of competition (C6) with the weight of the value can see in Table VIII.

TABLE VIII.   AMOUNT OF COMPETITION VALUE (C5)

Amount of Competition	Value
Very High	2
High	3
Medium	4
Low	5

After the criteria and weight values of each criterion have determined, the following completion steps can see in Table IX.

TABLE IX.   CRITERIA MATCH RATING

Alternative	C1	C2	C3	C4	C5	C6
Kec. Andir	3	4	4	5	4	2
Kec. Antapani	3	5	5	5	4	2
Kec. Arcamanik	3	4	3	3	3	3
Kec. Astana Anyar	4	3	3	4	3	3
Kec. Ciparay	4	3	2	3	3	5
Kec. Bandung Kidul	4	2	2	2	3	4
Kec. Bandung Kulon	3	2	2	2	3	3
Kec. Bandung Wetan	3	3	2	2	3	3
Kec. Batununggal	3	3	2	3	2	2
Kec. Bojongloa Kaler	3	3	3	2	2	2
Kec. Bojongloa Kidul	3	2	2	3	2	3
Kec. Buahbatu	3	3	4	3	2	3
Kec. Cibeunying Kaler	3	2	2	3	2	3
Kec. Cibeunying Kidul	3	2	3	2	3	3
Kec. Cibiru	4	2	2	3	2	3
Kec. Cicendo	3	2	3	2	3	3
Kec. Cidadap	3	2	2	3	2	3
Kec. Cinambo	3	3	2	3	3	3
Kec. Coblong	3	4	5	5	4	3
Kec. Gedebage	3	3	3	4	3	3
Kec. Kiaracondong	3	3	4	4	4	3
Kec. Lengkong	3	3	4	5	3	3
Kec. Mandalajati	3	3	3	3	4	3
Kec. Panyeulikan	3	4	3	3	4	3
Kec. Rancasari	4	3	4	3	3	3
Kec. Regol	3	3	3	3	4	4
Kec. Sukajadi	4	4	5	5	4	3
Kec. Sukasari	3	4	3	3	4	3
Kec. Sumur Bandung	3	3	4	3	2	3
Kec. Ujungberung	3	3	3	2	3	3

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

Determining the preference weight or level of interest (W) for each criterion as follows:

$$W = [15, 20, 30, 15, 10, 10]$$

Normalize the X decision matrix. With the formula:

$R_{ij} = X_{ij}$ if j is the Max (X_{ij}) profit criteria (benefit)
$R_{ij} = Min (X_{ij})$ if j is the cost criterion X_{ij} (cost)

X_{ij} provides an advantage to decision-makers, on the contrary, the cost criteria if X_{ij} raises costs for decision-makers. The results of X normalization calculations for each criterion are as follows:

$$R = \begin{bmatrix} 1 & 0,8 & 0,8 & 1 & 1 & 1,00 \\ 1 & 1 & 1 & 1 & 1 & 1,00 \\ 1 & 0,8 & 0,6 & 0,6 & 0,75 & 0,67 \\ 0,75 & 0,6 & 0,6 & 0,8 & 0,75 & 0,67 \\ 0,75 & 0,6 & 0,4 & 0,6 & 0,75 & 0,40 \\ 0,75 & 0,4 & 0,4 & 0,4 & 0,75 & 0,50 \\ 1 & 0,4 & 0,4 & 0,4 & 0,75 & 0,67 \\ 1 & 0,6 & 0,4 & 0,4 & 0,75 & 0,67 \\ 1 & 0,6 & 0,4 & 0,6 & 0,5 & 1,00 \\ 1 & 0,6 & 0,6 & 0,4 & 0,5 & 1,00 \\ 1 & 0,4 & 0,4 & 0,6 & 0,5 & 0,67 \\ 1 & 0,6 & 0,8 & 0,6 & 0,5 & 0,67 \\ 1 & 0,4 & 0,4 & 0,6 & 0,5 & 0,67 \\ 1 & 0,4 & 0,6 & 0,4 & 0,75 & 0,67 \\ 0,75 & 0,4 & 0,4 & 0,6 & 0,5 & 0,67 \\ 1 & 0,4 & 0,6 & 0,4 & 0,75 & 0,67 \\ 1 & 0,4 & 0,4 & 0,6 & 0,5 & 0,67 \\ 1 & 0,6 & 0,4 & 0,6 & 0,75 & 0,67 \\ 1 & 0,8 & 1 & 1 & 1 & 0,67 \\ 1 & 0,6 & 0,6 & 0,8 & 0,75 & 0,67 \\ 1 & 0,6 & 0,8 & 0,8 & 1 & 0,67 \\ 1 & 0,6 & 0,8 & 1 & 0,75 & 0,67 \\ 1 & 0,6 & 0,6 & 0,6 & 1 & 0,67 \\ 1 & 0,8 & 0,6 & 0,6 & 1 & 0,67 \\ 0,75 & 0,6 & 0,8 & 0,6 & 0,75 & 0,67 \\ 1 & 0,6 & 0,6 & 0,6 & 1 & 0,50 \\ 0,75 & 0,8 & 1 & 1 & 1 & 0,67 \\ 1 & 0,8 & 0,6 & 0,6 & 1 & 0,67 \\ 1 & 0,6 & 0,8 & 0,6 & 0,5 & 0,67 \\ 1 & 0,6 & 0,6 & 0,4 & 0,75 & 0,67 \end{bmatrix}$$

After that, do the ranking process using equations information :

V_i = ranking for each alternative
W_j = weight value of each criterion
R_{ij} = normalized performance rating value

V1= (15)(1)+(20)(0,8)+(30)(0,8)+(15)(1)+(10)(1)+(10)(1) = 90
V2= (15)(1)+(20)(1)+(30)(1)+(15)(1)+(10)(1)+(10)(1) = 100
V3= (15)(1)+(20)(0,8)+(30)(0,6)+(15)(0,6)+(10)(0,75)+(10)(0,67) = 72,17
V4= (15)(0,75)+(20)(0,6)+(30)(0,6)+(15)(0,8)+(10)(0,7)+(10)(0, 7) = 67,42
V5= (15)(0,75)+(20)(0,6)+(30)(0,4)+(15)(0,6)+(10)(0,7)+(10)(0,4) = 55,75
V6= (15)(0,75)+(20)(0,4)+(30)(0,4)+(15)(0,4)+(10)(0,7)+(10)(0,50 = 49,75
V7= (15)(1)+(20)(0,4)+(30)(0,4)+(15)(0,4)+(10)(0,75)+(10)(0,65) = 55,17
V8= (15)(1)+(20)(0,6)+(30)(0,4)+(15)(0,4)+(10)(0,75)+(10)(0,67) = 59,17
V9= (15)(1)+(20)(0,6)+(30)(0,4)+(15)(0,6)+(10)(0,5)+(10)(1) = 63,00
V10= (15)(1)+(20)(0,6)+(30)(0,6)+(15)(0,4)+(10)(0,5)+(10)(1) = 66,00
V11= (15)(1)+(20)(0,4)+(30)(0,6)+(15)(0,6)+(10)(0,5)+(10)(0,67) = 55,67
V12= (15)(1)+(20)(0,6)+(30)(0,8)+(15)(0,6)+(10)(0,5)+(10)(0,67) = 71,67
V13= (15)(1)+(20)(0,4)+(30)(0,4)+(15)(0,6)+(10)(0,5)+(10)(0,67) = 55,67
V14= (15)(1)+(20)(0,4)+(30)(0,6)+(15)(0,4)+(10)(0,75)+(10)(0,67) = 61,17
V15= (15)(0,7)+(20)(0,4)+(30)(0,4)+(15)(0,6)+(10)(0,5)+(10)(0,6) = 51,92
V16= (15)(1)+(20)(0,4)+(30)(0,6)+(15)(0,4)+(10)(0,75)+(10)(0,67) = 61,17
V17= (15)(1)+(20)(0,4)+(30)(0,4)+(15)(0,6)+(10)(0,5)+(10)(0,67) = 55,67
V18= (15)(1)+(20)(0,6)+(30)(0,4)+(15)(0,6)+(10)(0,75)+(10)(0,67) = 62,17
V19= (15)(1)+(20)(0,8)+(30)(1)+(15)(1)+(10)(1)+(10)(0,67) = 92,67
V20= (15)(1)+(20)(0,6)+(30)(0,6)+(15)(0,8)+(10)(0,75)+(10)(0,67) = 71,17
V21= (15)(1)+(20)(0,6)+(30)(0,8)+(15)(0,8)+(10)(1)+(10)(0,67) = 79,67
V22= (15)(1)+(20)(0,6)+(30)(0,8)+(15)(1)+(10)(0,75)+(10)(0,67) = 80,17
V23= (15)(1)+(20)(0,6)+(30)(0,6)+(15)(0,6)+(10)(1)+(10)(0,67) = 70,67
V24= (15)(1)+(20)(0,8)+(30)(0,6)+(15)(0,6)+(10)(1)+(10)(0,67) = 74,67
V25= (15)(0,7)+(20)(0,6)+(30)(0,8)+(15)(0,6)+(10)(0,7)+(10)(0,67) = 70,4
V26= (15)(1)+(20)(0,6)+(30)(0,6)+(15)(0,6)+(10)(1)+(10)(0,50) = 69,00
V27= (15)(0,75)+(20)(0,8)+(30)(1)+(15)(1)+(10)(1)+(10)(0,67) = 88,92
V28= (15)(1)+(20)(0,8)+(30)(0,6)+(15)(0,6)+(10)(1)+(10)(0,67) = 74,67
V29= (15)(1)+(20)(0,6)+(30)(0,8)+(15)(0,6)+(10)(0,5)+(10)(0,67) = 71,67
V30= (15)(1)+(20)(0,6)+(30)(0,6)+(15)(0,4)+(10)(0,75)+(10)(0,67) = 65,17

There are 3 major results for ranking for MSME locations, namely:

V1 = Kec. Andir with value 90
V2 = Kec. Antapani with value 100
V19 = Kec. Coblong with value 92.67

B. System Implementation

The smartphone android used when implementing this application is using a smartphone that uses by entrepreneurs. The minimum requirements of a smartphone to implement this application is using processor snapdragon 625, memory 2GB, free space of ROM is 10 MB, operating system Android 4.4 Kitkat, network using HSPA/LTE and must have Global Positioning System (GPS) sensor. The implementation of a mobile application interface can see in Fig. 4 until Fig. 6.

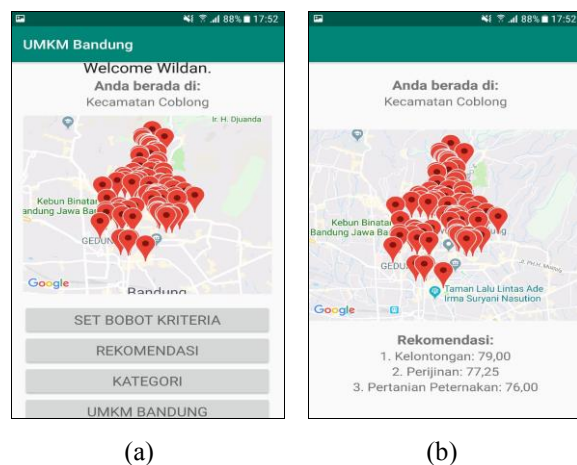(a)   (b)

Fig. 4. Recommendation using GPS location

In figure 4, it can explain that after the application is run, by default, it will detect the location of smartphone users by activating the global positioning

system (GPS) sensor. In Fig 4 (a), four menu choices are consisting of a set of criteria weights, recommendations, categories, and UMKM Bandung. Whereas Fig 4 (b) shows the information on the recommended business sector to be opened in the detected area. Fig 4 (b) will appear if the user selects the recommendation menu in Fig 4 (a).
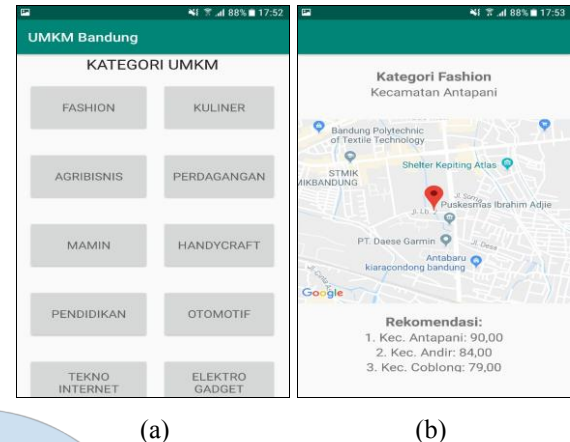

(a)   (b)

Fig. 5.   MSMEs recommendation using category

Fig. 5 (a) shows a list of MSMEs categories that can be selected. The application will display the most recommended locations to open based on the category options. Fig. 5 (b) shows that for the fashion category, it recommended opening in the Antapani sub-district area.

(a)   (b)
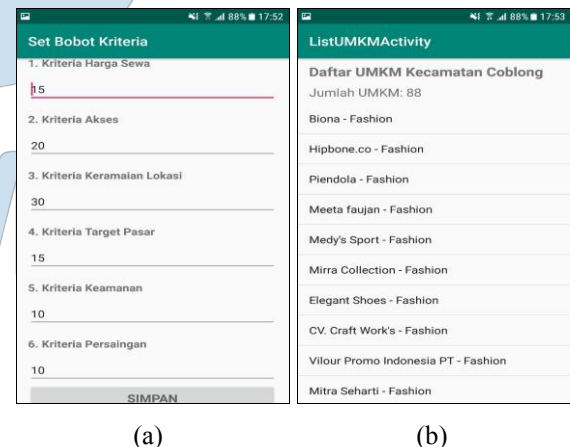
Fig. 6.   Setting the weight of criteria

In Fig. 6 (a), it can seem that the user can also change the rating weights of each criterion. This feature provided so that users are free to make a criterion the highest weight based on the desired situation and condition. In Fig. 6 (a), the user chooses the criteria for location crowd to be the highest value than the other criteria.

In Fig. 6 (b), users can also see a list of MSMEs in the selected location. Thus, the user indirectly also gets information related to the closest competitor that is available when opening a business in an area.

To input MSMEs data in an area, a website-based backend system use, as shown in Fig. 7, and Fig. 8. MSMEs data obtained from the relevant government agencies. This application using JSON as a web service so that the mobile application android can access the database stored on the server [16].

Fig. 7. Interface for input data MSMEs

Fig. 8. Back-end interface

C. User Acceptance Testing

Testing done by giving a questionnaire format to 30 prospective entrepreneur respondents, which are based on the target users and carried out calculations and then look for the percentage of each answer, can be seen in Table X.

