Determination of SME Tax with Naïve Bayes Method

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***Abstract*—The level of compliance of SMEs taxpayers should be addressed by the Regional Development Planning Authority (BAPPEDA). From field observations, one of the tasks of the Regional Technical Implementation Unit BAPPEDA UPTD in Central Bandung Region is to identify taxpayers of SMEs actors in the region. Most of the SMEs business actors in central Bandung do not know the business category and therefore do not understand the level and percentage when paying the tax rate. The head of BAPPEDA UPTD in Central Bandung Region hopes his unit can address these issues according to organizational functions in technical implementation. It is very appropriate to build a web-based taxpayer determination system using naive Bayes method because we can understand the nature of taxpayer problems generated by SMEs actors in Central Bandung. The results of this study determined variables to provide an understanding of tax rate payments according to the size of the SMEs actor's business. The created system can meet the expectations of the person responsible for the BAPPEDA UPTD Central Bandung Area, depending on the organizational capabilities of the technical implementation. The classification function is the result of using the naive Bayesian method in the calculation process to determine SMEs taxpayers.**

Keywords—SMEs Taxpayer, Naïve Bayes Method, Website Classification System.

I. INTRODUCTION

Micro, Small and Medium Enterprises (SMEs) are one of the key sectors supporting the Indonesian economy. This is because SMEs can absorb labor and increase the level of welfare for criminals. SMEs have a strategic role in the structure of the national economy. Over the last five years, the contribution of MSMEs to Gross Domestic Product or GDP increased from 57.84% to 60.34% and the employment rate also increased from 96.99% to 97.22% in the same period [1].

The significant increase in the contribution of SMEs to gross domestic product makes SMEs one of the sectors that have the opportunity to contribute to government tax revenues. However, the increase in the number of SMEs is not in line with the perception that SMEs taxpayers fulfill their tax obligations. The level of compliance of SMEs taxpayers is still relatively low and the government's tax revenue target has not been met. Of course, poor compliance of SMEs taxpayers becomes a problem every year [2].

Most SMEs business actors in Central Bandung do not know their business category so they do not understand the amount and percentage when paying tax rates. The Head of UPTD BAPPEDA Central Bandung Region wants his unit to be able to overcome these problems in accordance with organizational functions in technical implementation. In addition to the provisions on Tax Amnesty from the central government, SMEs actors in Central Bandung have a very high level of enthusiasm to comply with the current tax regulations. However, the enthusiasm of these business people does not match their understanding of paying tax rates commensurate with the size of the business. With these problems, it is very appropriate to build a web-based taxpayer determination system that can be accessed online, because it provides an understanding of the status of taxpayer problems caused by SMEs actors in the Central Bandung area. In the research, the development of a web-based information system to manage control objects is designed according to the C4 model and developed in PHP and MySQLWeb. As a result, the tax object management information system makes it easier for city governments, especially agencies/municipalities, to manage taxes: calculating taxes, recording taxes, and paying taxes [3].

The problem of taxpayers cannot be solved simply by building a web system. In this study, I tried to apply the Naive Bayes method to the system to be built. There is a study of the application of the Naive Bayes method and the projection of potential compliance of PBB-P2 taxpayers using the Naive Bayes method in Seberang Ulu I District, Palembang City. UPT BPPD Seberang Ulu I Subdistrict, Palembang City can issue tax enforcement policies to taxpayers who have the potential to be in arrears based on the results of the examination [4].

This study uses the Naive Bayes method to classify taxpayers in Simalungun Regency by using the parameters of modernization of the tax administration system, taxation socialization, tax awareness, tax sanctions, and taxpayer compliance. The data used in this survey is to provide a survey to those who run this type of business in Simalungun Regency, especially in Tana Jawa. The results of this survey will help the government, especially the local tax office, in determining whether its citizens understand and fulfill their tax obligations [5].

Based on the background findings of the problems mentioned above, this study will create a website-based system for determining SMEs taxpayers at the UPTD

BAPPEDA in the Central Bandung area. This study considers the naive bayesian method. It combines the probability of the taxpayer community with the taxpayer's payment criteria to determine a general understanding of the fulfillment of tax obligations. The description of this research can be found in the minutes report with the following title Determination of SMEs Taxpayers with the Naïve Bayes Method at BAPPEDA UPTD Central Bandung Region, Indonesia.

II. METHODS

The type of research used in writing this thesis is descriptive research using a quantitative approach, because in this study using data on UMKM figures from BAPPEDA UPTD Bandung area [6]. In the process of determining SMEs taxpayers in the UPTD BAPPEDA of the Central Bandung area based on Naive Bayes, we must take several steps to be able to create a web-based system that will serve the residents of Central Bandung. The methodology used in this study is illustrated in Figure 1 below [7].

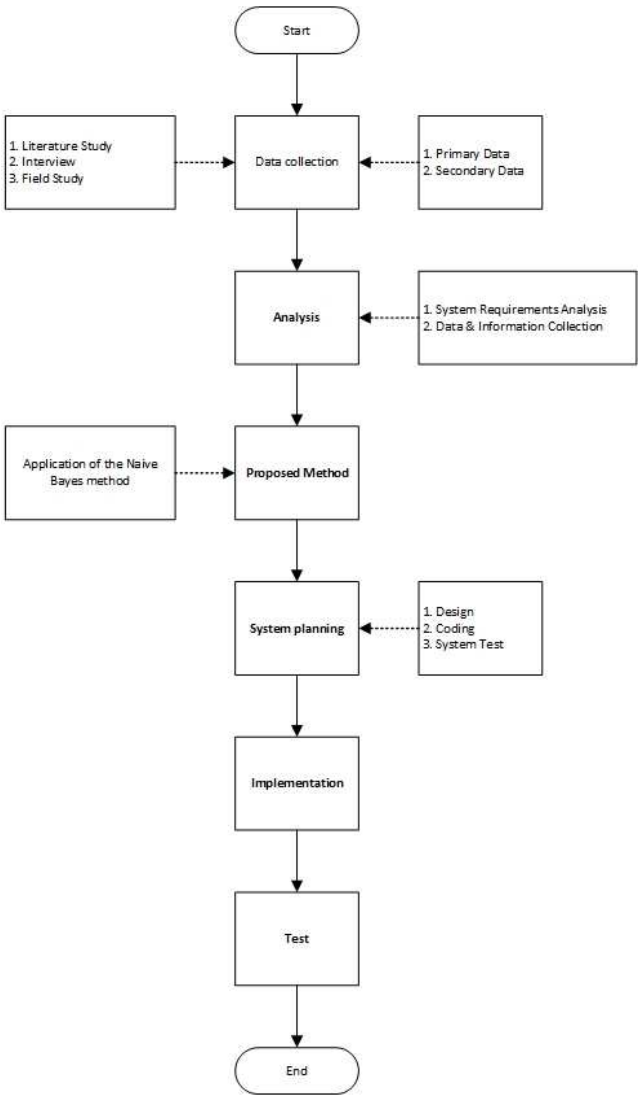

Fig. 1. Research Design

Basically, this phase is not only a data collection activity, but also grouping the data that is already available according to certain categories to facilitate the next process [8]. The data collected from this survey came from two sources. Primary data is data collected directly by researchers from data sources relevant to the study. This data was obtained from interviews with the UPT director and general functional staff. The data is processed using the Naive Bayes method and the results are determined according to the SMEs taxpayer scale [9]. Next, the secondary data needed for this research is data about SMEs actors and the implementation of the Naive Bayes website [10].

A. Data and Information Collection

In this study, a classification table for taxpayers and SMEs actors was made using training data from UPTD BAPPEDA. In this study, the calculation rules of the Naïve Bayes method were used. As an example of the calculation, several categories were selected, determining the value of the hypothesis and the value of evidence from that category, the probability value of the category and the calculation of Naïve Bayes [12]. as follows:

1. Taxpayer (WP):
   a. 0%
   b. WP 0.5%
2. Classified Data (X):
   a. Type of Business=Food
   b. Business Classification=Micro
   c. Total Turnover=Maximum 300 Million

For calculation used the formula.