TABLE X. ACCEPTANCE TESTING

Question 1 : Do you agree that this application of the MSMEs recommendation system can make it easier for you to determine your business location?				
SS	ST	RG	TS	STS
20	6	4	0	0
Average = (136/150) * 100 % = 90,6 %				
Question 2 : Do you agree that the application of the MSMEs recommendation system can help you determine where MSMEs are on target with marketing targets?				
SS	ST	RG	TS	STS
23	7	0	0	0
Average = (143/150) * 100 % = 95,3 %				
Question 3 : Do you agree that the MSMEs recommendation system application helps you get information about business locations using an android smartphone?				
SS	ST	RG	TS	STS
25	3	1	0	0
Average = (139 / 150) * 100% = 92,6 %				
Final Average = (90,6+95,3+92,6) / 3 = 92,83 %				

Based on the results of testing in Table X, it found that the functional objectives of this research could be categorized as successful because they obtained a total value of 92,83% from a maximum value of 100%.

V. CONCLUSION

The results obtained from this research are to start a business, must pay attention to several criteria. Applications built in research can provide recommendations to prospective entrepreneurs when opening a new business. It expected that the recommendations given could minimize the occurrence of failures in business. Research conducted at this time focus on Android-based mobile applications. Further research will focus on web-based and dashboard information systems so that all users who do not use an Android smartphone can also use this system.

ACKNOWLEDGMENT

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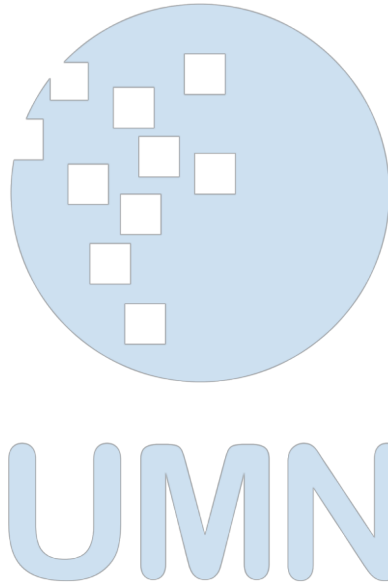
ADS-B Performance Monitoring and Potential Electromagnetic Interference

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Abstract—**The integration of unmanned aircraft systems (UAS) into the air traffic management will be very demanding. Surveillance equipments based on Automatic Dependent Surveillance-Broadcast (ADS-B) contribute a significant role for maintaining separations between both UAS and aircraft in order to maintain the requirements of aviation safety and airspace integrity. Performance analysis of ADS-B equipments related to signal quality and potential Electromagnetic/Radio Frequency Interference is very important to mitigate the failure risk in air traffic management. This paper discuss performance test analysis of ADS-B based surveillance equipments related to the most importance performance parameter namely the continuous reception of messages in terms of message drops and probability of update interval message receptions. Another performance test related to electromagnetic emission of ADS-B based surveillance equipments is conducted in order to mitigate potential RF interferences.**

Index Terms—**ADS-B, electromagnetic, performance test, Radio Frequency Interference (RFI), signal quality, surveillance, traffic management**

I. INTRODUCTION

Data received from ADS-B based surveillance equipments complement the coverage of radar data especially in areas where radar is not available (non-radar area). ADS-B data has a higher refresh rate of target (>1s) compare to radar. ADS-B data consists of navigational data such as position, velocity, time and integrity level. Secondary Surveillance Radar (SSR) is classified as a co-operative independent surveillance system. Aircraft replies SSR interrogating signal to the ground station (co-operative) and SSR ground station determines the aircraft range and azimuth with respect to the radar antenna (independent). Primary Surveillance Radar (PSR) is classified as a non-cooperative (no reply from aircraft) independent (ground station determine the aircraft range and azimuth based on the reflected PSR signal) surveillance system. In ADS-B system, the aircraft determine their own state (dependent) and the aircraft broadcast its position information to the ground station and the nearby aircrafts (co-operative). Therefore ADS-B is classified as a co-operative dependent surveillance system. The information of aircraft position is determined using GNSS (Global Navigation Satellite System).

Surveillance data received by ground stations is analyzed for data quality and signal quality in terms of latency and accuracy. Latency of surveillance data can be estimated by comparing the target (on-board reference) timestamps and the ground station timestamps. The accuracy of surveillance data can be calculated by having the root mean square and the average of the position offsets. The horizontal offset is determined as [1]:

$$d = (RE + h) \cdot \arccos (\sin \varphi 1 \sin \varphi 2 + \cos \varphi 1 \cos \varphi 2 \cos \Delta\lambda) \qquad (1)$$

with:

RE = the radius of the Earth

h = the altitude of the aircraft

φ = the latitude of the aircraft

λ = the longitude of the aircraft

Surveillance signal received by ground station is analyzed for signal quality in terms of update interval and integrity. The update interval of surveillance signal is the time interval between succeeding position messages received by ADS-B receiver. The time interval is calculated based on the timestamps from succeeding position messages received from a specific aircraft. This update interval relates closely to the reception probability. Reception probability may drop due to frequency congestion since ADS-B frequeny is also used for SSR. In addition, reception probability may also drop due to increasing traffic density and the type of ADS-B receivers. Integrity of surveillance signal is related to an indicator in the ADS-B message version 1 and 2 as NIC (Navigational Integrity Category). This NIC values present the Horizontal Position Limit (HPL). In En-route the acceptable NIC values must be higher or

equal to 5. In approaching phase the acceptable NIC values must be higher or equal to 7 [7][8] .

ADS-B becomes an enabler to improve surveillance data and signal quality in some non-radar areas. ADS-B data provides a better situational awareness for the pilot and better airborne separation applications. However, there is a necessity to improve the data and signal quality of ADS-B itself to ensure that a sufficient level of surveillance quality is satisfactory.

Therefore many studies have been performed to investigate the quality of ADS-B data and signal. In [1] an analysis of a large data set of raw ADS-B messages received by ground station has been described to investigate the quality of ADS-B. Results of this paper have shown that the aircraft are able to accurately report their navigational information, but reception probability and malfunctioning on-board equipment may decrease the quality of ADS-B signals. There are some foundings in this paper such as the corrupted ADS-B timestamps due to faulty in the time synchronization with UTC time. Update interval for position updates varies between 0.4 and 0.6 seconds. In the edge of coverage area the update interval increases due to poor reception from aircraft. But still the update interval is lower than the radar update interval (4seconds).

In [2] a study related to the use of ADS-B for Small Unmanned Aircraft Systems (SUAS) in a high density area and or near airport, in relation to separation with General Aviation (GA) which typically under 500 feet (ft) above ground level (AGL). The increase number of SUAS may result in a higher airspace traffic density with a large number of ADS-B. Results from this paper show that co-channel interference may impact GA aircraft ADS-B air to air performance negatively. While SUAS was not affected by the presence of GA aircraft, means that lower SUAS transmit power is recommended to reduce co-channel interference.

In [3] other types of surveillance equipments are evaluated for their surveillance quality. In the upcoming Communication Navigation Surveillance/Air Traffic Management (CNS/ATM), various types of surveillance sensors such as Ground Based Augmentation System (GBAS), Multi Lateration (MLAT) sensors and Wide Area Multilateration (WAM) are necessary to be fusioned in order to get a higher quality of surveillance data. Table 1 summarizes differences of SSR, WAMLAT and ADS-B.

In [4] security mechanisms to protect surveillance data using encoder-decoder algorithm is used which may detect illegitimate message as 4.3% of all datasets.

TABLE I. PERFORMANCE OF SSR, WAMLAT AND ADS-B [3]

	SSR	WAMLAT	ADS-B
Position fix-type	Time of Reception	Time Difference of Arrival	GNSS fix
Accuracy (at 90, 120 nm)	450,600 metres	30,60 metres	20,20 metres
Cost of Fitment	Nil cost	Nil cost	Cost involved
Potential for Global Coverage	No	No	Yes
Capacity increase	No	Potential	Yes
Aircraft to aircraft	No	No	Yes
Separation assurance	No	No	Yes
Aircraft intent	No	No	Yes

There are many parameters for the assessment of ADS-B performance, but this paper analyses only the signal quality in terms of update intervals, reception probability and electromagnetic radiated emission from various ADS-B surveillance equipment. The results of this test analysis provides an overview of the performance of ADS-B receivers and may be used as a reference for further study in a real observation ADS-B data instead of the generated RASS signal, a longer period of ADS-B data collection, and a more products testing for Radiated Emissions.

II. METHODOLOGY

This paper discusses merely the analysis of received surveillance signal in the signal quality aspects, by performing testing as follows:

1. Update intervals of the received surveillance signal from a RASS (Radar Field Analyser RFA 641) signal generator which simulates ADS-B Message DF-18.

2. Reception probability of the received position messages during the data collection period 15 August 2018

3. Electromagnetic Radiated Emission from several ADS-B receivers referring CISPR 22 product standards.

III. VULNERABILITY OF ADS-B SYSTEM

In [5][14] several critical elements that may cause decrease in data and signal quality of ADS-B system are discussed. The critical elements are:

1. GNSS data: Intentional threads (jammer, spoofing) and unintentional threads (ionospheric, GNSS satellites , RFI from: Mobile satellite service, VHF transmitter, Information Telecommunication Equipments, UWB radar, Digital TV broadcast)

2. Transmitter in the aircraft:

   a. Aircraft Navigational Sensors (GNSS):

   b. ADS-B transmitter (Intentional Threads: System Turn Off, Unlawful RFI)

3. Receiver in the aircraft:

   a. ADS-B receiver

   b. Surveillance Data processing

4. Ground Station:

   a. ATC display

   b. ATC processing system

   c. ADS-B receiver

   d. Traffic broadcast

5. Propagation Path (Intentional Threads: Spoofing, Jamming, RFI, Delayed message; unintentional threads: multipath, RFI)

The critical elements of ADS-B system are mostly from the ADS-B transmitter/receiver and the performance of GNSS. Performance of GNSS is discussed with their potential interference sources [15]. In addition, one of surveillance system which is based on ADS-B data is Advanced Surface Movement Guidance and Control System (A-SMGCS). A-SMGCS is an airport system used to improve the efficiency of the use of runway by increasing the capacity of runways while maintaining the required level of security]16]. One of the performance parameter of A-SMGCS is the Probabillity of Target Report (PTR) on the Surveillance output. This PTR value must be greater than or equal to 95% in the area of maneuver with the rate of renewal of data at least in one second [6, 16]. A complete Minimum Requirement for ADS-B data is discussed in [10].

This paper will discuss the signal quality in terms of Probability of Target Report (PTR) and the radiated emission of the ADS-B receivers.

IV. RESULTS AND DISCUSSION

A. ADS-B Signal Quality in Terms of Update Interval Rate and Reception Probability

Direct interviews with 30 entrepreneurs determine decision-making attributes (criteria), decision-making criteria and values. This value can be changed in the application based on the conditions desired by the user.

Statistical data of ADS-B receiver is discussed in [6] related to signal quality. The data was collected for six months. The Results are satisfactory and similar to the results published by EUROCONTROL and FAA 86.42% of them meets the EASA

requirements in RAD environment. Currently there is a large amount of ADS-B data available from several ADS-B stations in the world, which may be used for profiling the aircraft based on the kinematic characteristics to identify anomalies or unusual behavior of some aircrafts [9].

In this paper ADS-B is collected in a few hours only and then the collected data is analysed to assess their signal quality. The test setup of collecting ADS-B data has been performed in two types of test setup.

- *Test Setup 1:*

ADS-Breceiver is located on the third building of PTE-BPPT and received signals from ADSB-based surveillance transmitter which transmit ADS-B data to monitor ground vehicles (A-SMGCS) as shown in Figure 1.
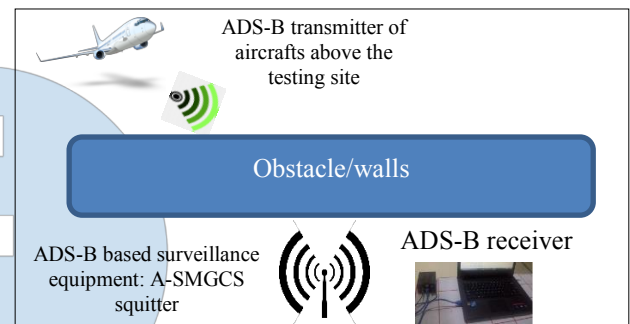
Fig. 1. First phase of test setup 1 of ADS-B signal quality testing with receiver inside the walls

At the first phase of testing, ADS-B receiver is conditioned to receive only ADS-B messages from A-SMGCS squitter for ground movement monitoring (ADS-B transmitter). The first phase of this testing has the setup as given in Figure 2.

Fig. 2. First phase of test setup 1, ADSB receiver only receives signal from A-SMGCS squitter

During this first phase of testing the antenna is blocked from the open sky to ensure no ADS-B messages received from aircrafts. The result is given in Table 2. Table 2 shows that the Probability of Reception (Probability of Target Report/PTR) is

higher than the required PTR value of 95 % when there is no received data from aircrafts. The receiver received only the transmitted data from ADS-B transmitter for ground vehicles.

TABLE II. RESULTS OF FIRST PHASE OF THE TEST SETUP 1 RELATED TO UPDATE INTERVALS AND PROBABILITY OF RECEPTION

Testing Parameter	Values	Units
Average Update Intervals	0.50	Second
Duration Time of Testing	1050.26	Second
Total Transmitted Data from ADS-B transmitter for ground movement monitoring	2100	Frames
Probability of Reception	**99.595**	%
Frame Loss	0.4054242	%
Total Detected Aircraft	0	aircraft

At the second phase of testing, ADS-B receiver is receiving not only data from ADS-B transmitter for ground vehicles, but received data from overflying aircraft above PTE-BPPT building which transmit ADS-B messages. The test setup of this 2nd phase of testing 1 is shown in Figure 3 and Figure 4. The result is given in Table 3.
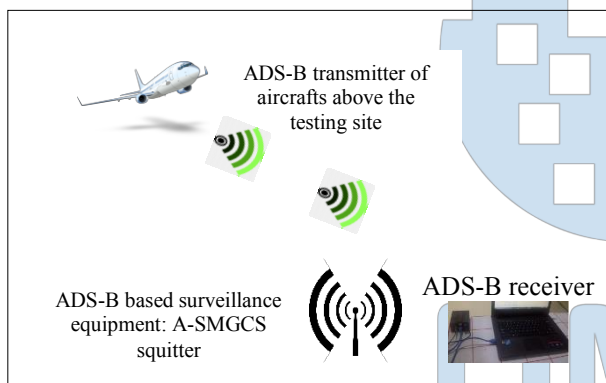

Fig. 3. Second phase of test setup 1 of ADS-B signal quality testing, ADS-B receiver has antenna open to the sky
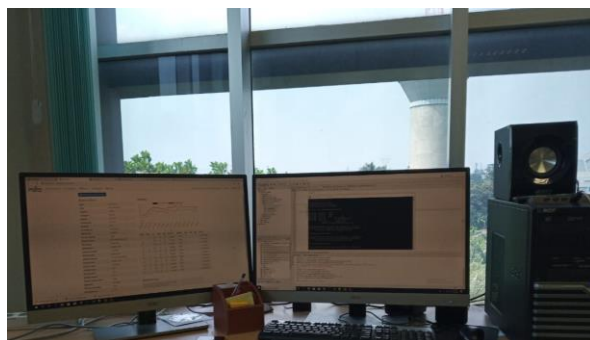
Fig. 4. Second phase of test setup 1, ADSB receiver receives signal from A-SMGCS squitter and the overflying aircrafts

TABLE III. RESULTS OF SECOND PHASE OF THE TEST SETUP 1 RELATED TO UPDATE INTERVALS AND PROBABILITY OF RECEPTION

Testing Parameter	Values	Units
Average Update Intervals	0.80	Second
Duration Time of Testing	929.98	Second
Total Transmitted Data from ADS-B transmitter for ground vehicles	1859	Frames
Probability of Reception	**62.582**	%
Frame Loss	37.418144	%
Total Detected Aircraft	23 to 26	aircraft

In this phase the performance of ADS-B receiver in terms of PTR has decreased to 62.582%, which is lower than the required PTR value. The ADS-B receiver received both data from ADS-B transmitter for ground vehicles and from 23 to 26 aircrafts overflying the PTE-BPPT building. The average update intervals are increasing too from 0.5 seconds to 0.8 seconds.

The decreased value of PTR may result for a possible data collisions since the ADS-B receiver used port that received only status data, Data Format (DF) 17 and DF-18 with a correct CRC bits (wrong data which is transmitted correctly will have a correct CRC bits. There is another port communication in the A-DSB receiver available which may report all datas including status data, error messages, and the DF17 and DF18 data.

- *Test Setup 2:*

ADS-B receiver is located on the second building of PTE-BPPT and received ADS-B signals generated from RASS Radar Field Analyser RFA 641 (Figure 5 and 6). RFA 641 generates a simulated ADS-B message DF18 which is received by ADS-B receiver.

In the first phase the RFA 641 generates ADS-B messages DF18and transmitted through a coaxial cable and then received by the ADS-B receiver.

Fig. 5. Test setup 2 first phase which is the RFA 641 connected through coaxial cable to the A-DSB receiver [13]

Fig. 6. Test setup 2 of ADS-B signal quality testing

The results of test setup 2 are given in table 4. The 2nd test setup has been conducted in two phases. The 1st phase by directly connecting with a coaxial cable from RAS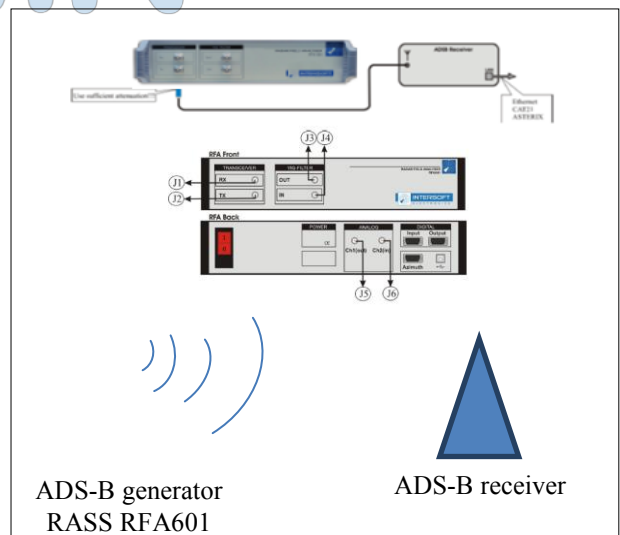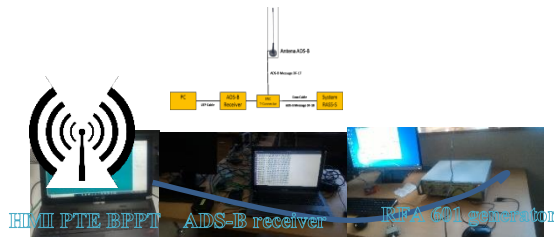S to ADS-B receiver. The 2nd phase of this set up, the RASS is still connected to ADS-B receiver by using a coaxial cable but in addition an antenna is attach to the ADS-B receiver to received signals from the overflying aircraft. Total received messages during the first phase of 2nd test setup is 1703 messages, while the total received messages during the second phase of 2nd test setup is 18.567 messages. The number of messages received at the second phase of testing is almost 10 times more messages than number of messages at first phase. The number of surface position messages during the second phase of testing is very low (491 messages).

During the time of observation the aircraft and ASMGC-S squitter tracking is effected by the amount of data losses. The tracking object is sometimes loss of track during this observation period. This results in loss of track in the HMI (Human Machine Interface) of ADS-B receiver as shown in Figure 7.
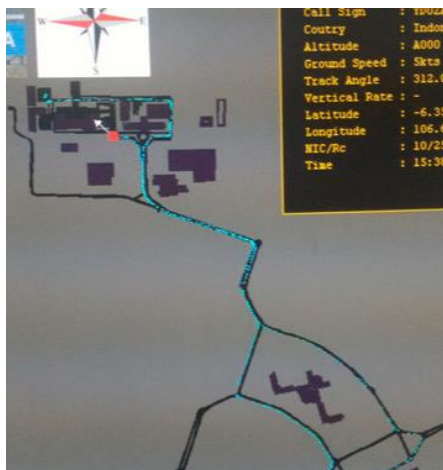
Fig. 7. Loss of track due to the data losses during the observation period of ASMGCS squitter

TABLE IV. RESULTS OF THE TEST SETUP 2 RELATED TO NUMBER OF DATA RECEIVED BY ADS-B RECEIVER

	15-08-2018	
	Coax cable from ADS-B receiver to RASS (1st phase)	Coax cable and antenna ADS-B receiver (2nd phase)
Starting Time	*15:22:03*	*15:46:01*
Total Airborne position message	0	7962
Total Surface position message	1619	491
Total Emergency message	0	217
Total Identification message	84	827
Total Velocity message	0	7895
Total Unknown Extended Squitter message	0	739
Total ADSBStatus message	0	436
Total Messages	*1703*	*18567*

In addition, there is a decrease in performance related to update interval. Average update interval during the first phase of 2nd test setup is 554 msec, while in the 2nd phase the average update interval decreases to 1829 msec as shown in Table 5.

TABLE V. RESULTS OF THE TEST SETUP 2 RELATED TO UPDATE INTERVAL TIMES

Test Setup 2 and the connection between RASS and ADS-B receiver:	Update Interval (milli seconds)			Total Observation Time
	min	avg	max	(seconds)
Coax cable (1st phase)	201	554	2103	896
Coax cable and additional antenna (2nd phase)	301	1829	9859	889

The decreased value of PTR may cause by a possible data collisions since the ADS-B receiver used port that received only status data, Data Format (DF) 17 and DF-18 with a correct CRC bits (wrong data which is transmitted correctly will have a correct CRC bits. There is another port communication in the A-DSB receiver available which may report all datas including status data, error messages, and the DF17 and DF18 data.

In addition, the horizontal offset is calculated as in equation 1 by using a refence position near PTE BPPT's building. The difference of horizontal offset between phase 1 and phase 2 in 2nd test setup is equal to 205 meter in average, with its minimum is equal to 152 meter and its maximum is equal to 1466 meter.

B. ADS-B Receiver Radiated Emission

In [12] a study about dropout rate of ADS-B messages from ADS-B receivers has shown that different type of aircrafts may have different duration of dropout time. The type of ADS-B transmitters and receivers used to receive ADS-B data has a significant impact into the duration of dropout time. The dropout rates are the number of times the data did not indicate a one second update period. The dropout rates are categorized into several data starting from the number of dropout of is less than 10seconds (over 49% of dropouts are in this category) until the number of dropout is greater than 60 seconds (about 7% of dropouts are in this category).

In the 2nd test setup with a coaxial cable connection only between RASS and ADS-B receiver, the number of received signal with dropout time less than 10 seconds is 92.89 %, while the number of received signal with dropout time between 10 seconds and 60 seconds is 7.10 %. There is no dropout time bigger than 60 seconds.

In the 2nd test setup with a coaxial cable connection and an additional antenna attach to ADS-B receiver, the number of received signal with dropout time less than 10 seconds is 98.52 %, while the number of received signal with dropout time between 10 seconds and 60 seconds is 1.78 %. There is 0.05% dropout time bigger than 60 second.

TABLE VI.   RESULTS OF THE TEST SETUP 2 RELATED TO NUMBER OF DROPOUT DATA

Dropout Time	Coax Cable (1st Phase)	Coax Cable+Additional Antenna (2nd Phase)
less than 10 seconds	0.9289	0.9852
between 10 to 60 seconds	0.0710	0.0178
greater than 60 seconds	0	0.0005

The number of data generated in the duration of approximately 900 seconds, on the first phase of 2nd testing, is around 1721 data. While on the second phase of 2nd testing is around 18000 data. The number of data in the 2nd phase of testing is much higher than the generated RASS data because the ADS-B receiver is connected through a port that received not only DF17 and DF18 datas, but also additional status data of aircraft, velocity and error data too.

In order to have a better overview about the number of data received in the airport area, a measurement is conducted near Jakarta airport. The number of data received is 2950 data for both DF17 and DF18 data (see Fig.8).
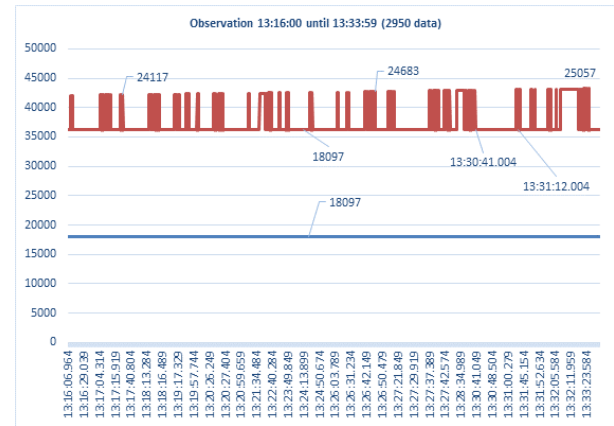
Fig. 8. ADS-B surveillance based signal strength scanning in the surrounding of Jakarta airport (dBuV)

The signal strength is approximately 25 dBuV as shown in figure 4, and the longest update interval is about 30 seconds (between 13:30:41.004 to 13:31:12.004) and some update intervals overlap. There are many signal sources from various targets, therefore testing of potential EMI (Electromagnetic Interference) from the surrounding equipment are necessary. Especially as mentioned in [11] there are many types of interference and classified into intentional interference (jamming, spoofing, and eavesdropping) and unintentional interference (EM emissions and harmonics).

EMI testing has been conducted regarding the radiated emission for both low frequency (30MHz to 1 GHz) and high frequency (1GHz to 6 GHz) (see fig.9). There are two ADS-B based receiver tested, ADS-B receiver 1 and ADSB-receiver 2.

Fig. 9. EMI testing setup fot ADS-B testing

Table 7 shows the result of EMI testing for high frequency radiated emission for the first ADS-B based receiver, while table 8 shows the result for the second ADS-B receiver.

TABLE VII.   RESULTS OF RADIATED EMISSION HIGH FREQUENCY OF ADS-B RECEIVER 1

Freq	PKk	Limit PK	AVG	Limit AVG	Margin PK	Margin AVG
MHz	dBuV	dBuV	dBuV	dBuV	dBuV	dBuV
1821.249	46.504	70	43.303	50	-23.496	-6.697

TABLE VIII. RESULTS OF RADIATED EMISSION HIGH FREQUENCY OF ADS-B RECEIVER 2

Frequency	PK	Limit PK	AVG	Limit AVG	Margin PK	Margin AVG
MHz	dBuV	dBuV	dBuV	dBuV	dBuV	dBuV
1819	45.318	70	41.519	50	-24.682	-8.481

The above figures show that the radiated emission at high frequency (1 GHz- 6GHz) is stronger in some frequency generated by the first ADS-B receiver, namely in the frequency of 1821.240MHz which has a value of 43.303 dBuV. Other frequencies have almost similar strength.

Table 9 shows the result for radiated emission in low frequency of ADS-B receiver 1 and Table 10 shows the result for radiated emission in high frequency of ADS-B receiver 2.

TABLE IX. RESULTS OF RADIATED EMISSION LOW FREQUENCY OF ADS-B RECEIVER 1

Frequency	PK	QP	Lmt_QP	Margin
MHz	dBuV	dBuV	dBuV	dB
31.08	-3.941	-8.793	40	-48.79
960.012	24.517	21.921	47	-25.08

TABLE X. RESULTS OF RADIATED EMISSION LOW FREQUENCY OF ADS-B RECEIVER 2

Frequency	PK	QP	Lmt_QP	Margin
MHz	dBuV	dBuV	dBuV	dB
32.004	-4.3	-9.264	40	-49.26
912	30.144	28.704	47	-18.3
959.986	26.893	24.785	47	-22.21

The above figures show that the radiated emission at low frequency (30 MHz- 1GHz) is stronger in some frequency generated by the second ADS-B receiver, namely in the frequency of 959.986 MHz which has a value of 24.785 dBuV. In addition, there is additional emission in the frequency 912MHz with a value of 28.704 dBuV. These frequencies will not have potential interference with ADS-B signal.