1. P(Ci):
   a. P(WP 0%) = 14/18 = 0.778
   b. P(WP 5%) = 4/18 = 0.222
2. Calculate P(X|Ci) for each WP:
   a. P (Type of Business = “Food” | WP 0%) = 13/14 = 0.928
   b. P (Type of Business = “Food” | WP 0.5%) = 4/4 = 1
   c. P (Business Classification = “Micro” | WP 0%) = 12/14 = 0.857
   d. P (Business Classification = “Micro” | WP 0.5%) = 3/4 = 0.75
   e. P (Total Turnover = “Maximum 300 million” | WP 0%) = 12/14 = 0.857
   f. P (Total Turnover = “Maximum 300 million” | WP 0.5%) = 0/4 = 0
3. X = (Type of Business = Food; Business Classification = “Micro”; Total Turnover = Maximum 300 million)
   a. P(X|Ci): P(X|WP = “0%”) = 0.928 x 0.857 x 0.857 = 0.682
   b. P(X|Ci): P(X|WP = “0.5%”) = 1 x 0.75 x 0 = 0
4. Max P(X|Ci) = (0.682; 0) = 0.682 Enter the 0% WP category.

B. Diagram Design and Implementation Phase

System design or design in this study is described through the UML model in the form of use case diagrams, activity diagrams, and sequence diagrams. System design here is a process that aims to change system requirements into a form of system blueprint [13]. Implementation or system

implementation is a process to put a new system into use. In addition, the implementation of the system also functions as a process to ensure the application achieves the desired goals [14]. This stage is carried out with the user and communicated, so that it can be a proposal in the development of further applications. This stage is the stage where the coding process is carried out which aims to change the design blueprint into a form that can be understood by machines using the PHP programming language and MySQL database [15].

III. RESULT AND DISCUSSION

A. Case Study Analysis

In this section, the function requirements of the SMEs taxpayer determination system are analyzed according to the case study that will be applied to BAPPEDA Central Bandung at the analysis stage. The specifications of the needs of the SMEs taxpayer determination system to be built are as follows:

1. Finance Staff Page:

   A1. Finance staff can login.

   A2. Finance staff can manage variables.

   A3. Finance staff can manage grades.

   A4. Finance staff can manage datasets.

   A5. Finance staff can update the account.

   A6. Finance staff can log out.

2. Business Actor Pages:

   B1. Business actors can determine the classification of taxpayers.

B. System Design

In designing this system, UML (Unified Modeling Language) and ERD (Entity Relationship Diagram) diagrams will be described as follows:

1. Use Case Diagrams

Use case diagrams for the application to be built are described only those related to the main business processes. Dialogue or interaction between users such as Financial Staff and business actors with the classification system in Figure 2. Figure 2 is a use case diagram in accessing the SMEs taxpayer determination system by users which can be explained in the description of each use case.

2. Description of Use Case Login

Activities between Finance Staff and the system in logging in to the system according to their access rights can be seen in TABLE I.

3. Description of Use Case Managing Variables and Value

Activities between Finance Staff and the SMEs taxpayer determination system in managing variable data can be seen in TABLE II and TABLE III.

4. Description of the Use Case for Managing Datasets

Activities between Finance Staff and the SMEs taxpayer determination system in managing SMEs datasets can be seen in TABLE IV.

5. Description of Use Case Determining Taxpayer

Activities between business actors and the MSME taxpayer determination system in determining taxpayers can be seen in TABLE V.

TABLE V shows a description of the use case in the form of interactions between business actors in accessing the calculation menu in the SMEs taxpayer determination system.

6. Description of Use Case Update Account

Activities between the Finance Staff and the SMEs taxpayer determination system in updating user accounts on a website-based system can be seen in TABLE VI.

7. Description of the use case for logging out

Activities between the Finance Staff and the SMEs taxpayer determination system in logging out can be seen in TABLE VII.