In addition, a measurement is conducted in the surrounding area of ADS-B receivers to collect information regarding potential electromagnetic interference in the ADS-B and GNSS frequency range. The result is given in Figure 10.
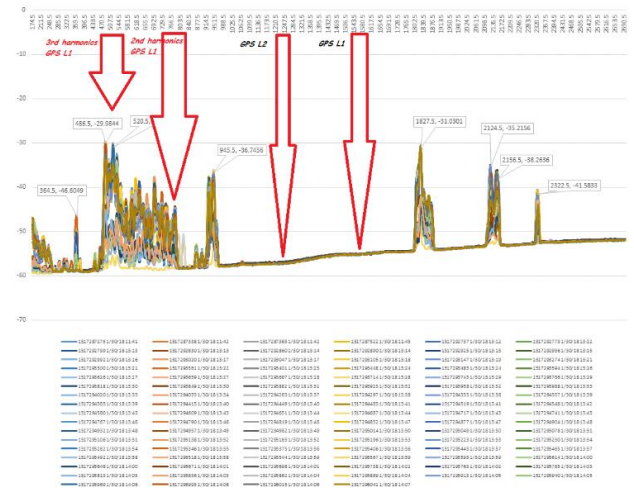
Fig. 10. Potential electromagnetic interference to the GNSS receiver inside ADSB [15]

The above figures show that there is a potential Electromagnetic Interference to the GNSS receiver in ADS-B [15].

V. CONCLUSION

This paper presented testing data analysis from various test setups to acquire update interval times, probability of reception, dropout data interval, and the radiated emission of two ADS-B receivers. If the data is generated from RFA 601, then the update interval is approximately 0.5second and the probability of reception is approximately 99.595% which is above the requirement of EUROCAE. When the data is received from both RFA 601 and an attached antenna, the update interval is approximately 0.8 second and the probability of reception has decreased into 62.582%, which is below the requirement of EUROCAE. A further study is necessary to assess whether lower probability of reception is caused by the option of port connection which transmit all data including error messages by trying different ports of connection in a longer observation time. Most of dropout time is less than 10 seconds and there is no dropout time is bigger than 60 seconds. A further statistical data analysis of ADS-B based surveillance equipment is necessary to assess the performance of this equipment in both signal quality and radio frequency interference. In addition, the radiated emission test results show that two ADS-B based surveillance equipment have similar radio frequency emission but with different field strength. A further study is necessary to assess more ADS-B based surveillance equipment in order to have a better data analysis.

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MeDict: Health Dictionary Application Using Damerau-Levenshtein Distance Algorithm

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Abstract—**Typographical error often happens. It can occur due to mechanical errors or missed hands or fingers when typing. Someone's ignorance of how to spell correctly also can cause typographical errors. Dictionary application development has been carried out by various parties so that the searching process in the dictionary becomes more efficient. However, there is no word search optimization when the typographical error happens. Typographical errors in the searching process can result in the information sought cannot be found. The Damerau-Levenshtein Distance algorithm implemented to provide search suggestions when a typographical error occurs. This research aims to design and build a health dictionary application, MeDict, using the Damerau-Levenshtein Distance algorithm. Technology Acceptance Model (TAM) used to evaluate the application. The result is 86.2% stating strongly agree that the application can be useful and 86.9% stating strongly agree that the application can be used easily.**

Index Terms—**Damerau-Levenshtein distance, dictionary, Technology Acceptance Model, typographical error**

I. INTRODUCTION

In the world of education, especially in the medical field, it is very important for a student majoring in medicine to understand medical terms. In the medical field, there are many terms that are difficult to understand [1]. In a book-shaped dictionary, the process of vocabulary search is still ineffective because the dictionary is large and thick, so the search process will take a long time [2]. Therefore, the development of dictionary applications has been carried out by various parties so that the search process the terms in the dictionary become more efficient. However, there was no search optimization when a typographical error occurred. Typographical errors by a user can result in the information sought can not be found.

Typographical errors can be caused by mechanical errors, such as mistyping due to finger movements. It sometimes also caused by someone's lack of knowledge about how to spell the correct word. Common mistakes made when typing include substitution, insertion, deletion, or transposition (exchanging two adjacent letters) [3].

To overcome this problem, we need a method that can be used to optimize word searching in a dictionary application. This search optimization can be done by providing search suggestions if the input word cannot be found in the dictionary.

The edit distance algorithm can be used to provide search suggestions, including the Hamming distance and Levenshtein distance algorithms [4]. Peggy has successfully implemented the Levenshtein Distance algorithm to optimize word search in Chinese - Indonesian translator applications [5]. However, research by Sutisna and Adisantoso proved that spelling correction using the Damerau-Levenshtein Distance algorithm can improve a search engine performance by 22% rather than using the Levenshtein Distance algorithm [6]. Research by Jupin, Shi, and Obradovic proved that the Damerau-Levenshtein Distance algorithm has a smaller number of errors (false positive) than the Jaro-Winkler Distance algorithm [7]. Vogler explained that the choice of a string distance algorithm depends on the problem situation being encountered. If the problem is typographical errors, then the variations of Levenshtein Distance algorithm are good, because the algorithm takes into account three or four (for Damerau-Levenshtein Distance) types of typing errors that usually occur [8].

Based on the previous researches, this health dictionary application called MeDict uses the Damerau-Levenshtein Distance algorithm to optimize word searching. The Damerau-Levenshtein Distance algorithm will be used to correct typographical errors by giving word suggestions that have similarities according to the Damerau-Levenshtein Distance calculations.

II. LITERATURE REVIEW

A. Damerau-Levenshtein Distance

The Damerau-Levenshtein Distance algorithm was developed by Frederick J. Damerau. Damerau-

Levenshtein Distance is a measurement (metric) produced through the calculation of the number of differences found in two strings. The Damerau-Levenshtein Distance algorithm determines the minimum number of operations needed to convert one string into another string.

Damerau-Levenshtein Distance algorithm is a development of the Levenshtein Distance algorithm. Damerau extended Levenshtein distance to also detect transposition errors and treat them as one edit operation [7]. Therefore Damerau-Levenshtein calculates the minimum insertion, deletion, substitution, and transposition operations to convert one word into another. Damerau stated that about 80% of typographical errors were the result of all four operations.

The pseudocode of the Damerau-Levenshtein Distance algorithm can be seen in Table 1.

TABLE I. PSEUDOCODE OF DAMERAU-LEVENSHTEIN DISTANCE ALGORITHM [9]

Damerau-Levenshtein Distance Algorithm
function damerauLevenshteinDistance(input s : array[1..m] of char, input t : array[1..n] of char) ◊ integer {function to compute Damerau-Levenshtein distance between two strings using Damerau-Levenshtein algorithm
DECLARATION i, j : integer cost : integer d : array [0..m][0..n] of integer

ALGORITHM
for i ← 1 to m do { source prefixes initialization }
  d[i][0] ← i
endfor
for j ← 1 to n do { target prefixes initialization }
  d[0][j] ← j
endfor
{ using Damerau-Levenshtein Algorithm to check } for i ← 1 to n do
  for j ← 1 to m do
    if (s[i] == t[j]) then
      cost ← 0
    else
      cost ← 1
    endif
    d[i][j] ← minimum (
      d[i-1][j] + 1, { deletion }
      d[i][j-1] + 1, { insertion }
      d[i-1][j-1] + cost { substitution }
)
    if (i > 1 and j > 1 and s[i] == t[j-1]
    and s[j-1] == t[i]) then
      d[i][j] ⇓ minimum (
        d[i][j],
        d[i-2][j-2] + cost { transposition }
)
    endif
  endfor
endfor
→ d[m][n] { return results }

B. Filter and Verify Method

In the 90s, the "filter and verify" method was introduced to reduce data comparisons in the calculation of edit distance. Research on this method is still very active. Filters can make the system more efficient by removing unnecessary comparisons. One of the most common methods is length filtering, where the difference in the length of the two strings *s* and *t* must not be greater than *k* [7]. The algorithm of length filtering can be seen in Table 2.

TABLE II. LENGTH FILTERING ALGORITHM [7]

Length Filtering Algorithm

Algorithm: LengthFilter(s, t)
Input: s, t: strings of characters
Output: Boolean
Begin
  if $abs(|s| - |t|) > k$: **return** FALSE
  else: **return** TRUE
  end-if
end

C. Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM) was introduced by Fred D. Davis in 1989 as an instrument for predicting the possibility of new technology being adopted in a group [10].

The Technology Acceptance Model can be illustrated in Fig. 1. According to this model, the user's attitude towards the use of a given system is considered to be the major determinant of whether he uses it or not. Attitudes toward use are influenced by two variables: perceived usefulness and perceived ease of use. Perceived usefulness is the degree to which an individual believes that using a particular system will improve the performance of his work. Perceived ease of use is the degree to which an individual believes that using a particular system will be free of physical and mental effort. Perceived usefulness is also influenced by perceived ease of use because a system that is easier to use will result in increased job performance. Design features directly influence perceived usefulness and perceived ease of use [11].
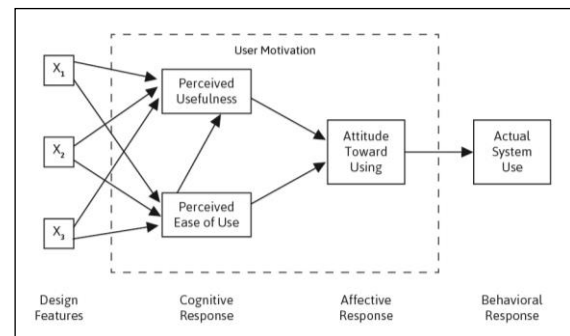

Fig. 1. First phase of test setup 1 of ADS-B signal quality testing with receiver inside the walls

Initially, Davis used 14 indicators (initial scale items) in measuring perceived usefulness and perceived ease of use. But after several trials, the

results obtained in the form of 6 measurement indicators are better and more practical. Table 3 is a measurement indicator for the variables of perceived usefulness and perceived ease of use.

TABLE III. INDICATORS OF PERCEIVED USEFULNESS AND PERCEIVED EASE OF USE [12]

Scale Items
Usefulness
1. Work More Quickly
2. Job Performance
3. Increase Productivity
4. Effectiveness
5. Makes Job Easier
6. Useful
Ease of Use
1. Easy to Learn
2. Controllable
3. Clear & Understandable
4. Flexible
5. Easy to Become Skillful
6. Easy to Use

III. EXPERIMENTAL RESULTS

Damerau-Levenshtein Distance algorithm will be evaluated by comparing the results of manual calculation with the results of the calculation of edit distance by the application. Following is the scenario of testing the Damerau-Levenshtein Distance algorithm. Table 4 is a sample of data entered by the user.

TABLE IV. USER SAMPLE DATA

Words typed	Words supposed to be
dislekei	disleksia
neuorablastona	neuroblastoma
influnea	influenza
frotifikasi	fortifikasi
black water feaver	blackwater fever

The application will calculate the edit distance value using the Damerau-Levenshtein Distance algorithm and provide a list of word suggestions that are similar to words entered by the user. Fig. 2 shows the search result for the word "dislekei" in the health dictionary application. Based on Fig. 2 it can be seen that the application can provide search suggestions when typographical error occurs.

The tolerance value used in this application is 50%, meaning that the application will only display word suggestions that have an edit distance that is less than or equal to 50% of the number of letters entered by the user. The word "dislekei" has 8 letters, meaning the application will display word suggestions that have an edit distance value of less than or equal to 4.
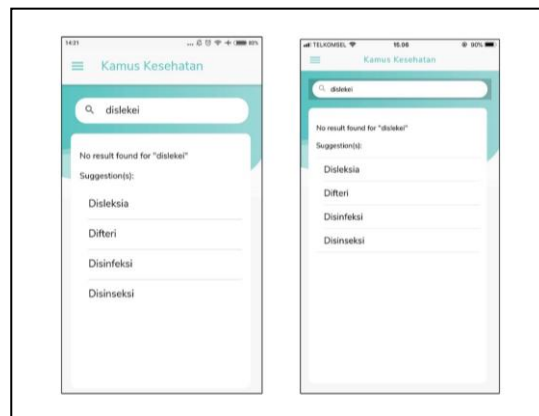
Fig. 2. User's Search Result

Table 5 is the manual calculation of the Damerau-Levenshtein Distance algorithm. The last cell colored in green shows the edit distance value between the words "dislekei" and "disleksia", which is 2.

TABLE V. DAMERAU-LEVENSHTEIN DISTANCE CALCULATION

		d	i	s	l	e	k	s	i	a
	0	1	2	3	4	5	6	7	8	9
d	1	0	1	2	3	4	5	6	7	8
i	2	1	0	1	2	3	4	5	6	7
s	3	2	1	0	1	2	3	4	5	6
l	4	3	2	1	0	1	2	3	4	5
e	5	4	3	2	1	0	1	2	3	4
k	6	5	4	3	2	1	0	1	2	3
e	7	6	5	4	3	2	1	1	2	3
i	8	7	6	5	4	3	2	2	1	2

Fig. 3 is the result of the Damerau-Levenshtein Distance calculation by the application. It shows that the result of the edit distance is 2. Based on Table 5 and Fig. 3, it can be seen that the calculation result in the health dictionary application equals to the result of the manual calculation.

```
distance = d[8][9] = 2
```

Fig. 3. Damerau-Levenshtein Distance Calculation Result by Application

Application acceptance testing was also conducted in this study. The method used in testing application acceptance is based on the Technology Acceptance Model (TAM) by distributing questionnaires. The sampling technique used was purposive sampling technique. Therefore, the questionnaire was given to 35 respondents related to the medical field, namely medical students and nursing students to get an assessment of this health dictionary application. Questionnaire questions are divided into two parts: perceived usefulness and perceived ease of use.

Table 6 is the answer to the questionnaire for the perceived usefulness variable. Based on the calculation of the total score of the perceived

usefulness variable, it can be concluded that 86.2% of users strongly agree that this health dictionary application can improve work performance and be useful.

TABLE VI. PERCEIVED USEFULNESS QUESTIONNAIRE RESULT

Questions	1	2	3	4	5
The Medict application speeds up my work in finding the meaning of a medical term	0	1	3	15	16
Using the Medict application can improve my work performance	0	0	4	17	14
In my opinion, using Medict application can increase my productivity	0	1	4	18	12
In my opinion, the use of Medict application can help me search the meaning of a medical term effectively	0	1	5	10	19
In my opinion, the Medict application can facilitate me in finding the meaning of a medical term	0	0	4	14	17
Overall, the Medict application is useful	0	0	4	14	17

Table 7 is the answer to the questionnaire for the variable perceived ease of use. Based on the calculation of the total score of the ease of use variable, it can be concluded that 86.9% of users strongly agree that the health dictionary application is easy to use.

TABLE VII. PERCEIVED EASE OF USE QUESTIONNAIRE RESULT

Questions	1	2	3	4	5
In my opinion, Medict application is easy to learn	0	1	3	18	13
In my opinion, Medict application can be run according to its function	0	0	3	18	14
In my opinion, Medict application is clear and understandable	0	1	4	11	19
My interaction with Medict application is easy for me to understand	0	0	2	16	17
I can easily familiarize myself with every feature in Medict application	0	1	4	14	16
Overall, Medict application is easy to use	0	0	2	16	17

IV. CONCLUSION

The health dictionary application has been successfully designed and built using the Damerau-Levenshtein Distance algorithm. The application is built based on mobile which can be used on devices with the Android and iOS operating systems. The programming language used to build this application is Typescript using the Ionic framework. The health dictionary application can provide search suggestions with the Damerau-Levenshtein Distance algorithm calculation if there are typographical errors. Search suggestions given to users are sorted from the lowest to highest edit distance values. The implementation of length filtering method also works fine to reduce the comparison of words that are not needed.

This application has been evaluated by 35 respondents using the Technology Acceptance Model (TAM) and obtained a result of 86.2% states strongly agree that the application can be useful (perceived usefulness) and 86.9% states strongly agree that the application can be easily used (perceived ease of use).

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The Right Sentiment Analysis Method of Indonesian Tourism in Social Media Twitters

Case Study: The City of Bali

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Abstract—The growth of social media is changing the way humans communicate with each other, many people use social media such as Twitter to express opinions, experiences and other things that concern them, where things like this are often referred to as sentiments. The concept of social media is now the focus of business people to find out people's sentiments about a product or place that will become a business. Sentiment Analysis or often also called opinion mining is a computational study of people's opinions, appraisal, and emotions through entities, events and attributes owned. Sentiment analysis itself has recently become a popular topic for research because sentiment analysis can be applied in many industrial sectors, one of which is the tourism industry in Indonesia. To be able to do a sentiment analysis requires mastery of several techniques such as techniques for doing text mining, machine learning and natural language processing (NLP) to be able to process large and unstructured data coming from social media. Some methods that are often used include Naive Bayes, Neural Networks, K-Nearest Neighbor, Support Vector Machines, and Decision Tree. Because of this, this research will compare these four algorithms so that an algorithm can be used to analyze people's sentiments towards the city of Bali.

Index Terms—decision tree, k-nearest neighbor, naive bayes, neural networks, sentiment analysis, social media, support vector machines, twitter

I. INTRODUCTION

At this time social media is certainly not something foreign to talk, social media has changed human lives and ways human interact because social media is currently used by someone as a source of information and entertainment media [1]. The growth of social media itself change the way humans communicate with each other, many people use social media to express opinions, experience or other things that concern them, where things are like this is often referred to as sentiment [2]. The new concept of social media now became a main agenda of business people, be it decision makers or consultants businesses, all trying to identify whether the company can get various benefits [3]. One branch of research which then developed from the information explosion situation on the internet is sentiment analysis [4]. By doing a sentiment analysis, public opinion can be known about a product or service offered or to do a research [5].

Sentiment Analysis or often also called opinion mining is a study computational from people's opinions, appraisal, and emotions through entities, event and attributes owned [4]. Sentiment analysis itself has become a popular topic to be made because sentiment analysis can be applied in many industrial sectors, include the tourism industry [6]. Tourism sector in Indonesia itself always experience improvements every year and this tourism sector now ranked 42nd in the world [7]. One purpose famous tourism both in Indonesia and the world is the city of Bali, no Undoubtedly Bali City has a rich and diverse cultural heritage and the beauty of natural panoramas [8]. technology has become one important factor in improving the tourism industry sector in Indonesia, this is because in this digital age almost all people are connected to it social media as long as they are traveling [7]. In some last year, twitter became one of many social media that used by a lot of people, Twitter is one of the media social and a service microblogging which allows its users to send a message real time [2]. With twitter, public sentiment or opinion on tourism in a city can be known because inside tweet someone often conceives important information from an event that is very valuable to use as a tool to find out public opinion about these attractions, in addition that by using twitter can be seen the event or topic of the discussion currently popular with regard to tourism in the city by using hashtags [7].

To be able to do a sentiment analysis mastery of several techniques such as techniques to perform are required text mining, machine learning and natural language processing (NLP) to be able to process large and unstructured data that comes from social media [9]. Several algorithms that are often used to do sentiment analysis's are Support Vector Machine, Naïve Bayes, K-Nearest Neighbors, and Decision tree. Research conducted by Mardiana make a comparison

of methods for carrying out a classification among them are algorithms Support Vector Machine, Naïve Bayes, K-Nearest Neighbors, and Decision tree mention that the highest accuracy is obtained by using the SVM algorithm [10]. Other studies conducted by Romadloni conducted an algorithmic comparison Naïve Bayes, KNN, and Decision Tree mention that the highest accuracy is obtained with using an algorithm Decision Tree [11]. While other studies were conducted by Aulianita who compares algorithms SVM and KNN mention that the highest accuracy is obtained by using an algorithm KNN [12].

From the discussion above it was found that social media has been used by more than half of the world's population and social media alone have many the benefits. One of the benefits of social media is that it can do sentiment analysis or public opinion on something because of social the media is currently used by the public to express opinions or experience that concerns them. There are several algorithms that is usually used in sentiment analysis, i.e. the algorithm Naive Bayes, Support Vector Machine, K-Nearest Neighbors, and Decision Tree. Surely every method or algorithm used for analyzing sentiments will require different methods and producing results different. Therefore, this study will compare the four algorithms in conducting tourism sentiment analysis in Indonesia, especially the city of Bali, using social media twitter as data source.

II. BASIC THEORY

A. Sentiment Analysis

Sentiment analysis is a technique or method used for identify how a sentiment is expressed using text and how these sentiments can be categorized as positive sentiments negative sentiment [2]. Sentiment analysis includes the detection, analysis and evaluation of states of mind people to various events, problems, services or other interests [13]. The purpose of sentiment analysis itself is to find opinions, identify the sentiments they express, and then classifies its polarity [14]. Sentiment analysis itself can be divided into 2 parts, opinion mining relating to expressions and opinions and emotional mining related to with one's emotions in pronunciation or articulation [13].
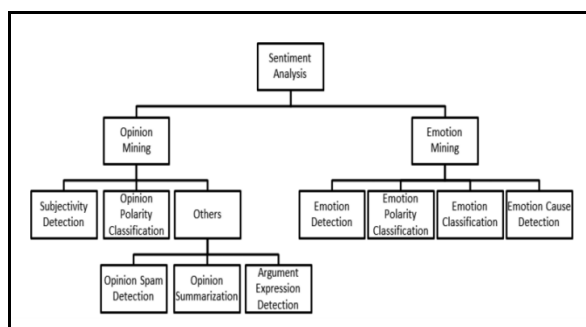

Fig. 1. Taxonomy of sentiment analysis

Opinion Mining more towards the concept of opinion expressed in the text which can be categorized into positive, negative or neutral expressions, while emotion mining more toward someone's emotions (happy, sad, angry) which is poured into a text [13].

B. Support Vector Machine

Support vector machine is a set of guided learning methods (supervised learning) which analyzes data and recognizes patterns, is used for classification and regression analysis [2]. Support Vector Machine is one of the best methods that can be used in the problem of classification, the concept of SVM stems from the problem of classification two class so that requires training set positive and negative [15]. The concept of classification is done by maximizing boundaries hyperplane that separating a data set or class, ability Support Vector Machine in finding hyperplane make this algorithm has a high level of generality and makes it the algorithm with the best level of accuracy compared to the others algorithm [1].
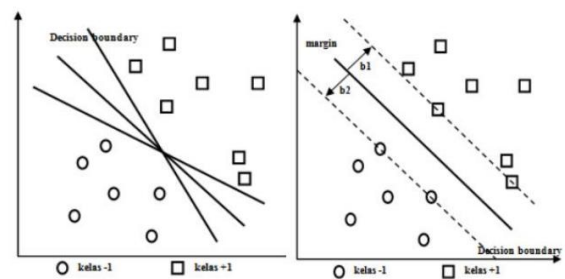
Fig. 2. Illustration of support vector machine

The picture above explains the concept of SVM classification, shown in figure (a) some data with circles as class -1 and squares as class +1, at the picture also exists hyperplane which is possible for data sets [16]. Figure (b) is hyperplane the maximum, calculation hyperplane done by calculating the distance of the margin to the nearest data from each class, the closest data is called Support Vector Machine [16].

C. K- Nearest Neighbors

Algorithm K-Nearest Neighbors (k-NN) is one of the most popular algorithms in machine learning, this is because the process is easy and simple, other than that k-NN also one of the algorithms supervised learning with process learning based on the value of the target variable associated with the variable value predictor [17]. Simple principle adopted by the algorithm NN is "if an animal is walking like a duck, then the animal may be duck", the closer the test data location is, it can be said that the training data these are seen more closely by the test data [12]. In the algorithm k-NN all data owned must have a label, so that when there is new data provided is then compared with existing data and the most similar data

is taken and see the label of the data [17]. Learning data is projected into a multi-dimensional space, where each dimension represents a feature of the data, this space is divided into sections based on the classification of learning data, the best k values for this algorithm depends on the data, in general, a high k value will be reduce the effects of noise on classification, but create boundaries between each the classification becomes more blurred [11].

D. Decision Tree

Decision tree is a classification method of representation of a tree or decision tree, where an attribute is represented as node, and as the value is the branch of the tree, and the class is presented as a class [18]. In this case node the very top of a decision tree named as root, as in the picture [18].

Fig. 3. Overview of the decision tree structure

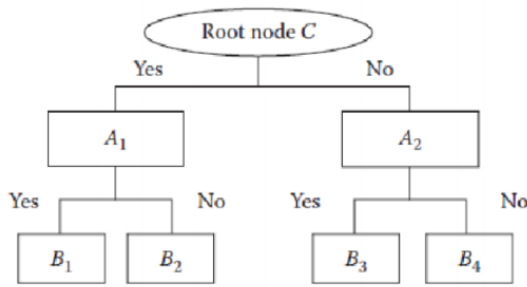One decision tree algorithm is C4.5, this algorithm is used for produces a decision tree and is commonly used for classification, therefore this is C4.5 often referred to as a statistical classifier [19].

E. Naïve Bayes

Algorithm Naïve Bayes classifier is an algorithm used for look for the highest probability value to classify test data in categories the most appropriate, this algorithm is one method machine learning which uses probability calculations [11]. This algorithm works with how to classify classes based on simple probabilities where in this case it is assumed that each attribute that exists is separate from each other, as for The formula equation of the method is as follows (1) and (2) [18].

$$P = (Y_k \mid x_1, x_2, \dots x_a)$$
$$P = (Y_k \mid x_a) = \frac{P(Y_k) + P(X_a \mid Y_k)}{P(X_a)} \quad (1)$$

Where:

- $Y_k P(X_a \mid Y_k)$ = class category
- $P(Y_k)$ = class probability
- $P(X_a)$ = probability of document appearing

Based on the results obtained, then the class selection process is carried out optimal so that the greatest opportunity value of each probability is chosen existing classes [18].

F. Confusion Matrix

Confusion matrix performs tests to estimate objects that are true and false, the test sequence is tabulated in confusion matrix Where the predicted class is displayed at the top and the class observed next left [22]. Confusion Matrix illustrated by a table that states the amount of test data is correctly classified and the amount of test data that is incorrect classified [23].

TABLE I.   CONFUSION MATRIX

Correct Classification	Classified as	
	Predicted "+"	Predicted "-"
Actuall "+"	True Positives	False Negative
Actual "-"	False Positives	True Negatives

Based on the table above:

- True Positives are the number of positive data records classified as a positive value.
- False Positives are the number of negative data records classified as a positive value.
- False Negatives are positive data records classified as positive value.
- True Negatives are negative data records classified as negative value.

G. ROC Curve

ROC curve widely used in data mining research in assessing results prediction, technically ROC Curve divided into two dimensions, where level True Positive put on the Y axis and level False Positive put on the axis X [22].). Chart Receiver Operating characteristic (ROC) is techniques for describing, organizing and choosing classifiers based on their performance, this curve is used to measure value Area Under Curve (AUC) [24]. he curve ROC show accuracy and comparing classification visually with presenting confusion matrix, whereas AUC is calculated to measure the difference in method performance used [25]. The guidelines for classifying accuracy testing using the AUC value are as follows:

a) 0.90 - 1.00 = Excellent Classification

b) 0.80 - 0.90 = Good Classification

c) 0.70 - 0.80 = Fair Classification

d) 0.60 - 0.70 = Poor Classification

e) 0.50 - 0.60 = Failure

III.   RESEARCH METHODOLOGY

The research method used in this study was adapted from Kusumawati with a number of adjustments [26]. This research consists of data crawling, data-pre-processing, data labeling, data

sharing, sentiment classification, and result & validation. The flow of research stages can be seen in Figure below.
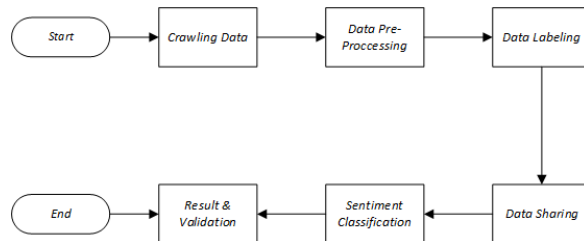

Fig. 4.   Flow of work

A. Crawling Data

Tweets is collected with use API which has been provided by twitter, this API allows users to retrieve data from the application twitter a maximum of 7 days before. To be able to retrieve data, a tweet is used by the R Studio application. The R version used is version 3.6.2 and library used for data retrieval is rtweet library. In this research, tweet taken is which contain keyword "Bali" to get an opinion or experience Twitter users regarding tourism in the city of Bali. Tweets which are already collected is written in English and stored in CSV format.

B. Data Pre-Proccessing

At this stage and still using R Studio as tools. This stage will cleanse tweet collected and make a few changes.

- Change all words to lowercase, all words are changed to lowercase letters. This is done because library which exists in the R application it will read word for word in lowercase letters.

- Remove punctuation, all punctuation in tweet will be deleted.

- Delete the username, if in a tweet call or mention user Otherwise, the username will be deleted.

- Remove hashtag, delete all the "#" symbols in the data tweet that has been collected.

- Remove URL, tweet taken from twitter contain many urls, whether its http or https or link picture so it needs to be removed to simplify the labeling process.

- Removing RT or Retweet, all RT words or retweets will delete because it was judged to have no meaning.

- Remove emoticons, remove emoticons or existing emoji in the tweet.

- Clear data repetition, tweet taken identified has some data repetition that needs to be deleted for simplify the sentiment analysis process.

C. Data Labeling

After making a data crawling and data pre-processing, then the next step is giving label to every tweet you get. Data given label is data that contains user opinions on tourism in the city of Bali. Data tweets that contain advertising and not relevant to tourism in the city of bali will be removed. Data labeling used to provide positive or negative labels for each tweet which exists. In this study, the manual labeling process will be carried out by interviewees. Selected interviewees are people who have good understanding of English (English Literature Graduates). Interviewees can give positive, negative or neutral labels to tweets relating to tourism in the city of Bali. Label given by resource persons based on their interpretation of the contents of the tweet.

D. Data Sharing

At this stage the data that has been given a label will be shared into 2 parts, namely data training and data testing. Algorithm which will be used is an algorithm Supervised Learning, that is learning methods with training and trainers. In this approach, to find the decision function, separator function or regression function, training data is needed as an example of data that has output or label during the training process [27]. In this research data training and data testing will use the 70:30 rule.

E. Sentiment Classification

In this research the sentiment classification algorithm will used is an algorithm Naive Bayes, Support Vector Machine, K-Nearest Neighbors, and Decision Tree by using tourism in Bali city as a research object. This is done to find out the right algorithm is used to do sentiment analysis community towards the city of Bali. The model will be trained with data that has already been collected and determined sentiments. Next is the testing data whose sentiment has not been determined will be used to show whether the model created can represent data that has been be trained.

F. Result & Validation

After classifying sentiments and the results have been obtained prediction of sentiment analysis using the fourth algorithm, that is Naive Bayes, Support Vector Machine, K-Nearest Neighbors, and Decision Tree then the next result will be validated to find out how much accuracy each produced each algorithm in classifying tourism sentiments in the city Bali. Score Area Under Curve obtained will be the basis comparison of these four algorithms to determine for

the right algorithm is used in classifying sentiments in Indonesia's tourism industry.

IV. RESULT & DISCUSSION

A. Crawling Data

Crawling data carried out in stages, starting from 1 February 2020 until March 21, 2020. Data collection is done using the R Application Studio with the help of the API provided by twitter. Data during the pandemic of COVID-19 was not used because it could give different results for the sentiment analysis.
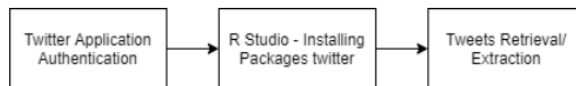

Fig. 5. Data crawling stages

The stages of data collection are divided into 3 stages, namely:

1) Twitter Application Authentication, Twitter requires all data requests to use O Auth for user authentication. Application developers are asked to register the application on the site https: //apps/twitter.com for can access features data crawling which can pull tweet data from Twitter social media.

2) Installing R Package, there are several packages that are used to be able to do interaction with Twitter API and do Twitter data crawling. Some of the packages include packages 'rtweet', 'twitteR', 'streamR' and 'RtwitterAPI'. In this study packages were used 'rtweet' which is used to connect by including tokens obtained inside the script and use functions data crawling by including keywords which is desired.

3) Extraction of tweets, Tweets collected in this study are tweets contain the keyword "Bali". Total tweets that have been collected with these keywords reaching 16,000 tweets accompanied by several attribute or variable attached on the tweet.

B. Data Pre-Proccessing

Proses	Sebelum pre processing	Sesudah pre-processing
Case folding	half of bali booked, yE hAw	half of bali booked ye haw
Remove Punctuation	Bali here I come!!	bali here i come
Remove Username	@ladsrw dom bali, wish me luck, thankyouu	dom bali wish me luck thankyouu
Remove hashtag	Family Gathering at bali #day2	family gathering at bali
Remove URL	Thinking about this day in Bali https://t.co/MLfdInyx9e	thinking about this day in bali
Remove RT	@DavidVidecette You should visit Bali. O m. G.	you should visit bali o m g
Remove Emoticon	Beautiful Bali ♥ https://t.co/ReYpPqyb8p	beautiful bali

Fig. 6. Result of the pre-proccessing stages

Figure 6 shows the results of the data pre-processing process performed before conducting the sentiment analysis process. This is done to make it easier the analysis process by balancing the format of the data to be analyzed.

C. Data Labeling

Overall, data that has been collected and has gone through the stages of data pre-processing totaling 4000 tweet. Data labeling is done manually with two criteria, namely positive and negative. The following results have been given data label.

Text	Labeling
bali is severely overrated	Negatif
our expensive visit to the fat bowl in bali	Negatif
the very disappointing food experienced at the bali beach shack	Negatif
the flare of street crime bali police polresta all out in maintainsecurity	Negatif
i wanna go surfing in bali but this virus shit got me kinda shook y travelled from iran to auckland via bali any passengers who took the emirates plane from bali to auckland are urged to contact authorities if they were concerned	Negatif
would love to goto bali	Positif
amazing pool hanging gardens of bali	Positif
yeah its awesome stuff i try to walk barefoot outside as much as possible in bali they have cafs where you can hire a tray of green plants to put your feet amongst whilst you are eating or networking you can really feel the energy tingle up your legs its very relaxing iod	Positif
visit indonesia nungnung waterfall an awesome waterfall in bali	Positif
the gorgeous entrance at tanah lot and pura batu bolon git is customary at bali to have such enterance at all religious placesit means folded hands and good vibes only	Positif

Fig. 7. Examples of tweet data labeling

D. Data Sharing

The data that has been collected will be divided into two parts, namely data training and also testing data. Training data is used to train machines that are made to find out how a tweet can be categorized as a tweet which is positive or negative. While testing data is used for test whether the classification has a high level of accuracy or low. Accuracy results will certainly be influenced by training data has been used to train the system that was made. the data divided into 2 parts with the proportion of training and testing data which is 70:30. The proportion then produces 2,273 tweets which will be made training dataset training dataset training dataset training dataset training dataset training dataset training dataset training dataset and 973 tweets will be testing dataset.

E. Sentiment Classification

Rapidminer this time will be used as a tool to classify public sentiment towards the city of bali. Rapidminer has a variety of operators that can be used for various purposes of analysis. Here is a big picture of the process sentiment classification is done using the operators of the application Rapidminer.
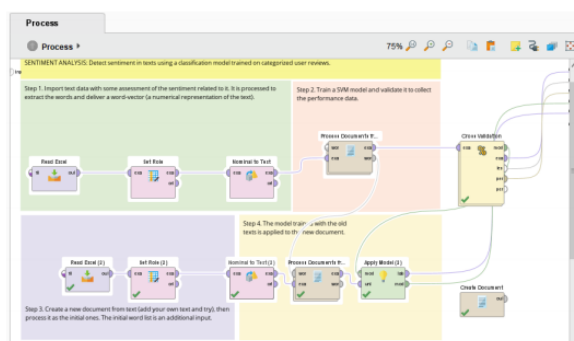
Fig. 8.   Sentiment analysis process

In the initial stages the excel operator is used to enter data tweet which have been manually labeled to determine the sentiment of each twet, whether positive or negative. Data entered into rapidminer is data that has been carried out with pre-processing stages using the R Studio application. In making the sentiment classification process, it needs to be determined attribute which one will be classified. This can be done using operator set role on the rapidminer application. This operator works for determine the function of an attribute to be processed. Other than set role operation, the nominal to text operator is used too for changes everything nominal attribute becomes a string attribute. Each nominal value is only used as the string value of the new attribute. If the value is missing in the nominal attribute, the value new will also disappear.

Fig. 9.   Document process

In Figure 9 shows the operators used in processing documents or text into a vector with the method Term Frequency-Inverse document frequency. This method combines two concepts for weight calculation, i.e. the frequency of occurrence of a word inside a specific document and inverse the frequency of documents containing the words. There are several sub operators created in the process operator document to assist the process sentiment classification, such as the tokenize operator used to separate Data string becomes a word and stop words operators used to eliminate general or irrelevant words like the, for, of, and, so, forth, so that a collection of texts that has meaning and is related is produced with sentiment classification.
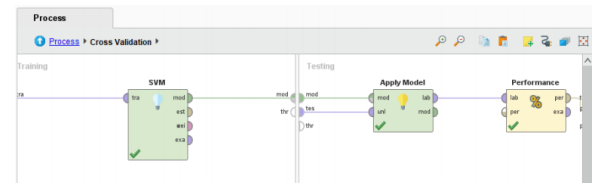
Fig. 10. Modeling with the SVM method

Cross validation is a resampling procedure used to evaluate machine learning models on data samples limited. This procedure has a single parameter called k which refers on the number of groups where the data sample will be shared. Because of this, procedure this is often called k-fold cross-validation. total fold used in the model made is 10 fold. In this case there are several operators available in the operator Cross Validation. SVM operator or Support Vector Machine used because of the algorithm this is one of the algorithms used in making models sentiment classification. This algorithm is one of the best methods you can used in classification problems. The key idea of SVM is to find the surface of the decision (Hyperlane) the maximum from each point data, to carry out machine training supported by vectors or commonly called Support Vector Machine. The SVM operator in the Rapidminer application supports various types of kernels including point, radial, polynomial, neural, anova, epachnenikov, a combination of gaussian and multiquadric. Explanation of this type of kernel is given in the parameters section.

Furthermore, the algorithm is used to do the classification sentiment is an algorithm Naive Bayes, This algorithm makes use of the method probabilities and statistics that predict future probabilities based on experience or data in the past.
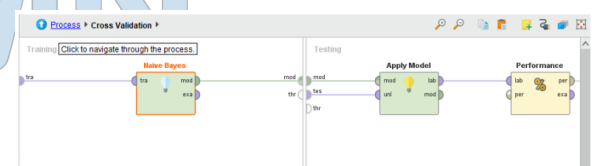
Fig. 11. Modeling with the Naive Bayes method

Figure 11 shows the use of the Naïve Bayes algorithm for do sentiment classification. Based on the documentation carried out by Rapidminer, this algorithm can build a good model even with small data sets, and are easy to use and don't require resource which is great for doing computing.

The third algorithm that will be used to classify sentiments the community against the city of Bali is an algorithm Decision Tree. Method Decision tree is a classification method of the representation of a tree decision, where an attribute is represented as a node, and as its value is the branch of the tree.

Fig. 12. Modeling with the Decision Tree method

Figure 12 shows the process of making a model using method decision tree. Operator decision tree in the Rapidminer application is a decision tree that contains collections node meant for make decisions about the value of affiliation to a class or estimated value numeric target. Every node in the decision tree represents the rules separation for one attribute certain, in the case of classification these rules are used to separate the values that have class different.

The final algorithm that will be used to do the classification people's sentiment towards the city of Bali is an algorithm K-Nearest Neighbors (KNN). This algorithm classifies based on similarity of data with other data.

Fig. 13. Modeling with the k-NN algorithm

In Figure 13 shows the stages of the model making process with use operator k-nearest neighbors y which is in the Rapidminer application. This operator works based on comparing examples that do not known (data testing) with training examples k (data training) which is nearest neighbors from unknown examples.

There are several performance operators that exist in the Rapidminer application, such as performance (Classification), performance (Binominal Classification), Performance (Regression), or general performance that can be used for all types of learning assignments. In this study performance used is binominal classification performance. Performance binominal classification makes predictions where the result has two values, namely positive and negative. Additionally, the predictions for each example might be correct or wrong, leads to confusion matrix 2x2 with 4 classifications, namely trues positive, false positive, true negative, and false negative.

Fig. 14. Testing process

Figure 14 shows the repetition of the process used to do testing of the model that has been made.

F. Result & Validation

Based on the data collection process that has been carried out, obtained frequency of words that appear most often in searches with the keyword "Bali" using the R Studio application.

Fig. 15. Positive worldcloud

In Figure 15 is the frequency of words that most often appear from the data given is labeled "negative".

Fig. 16. Negative worldcloud

Figure 16 shows the frequency of words that appear most often from the data that is labeled "positive". Can be seen words like beautiful, love, like, happy and others are positive words.
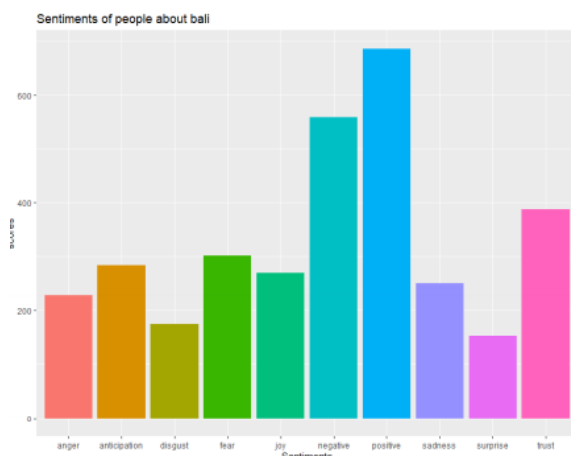
Fig. 17. Sentiments about Bali

Figure 17 is a visualization of emotions or sentiments from the data people's sentiments about the city of Bali. Visualization is made using ggplot2 package in the R.

Method	Acuracy	Precision	Recall
Support vector Machine	73,91	72,95	94,53
K-Nearest Neighbors	74,26	77,3	84,95
Naïve Bayes	69,96	76,99	69,36
Decision Tree	72,94	71,48	96,37

Fig. 18. Comparison tables for accuracy, precision and recall

Figure 18 is a comparison table of accuracy values, precision, and recall generated from each method used. Highest accuracy value obtained by using an algorithm k-Nearest Neighbors with value accuracy of 74.26%. This value has a difference of 0.35% with the algorithm SVM which obtained a value of 73.91%.

Metode	Nilai AUC	Klasifikasi
Support vector Machine	0,805	Good Classification
K-Nearest Neighbors	0,792	Fair Classification
Naïve Bayes	0,525	Failure Classification
Decision Tree	0,632	Poor Classification

Fig. 19. Comparison of AUC values

Figure 19 shows the comparison of values AUC each method gets used. Algorithm Support Vector Machine be the most algorithm appropriate to be used in analyzing public sentiment towards the city of Bali with value AUC of 0.805 and included in Goof Classification. Next is the algorithm K-Nearest Neighbors get an AUC value of 0.792 and go inside fair classification. Although the resulting accuracy value the algorithm K-NN slightly larger than the SVM algorithm but overall the algorithm K-NN get a smaller AUC value than the algorithm SVM. Apart from that algorithm Naïve Bayes who get an AUC value of 0.525 and Decision Tree get an AUC value of 0.632. Both algorithms are entered into classification Failure classification and Poor Classification. This matter indicates the two algorithms are not appropriate to be used in doing sentiment analysis with tourism objects in the city of Bali.

V. CONCLUSION

This research succeeded in analyzing public sentiment towards the city of Bali based on data available on social media Twitter. Model data training conducted using the algorithm Naive Bayes, Neural Network, K-Nearest Neighbor, Support Vector Machines, and Decision Tree has a level of accuracy, precision recall that different. Based on the AUC value generated, the algorithm Support Vector Machine is the most appropriate algorithm used in analyzing tourism sentiments in Indonesia, especially in Bali AUC value of 0.805 and entered into Good Classification. Based on the values generated, the SVM algorithm is appropriate in analyzing sentiments in the tourism industry and through the process labeling that has been done, it is also known that people's sentiments towards the city of Bali which is more positive than sentiments that are negative.

For further research, it could measure the most frequently visited tourist attractions in the city of Bali based on the data that has been collected. This is done to obtain information on the ranking of tourist attractions in Bali that are currently popular with tourists. In addition, it is hoped that further research can automate tourism sentiment in Indonesia which is implemented into an application, which aims to provide information to the public about tourist attractions in Indonesia that have positive sentiments and are worth visiting.

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Critical Success Factors of Knowledge Management in Higher Education Institution

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Abstract—**Knowledge Management (KM) has become an integral factor for many organizations to achieve their goals. Currently, Higher Education Institutions (HEI), have also joined the practices of KM, to enhance the institution's quality, boosting the effectiveness, developing human resource, and constructing the knowledge culture within the institution. The aim of this study is to observe the constructed Critical Success Factor (CSF) model affecting the implementation of KM. This study follows Kitchenham's Systematic Literature Review (SLR) procedures from 15 eligible journal articles obtained through KM related literature. The results, analysis, and discussions are elaborated in the paper.**

Index Terms—**critical success factor, higher education institution, knowledge management, systematic literature review**

I. INTRODUCTION

The rapid advancement in Information Technology has improved human knowledge, particularly in developing knowledge through creation, retain, and distribution of information, thereby humans would become better informed. Humans could easily absorb information that they needed, as it all occurs because of the Knowledge Management process formed by several interest institutions. In the present time, humans have realized that Knowledge Management has become an important part for businesses and corporations to accomplish their strategic goals, and thus gaining the competitive advantages over its competitors. Meanwhile, within the Higher Education Institution (HEI) context, some Universities have also begun to implement the Knowledge Management practices for the purpose of fulfilling their institution's business objectives [1].

Knowledge Management (KM) refers to a process to gather, select, access, distribute, and applying the knowledge gathered from the external and internal data sources for the purpose of fulfilling organization objectives [2] [3] In an institution, KM aims to enhance quality and effectiveness, human resource development, and to develop a knowledge base organization to improve investment of knowledge within the organization [4]. However, it is important to note that the majority of KM project has failed to deliver at the beginning of its stage [5]. Therefore, it is essential to determine the critical success factor of KM in HEI, is so doing such identified factors would be able to increase the chance of successful implementation, as well as to reduce the impact of loss that might occur.

II. LITERATURE REVIEW

A. Knowledge Management Life Cycle

The KM Process consists of steps that should be taken by an organization to gain the purpose of KM practices. Figure 1 below shows the KM process called KM life cycle, as follows: The phase is summarized into KM Life Cycle, as follows [6] [7]:
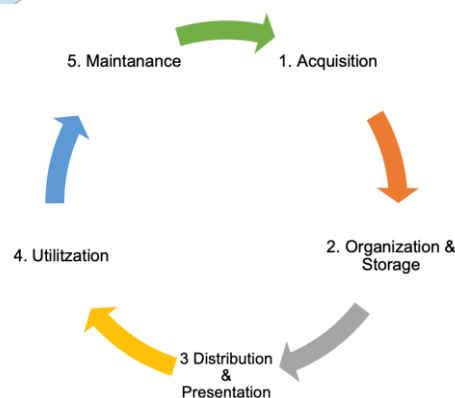

Fig. 1. Knowledge management life cycle

A.1 Acquisition

Phase to collect the data related to the knowledge needed by the institution. The source of data could come in various ways such as relationship, meetings, corporation, communication, forums, surveys, training, regular activities, etc.

A.2 Organization and Storage

Phase to organize and store the data gathered from the data acquisition steps. The data collected is

selected and trimmed before being processed and stored to assist the decision support system.

A.3 Distribution and Presentation

The phase of distribution of knowledge to the related users that would be benefitted with the knowledge product. The knowledge has differed for each group of users depending on their role and level in the knowledge strategy.

A.4 Utilization

The phase of using the knowledge from the distribution phase into a real-life situation. Such as the gained knowledge is used to increase efficiency and enhance the educational knowledge into the environment, it allows the user to respond quickly to a problem and positively to any concern raised in several situations.

A.5 Maintenance

This phase is to maintain and enhance the related Knowledge gained before, by reviewing the previous knowledge to review and improve the cycle of KM Strategy.

B. Knowledge Management in Higher Education

There are no fundamental differences of KM in HEI with the KM incorporate in terms of steps and requirements, there are only a few adjustments that should be made to compensate with the education industry [8] [9]. However, it is difficult for an institution to implement the KM principle immediately as there are some doubts and consideration to the benefits and drawbacks of implementing new concepts within the organization. The Paper of "Applying Corporate Knowledge Management Practices in Higher Education" suggested a few steps to plan and integrate the KM principles in the education industry context [1] namely:

- Strategy, determine the purpose of implementing Knowledge Management.

- Infrastructure Institution, all department from Human Resource, financial measurement of success, and information system should be able to support KM.

- Seek a high level of experienced and dedicated people to be the initiator and executor of KM.

- Choosing pilot project KM with high impact and low risk in mind.

- Compile a complete action plan to execute the pilot project, complete with process and role of the project team.

- After finished, access the results and enhance its action plan.

C. Implementation of Knowledge Management in Higher Education

There are a few factors that should be considered as a hindrance to implementing KM in HEI, those difficulties are [9] [10]:

- Characteristic and Infrastructure of Education Industry. The availability of infrastructure that includes technology and information system available in the institution proved to be significant to acquire and process the data.

- Culture of Education industry that consists of several subcultures, such as academic culture, administrative culture, and other subculture available within each function or faculties. Therefore, the benefit of KM principles should be understood completely within the organization for each function to implement those in the best possible way.

- Management Structure, several management structures have their own benefits whenever they decided to implement a new policy. In Education industry, which usually decentralized management, it is more straightforward if all management officials within each department are committed to implementing KM.

D. Critical Success Factor for Higher Education Institution

Processes that are related and have an important factor in developing a better educational system, which usually consists of admission, curriculum establishment, teaching and learning activity. Examination, alumni relation, strategic planning, etc [11]. The overall process identified above summarized into several activities that have a role as the Critical Success Factor Indicator for Education Institution to measure KM, for instance [12]:

- Intellectual Accomplishments

  Intellectual Accomplishment designates to an educational institution in terms of its intellectual and intellectual development, such as scientific paper, intellectual copyright, teaching materials establishment, consultation, industry-ready, preparing the student for higher education, etc. this measurement is possible by investing in the technology and infrastructure to enable data acquisition.

- In-House Process

  In house process designate to other operational support processes within the institution, such as admission, curriculum development, teaching and learning activity, etc. KM enforces and reevaluates each

process within the institution to ensure each step is value-added and eliminate the non-value-added process to enhance effectiveness and efficiency.

- Stakeholders (Culture and Commitment)

  Stakeholders within the education institution are every user that influenced the aim, action, and policy of the university, such as staffs, teachers, students, parents, industry, and environment. The Stakeholder's involvement in this area consists of its shared commitment within the organization, which comes from both the management and other parties involved.

- Cerebral Development and Augmentation

  Cerebral Development and Augmentation is the activity that has a purpose to develop the internal institution, such as the chance to develop within the organization and the infrastructure support for research purpose. The purpose activity can be obtained by accommodating potential people to develop by their gained experience and continuous learning within the institutional context.

III. RESEARCH METHODOLOGY

This study uses the literature review method as proposed by Kitchenham. According to Kitchenham [13], a systematic literature review is a process for identifying, evaluating, and interpreting research sources that are related systematically [14]. This research uses stages in a systematic literature review, namely planning, implementation, and reporting. The detailed of each stage can be seen in Figure 2 below.
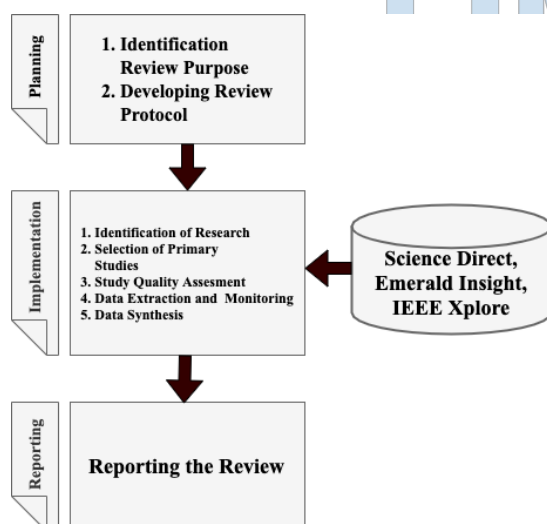

Fig. 2. Research methodology

A. Planning

The planning phase consists of two parts: identifying the purpose of conducting an SLR and developing a review protocol [14]. This study aims to

identify the factors that support the successful implementation of KM to have an impact on higher education. The criteria for research questions are using Population, Intervention, Comparison, Results and Context (PICOC) which can be seen in Table 1.

TABLE I. RESEARCH QUESTIONS CRITERIA

Criteria	Description
Population	University, Higher Education, Education
Intervention	Factor, Critical Success Factor, Knowledge Management, Impact, Evaluation
Comparison	N/A
Outcomes	Factor, Impact, Future, State of the Art
Context	Critical Success Factor, Knowledge Management

The criteria in Table 1 will then be used to develop research questions in Table 2.

TABLE II. RESEARCH QUESTIONS MOTIVATION

Research Question	Motivation
What is the critical success factor for implementation of Knowledge Management in higher education?	To know and review the state-of-the-art and future direction of critical success factor Knowledge Management in higher education.

B. Implementation

In the implementation phase, the selection of research was studied from well-known journal publishers or databases such as Science Direct, Emerald Insight, and IEEE Xplore. Studies that have been found in the database of selected journals gained through several criteria based on Table 3.

TABLE III. CRITERIA SELECTION PROCESS

Criteria	Type
Paper has the related keywords to KM and higher education.	Inclusion
Paper can answer the research question and add supplementary information.	Inclusion
Remove the same studies	Exclusion

This study was using Mendeley software to manage the identification and selection process. Keywords to search for relevant literature are arranged using Boolean sentences such as (factors OR critical success factors) AND (Knowledge Management) AND (higher education OR education OR university). The paper used for SLR is a paper in the range of 2009-2018. Boolean search stages find 535.039 sources. The results of selecting each stage can be seen in Table 4.

TABLE IV. LITERATURE IN THE SELECTION PROCESS

Digital Library	Discover	Selected
Science Direct	532.147	10
Emerald Insight	430	1
IEEE Xplore	2.462	4
Total	535.039	15

C. Reporting

At the reporting stage, the main objective is to extract data and synthesize Information retrieval in accordance with the research question which is the data extraction process. Data extraction from each paper was documented through template format. Furthermore, data from the previous studies were summarized and concluded.

IV. RESULT AND ANALYSIS

In this section, the results and analysis of the systematic literature review will be further elaborated.

A. The State of the Art of Knowledge Management in Higher Education

Tables in **appendix** summarized the journal articles used as the reference for this current study to identify the Critical Success Factor (CSF) for KM practices in the HEI. The 15 article references were used to construct the CSF for several relatable institutions that can be applied to the study, by reviewing the finding of the previous study that consists of the framework used, CSF dimension, and CSF description. To facilitate this systematic literature study, we synthesize the CSF model by simplifying the dimensions into five dimensions as shown in table 5, namely: Stakeholders' culture, stakeholders' commitment, in house processes, intellectual and technological accomplishment, and cerebral development and augmentation.

TABLE V. MODEL OF CSF KM WITH FIVE DIMENSIONS

No	Dimension	Description	Reference	
1	Stakeholders Culture	High commitment from management to deploy knowledge sharing culture	[7] [15] [17] [19]	[10] [16] [18]
2	Stakeholders Commitment	People involved are committed and trained to use Knowledge Management	[8] [11] [18] [20]	[10] [16] [19] [21]
3	In House Processes	Re-evaluate process to ensure each step are value-added	[7] [11]	[9] [17]
4	Intellectual and Technological Accomplishment	Invest in Technology to capture information before being processed into Knowledge	[9] [17] [19] [22]	[10] [18] [21]
5	Cerebral Development and Augmentation	Continuous learning and applying gained experience through daily process routine	[1] [17] [23]	[9] [19]

A. Stakeholders Culture

The First CSF is the stakeholder culture which described as the commitment started from the top, which is the motivational push of knowledge sharing culture to realize the benefit of it, proved to have a significant impact to the successful implementation of KM project.

B. Stakeholders Commitment

The Second CSF is Stakeholders commitment which is all the party involved in the Knowledge Management in Higher Education Institution which includes students, parents, staffs, and teachers; which has been coached and committed to comprehending that knowledge management provides crucial benefits for them in the education industry.

C. In House Processes

The Third CSF is the In-house process, which is all the step by step procedure that happens within the daily routine of the organization. The process should be reviewed and measured to ensure that each of them provides a value-added process and remove the unnecessary non-value-added process to enhance effectiveness.

D. Intellectual and Technological Accomplishment

The Fourth CSF is the Intellectual Accomplishment which could be supported by the willingness of the institution to invest on technology that acts as an enabler or infrastructure, to ensure that they collect the right data and information to be used as the Knowledge that would benefit them in the future.

E. Cerebral Development and Augmentation

The Fifth CSF is the Cerebral Development and Augmentation, which is the continuous learning of the users in the organization while also applying the gained experience to meaningful knowledge. This embraces the chance given by the institution to employ them in their daily routine.

The Five CSF are gained based on reference that collected from ScienceDirect, ResearchGate, and IEEE, the five of them has enough references that support the idea and each of the studies revealed that CSF has an integral impact to the successful implementation of Knowledge Management, therefore by focusing on the CSF while generating the KM Strategy would improve the chance of success and effectiveness of KM Implementation. Figure 3 below is the summary of the synthesis of the literature review described as the classification dimensions of CSFs of KM in HEI.
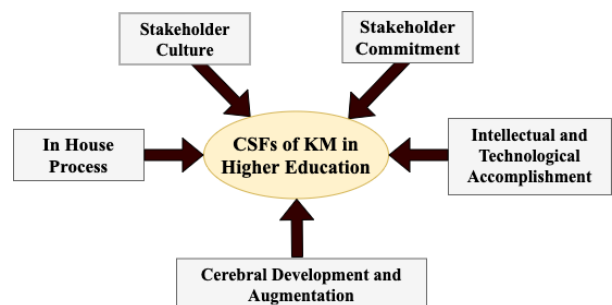

Fig. 3. CSFs model of KM implementation in HEI

B. Future Direction of Knowledge Management in Higher Education Institution

For further improvement, KM in HEI should focus on Content Management for better-perceived knowledge, as usually unstructured information gathered is difficult to absorb by the audience if the presentation is not adequate. Therefore, as an educational institution, the university should take attention in knowing their audience and what is best for their interest for better knowledge absorption. The Information gathered during KM phase should be better represented towards the audience to ensure the information is well received and used for the benefits of all parties. The content management includes Enterprise Resource Planning, Customer Relationship Manager, and Human Resource Management application [24].

KM should also consider Big Data, by implementing a data mining process that comprises of structured data and unstructured data. Big data has proven to be very relevant in KM area as it helps with the creation of new knowledge, managing knowledge in the organization, and improve planning of future projects [25]. The abundance of data and information through Big Data must be used in the best way possible to enhance the effectiveness of KM implementation in HEI, for instance, trends in university studies major, effective learning environment for the millennial generation, and how to attract today generation into enrolling universities. Such knowledge is necessary for private higher education institution as they need to compete with other universities.

V. CONCLUSION

This study mainly contributes to the development of KM in HEI, in hopes that KM will be used in a broader way throughout education institution. In order to gain a high chance of successful implementation of KM, focusing on Critical Success Factor identified in this research is required during the strategy formulation which includes stakeholder culture, stakeholder commitment, in house processes, intellectual accomplishment, and central development and augmentation extensively. Indeed, the critical success factor mentioned requiring the commitment from top management to implementing knowledge sharing culture throughout the institution, the development and training of people involved in KM, process re-evaluation, technology investment, as well as the opportunity to develop and applying knowledge gained.

The rewards of implementing KM principles has proven to exceed the investment required, as more industries over several decades have already implementing KM to improve and compete within the industry. HEI of course should also compel to do the same, as principally they are no different from other corporate institution in terms of their common goal, which is to fulfill their customer/stakeholder satisfaction. This research can become a foundation for further research to make success Knowledge Management System for HEI. KMS in HEI is a new way of managing knowledge to give valuable information for the improvement of HEI quality [8]. Analyze the implementation of KM benefit also can become further research to management to enhance the competitive advantage of HEI. Furthermore, the success KM can be useful to combine with data mining to discover the hidden pattern and solve HEI issue.

APPENDIX

Reference	Context Domain	Framework	Dimension	CSF
[1]	Applying Corporate Knowledge Management Practices in Higher Education	Build their own	Culture	Human Resources support knowledge management
			Technology	Information technology enable to measure KM's financial impact, such as cost reductions, customer satisfaction, and speed to market
[7]	Functional approach of knowledge management system applied to institutions of higher education	Organization, information, decision, knowledge (OIDK) Model	Company goal	Improve relationship with existing and new customer
			Process	Evaluate and improve critical internal process that drive stakeholder satisfaction
			Commitment	Working environment that enable KM in workplace
[8]	Knowledge Management in Higher Education	Stankosky pillar of KM	Leadership	Enable opportunity to apply knowledge management practices
			Organization	Focus on process that enhance individual ability, organization ability, motivations, and opportunity to learn
[9]	Knowledge Management in Higher Education in Chiang Mai: A Comparative Review	Duffy KM Functionality	Learning	Become enabler for supporting KM Infrastructure
			Technology	1. Technology infrastructure act as a pipeline for knowledge conversion process from explicit and tacit knowledge 2. Technology enable capture, define, store, categorize, indexing, and linking objects to knowledge unit
			Process	Continuous Identification of relatable opinions, comments, feedback, and expectation of user to mapped new possible architecture to answer the problem and challenge faced by the company
[17]	The Critical Success Factors for Knowledge Management Adoption – A review Study	Build by itself model	Organizational	Management support, Technology support, Organization structure, Trust, Adaptability, People related issue
			Individual	Learning attitude, Openness, Incentive, Trust, Adaptability, Reward, Leadership
			Knowledge	Knowledge structure, Knowledge source, Creation, sharing, application
			Performance	Organizational performance, Management index
[10]	Knowledge Management in Higher Education: A UK Case Study	Stankosky KM Pillar	Staff Characteristic	1. Staff should act as a unit to build team concept of KM. 2. KM concept should be perceived and demonstrate benefits to academic staff at individual level
			Culture	Knowledge sharing culture is different in every department within an institution, which impacted KM environment
			Management Structure	University organizational structure impacted decision making process and rate of change
			Technology	21st century management tools and technology should be prioritized to assist KM Implementation within HEI
[11]	Identifying knowledge indicators in Higher Education Organization	Knowledge Centric Higher Education Organization	In house process	Research taken
			Intellectual accomplishment	1. Administrative process 2. Teaching learning process
			Central development and augmentation	Initiative taken by faculty development to provide aids to facilitate research
			Stakeholder	Students, parents, industry, society
[15]	The Presentation of Suitable Model for Creating Knowledge Management in Educational Institutes (Higher Education)	Build own model	Human Resources	Levels of how capable an individual within the organization dealing with Knowledge Management
			Organization Structure	Formal and informal organization structure and trust system can lead to creativity and ability of compatibility in the organization
			Information Technology	Technology and communication system will benefits Knowledge sharing
			Organization Culture	Viewpoint of organizational value towards learning and knowledge transformation

Reference	Context Domain	Framework	Dimension	CSF
[19]	A Model for linking Knowledge Management Strategies, Critical Success Factors, Knowledge Management Practices and Organizational Performance; the Case of Iranian Universities	Build own model	Leadership and top management	Support from top management in terms of communication, creativity, culture, people, incentives, and evaluation
			Culture	Sharing culture provide efficiency and effectiveness in Knowledge creation
			Technology	Technology support provides positive effect on innovativeness
			People	Human strategy on socialization and system strategy is appropriate for KM
			Structure	KM mediates relationship between Organization strategy and organizational culture and effectiveness
			Performance Management	KM has direct relationship with financial and nonfinancial performance of organization
[16]	Data mining for exploring hidden patterns between KM and its performance	Martensson CSF Factor	Top Management Support	Support from top management resulted in higher KM performance
			Communication	
			Creativity	
			Culture and people	
[20]	Assessing the impact of knowledge management strategies announcements on the market value of firms	Build own model		Stakeholder commitment in developing KM strategies would result in positive number with company's financial performance
[21]	A Four-factor model on the Success of Knowledge Management	Build own model	Technical	Design and application of KMS using Information technology-based tools
			External environment	Factors that are uncontrollable by organization directly such as market, technology, competitor, customer preference; to be used as an opportunity for KM practices
			Internal resources	Refer to how organization manipulate internal resources factor in order to adapt to change of external environment and improve KM effectiveness
			Managerial	Factors that should be controlled and adjusted by the organization to achieve KM Goals, that includes: coordination, motivation, monitor, and measurement
[22]	Knowledge Management technologies and applications: a literature review	Strategy based ontology of KM Technologies	Technologies	Facilitate organizational Knowledge process by providing basic infrastructure, enable knowledge workers and organization to access knowledge resources
[23]	An integrated view of Knowledge Management for performance	Build own model	Culture	Collaboration between people to support and help others task
			Structure	Learning culture to encourage opportunities of development and learning
			Management	Top management understands and support KM practices
			Technology	Collaboration, communication, search, access, decision making, and storage of information supported by IT
[18]	Knowledge Management: An organizational capabilities perspective	Build their own	Infrastructure	Technology act as a linkage of information and communication systems in an organization to eliminate barriers and creating organizational knowledge
			Structural	Structures should forbid the hoarding of information that could restrict KM practices In organization, such as internal organizational boundaries/structures across the supply chain
			Cultural	Sharing corporate culture where employee interaction is encouraged to transmit knowledge between individual

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- The word "data" is plural, not singular.

- The subscript for the permeability of vacuum μ_0, and other common scientific constants, is zero with subscript formatting, not a lowercase letter "o."

- In American English, commas, semi-/colons, periods, question and exclamation marks are located within quotation marks only when a complete thought or name is cited, such as a title or full quotation. When quotation marks are used, instead of a bold or italic typeface, to highlight a word or phrase, punctuation should appear outside of the quotation marks. A parenthetical phrase or statement at the end of a sentence is punctuated outside of the closing parenthesis (like this). (A parenthetical sentence is punctuated within the parentheses.)

- A graph within a graph is an "inset," not an "insert." The word alternatively is preferred to the word "alternately" (unless you really mean something that alternates).

- Do not use the word "essentially" to mean "approximately" or "effectively."

- In your paper title, if the words "that uses" can accurately replace the word using, capitalize the "u"; if not, keep using lower-cased.

- Be aware of the different meanings of the homophones "affect" and "effect," "complement" and "compliment," "discreet" and "discrete," "principal" and "principle."

- Do not confuse "imply" and "infer."

- The prefix "non" is not a word; it should be joined to the word it modifies, usually without a hyphen.

- There is no period after the "et" in the Latin abbreviation "et al."

- The abbreviation "i.e." means "that is," and the abbreviation "e.g." means "for example."

IV. USING THE TEMPLATE

After the text edit has been completed, the paper is ready for the template. Duplicate the template file by using the Save As command, and use the naming convention as below

IJNMT_firstAuthorName_paperTitle.

In this newly created file, highlight all of the contents and import your prepared text file. You are now ready to style your paper. Please take note on the following items.

A. Authors and Affiliations

The template is designed so that author affiliations are not repeated each time for multiple authors of the same affiliation. Please keep your affiliations as succinct as possible (for example, do not differentiate among departments of the same organization).

B. Identify the Headings

Headings, or heads, are organizational devices that guide the reader through your paper. There are two types: component heads and text heads.

Component heads identify the different components of your paper and are not topically subordinate to each other. Examples include ACKNOWLEDGMENTS and REFERENCES, and for these, the correct style to use is "Heading 5."

Text heads organize the topics on a relational, hierarchical basis. For example, the paper title is the primary text head because all subsequent material relates and elaborates on this one topic. If there are two or more sub-topics, the next level head (uppercase Roman numerals) should be used and, conversely, if there are not at least two sub-topics, then no subheads should be introduced. Styles, named "Heading 1," "Heading 2," "Heading 3," and "Heading 4", are prescribed.

C. Figures and Tables

Place figures and tables at the top and bottom of columns. Avoid placing them in the middle of columns. Large figures and tables may span across both columns. Figure captions should be below the figures; table heads should appear above the tables. Insert figures and tables after they are cited in the text. Use the abbreviation "Fig. 1," even at the beginning of a sentence.

TABLE I.   TABLE STYLES

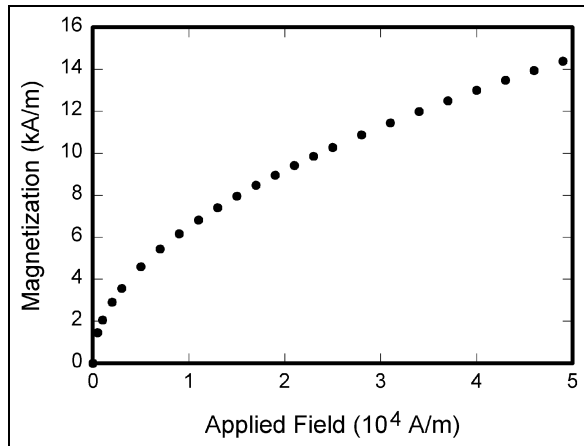| Table Head	Table Column Head		
	Table column subhead	*Subhead*	*Subhead*
copy	More table copy		

Fig. 1.   JSON File for Fingerprint Database

V.   CONCLUSION

A conclusion section is not required. Although a conclusion may review the main points of the paper, do not replicate the abstract as the conclusion. A conclusion might elaborate on the importance of the work or suggest applications and extensions.

APPENDIX

Appendixes, if needed, appear before the acknowledgment.

ACKNOWLEDGMENT

REFERENCES

The template will number citations consecutively within brackets [1]. The sentence punctuation follows the bracket [2]. Refer simply to the reference number, as in [3]—do not use "Ref. [3]" or "reference [3]" except at the beginning of a sentence: "Reference [3] was the first ..."

Number footnotes separately in superscripts. Place the actual footnote at the bottom of the column in which it was cited. Do not put footnotes in the reference list. Use letters for table footnotes.

Unless there are six authors or more give all authors' names; do not use "et al.". Papers that have not been published, even if they have been submitted for publication, should be cited as "unpublished" [4]. Papers that have been accepted for publication should be cited as "in press" [5]. Capitalize only the first word in a paper title, except for proper nouns and element symbols.

For papers published in translation journals, please give the English citation first, followed by the original foreign-language citation [6].

[1]   G. Eason, B. Noble, and I.N. Sneddon, "On certain integrals of Lipschitz-Hankel type involving products of Bessel functions," Phil. Trans. Roy. Soc. London, vol. A247, pp. 529-551, April 1955. (*references*)

[2]   J. Clerk Maxwell, A Treatise on Electricity and Magnetism, 3rd ed., vol. 2. Oxford: Clarendon, 1892, pp.68-73.

[3]   I.S. Jacobs and C.P. Bean, "Fine particles, thin films and exchange anisotropy," in Magnetism, vol. III, G.T. Rado and H. Suhl, Eds. New York: Academic, 1963, pp. 271-350.

[4]   K. Elissa, "Title of paper if known," unpublished.

[5]   R. Nicole, "Title of paper with only first word capitalized," J. Name Stand. Abbrev., in press.

[6]   Y. Yorozu, M. Hirano, K. Oka, and Y. Tagawa, "Electron spectroscopy studies on magneto-optical media and plastic substrate interface," IEEE Transl. J. Magn. Japan, vol. 2, pp. 740-741, August 1987 [Digests 9th Annual Conf. Magnetics Japan, p. 301, 1982].

[7]   M. Young, The Technical Writer's Handbook. Mill Valley, CA: University Science, 1989.

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