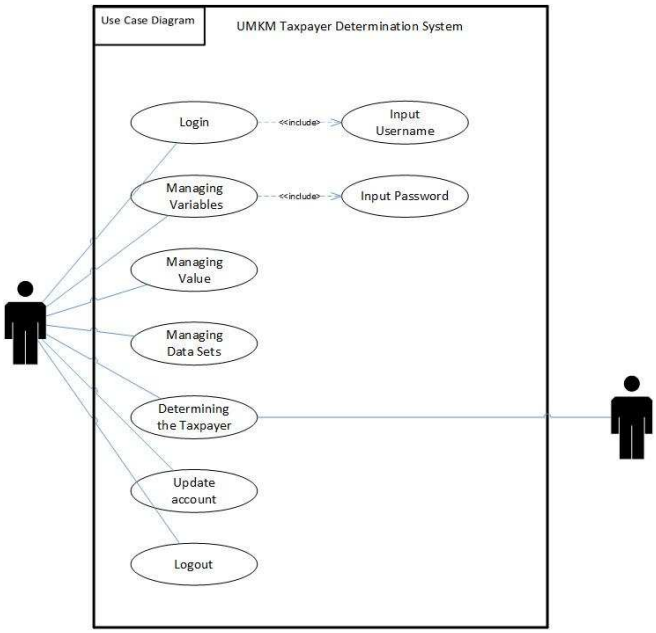

Fig. 2. Use Case Diagram

TABLE I. DESCRIPTION LOG IN

Use Case Name	Login
Requirements	A1
Goal	Finance staff can log in and access the main page of the taxpayer determination system.
Pre-conditions	Finance staff already has a username and password.
Post-conditions	The system displays the main page or dashboard.
Failed end conditions	Finance staff entered the wrong email or password.
Primary Actors	Financial staff
Main Flow / Basic Path	1. Finance staff run the system using a browser. 2. The system displays the home page. 3. Finance staff select the login menu. 4. The system displays the login page. 5. The Finance Staff enters the username and password, then presses the 'Login' button. 6. Website-based system checks whether the username and/or password yang entered true or false. If true, the system will display the main page or dashboard. However, if you enter the wrong email and/or password, the system will deny the Finance Staff access rights and ask to re-enter the login data

TABLE II. DESCRIPTION MANAGING VARIABEL DATA

Use Case Name	Managing Variable Data
Requirements	A2
Goal	To update the appropriate variable data
Pre-conditions	Finance staff has logged in.
Post-conditions	The system displays the latest taxpayer variable data.
Failed end conditions	The Finance Staff did not fill in the variable code and variable type fields.
Primary Actors	Financial staff
Main Flow / Basic Path	1. Finance staff selects the 'Variables' menu. 2. The system displays the existing Variable data. 3. The Finance Staff press the 'Add' button. 4. The system displays the 'Add Variable' form. 5. Finance staff fill in variable data, then press the 'Save' button. 6. The system saves the addition of variable data into the database.
Invariant A:	A3. The Finance Staff press the 'Change' button. A4. The system displays the 'Change Variable' form. A5. The Finance Staff changes the variable data, then presses the 'Save' button. A6. The system saves changes to variable data into the database.
Invariant B:	B3. The Finance Staff selects the variable data to be deleted, then presses the 'Delete' button. B4. The system deletes the selected variable data from the database.

TABLE III. DESCRIPTION MANAGING VALUE

Use Case Name	Managing value data
Requirements	A3
Goal	To update variable value data.
Pre-conditions	Finance staff has logged in.
Post-conditions	The system displays the latest variable value data.
Failed end conditions	Finance staff does not fill in the input fields id, variables, and values.
Primary Actors	Financial staff
Main Flow / Basic Path	1. Finance staff selects the 'Value' menu. 2. The system displays the existing variable value data. 3. The Finance Staff press the 'Add' button. 4. The system displays the 'Add Value' form. 5. Finance staff fill in the value data, then press the 'Save' button. 6. The system stores the addition of variable value data into the database.
Invariant A:	A3. The Finance Staff press the 'Change' button. A4. The system displays the 'Change Value' form. A5. The Finance Staff changes the value data, then presses the 'Save' button. A6. The system saves the value data changes into the database.
Invariant B:	B3. The Finance Staff selects the value data to be deleted, then presses the 'Delete' button. B4. The system deletes the selected value data from the database.

TABLE IV. DESCRIPTION MANAGING VALUE DATASET

Use Case Name	Managing value dataset
Requirements	A4
Goal	To update the SMEs dataset.
Pre-conditions	Finance staff has entered data on variables and values.
Post-conditions	The system displays the latest dataset.
Failed end conditions	Finance staff did not fill in the company name and variable-value input fields.
Primary Actors	Financial staff
Main Flow / Basic Path	1. Finance staff select the 'Dataset' menu. 2. The system displays the existing dataset. 3. The Finance Staff press the 'Add' button. 4. The system displays the 'Add Dataset' form. 5. The Finance Staff fill in the company name and variable-value data, then press the 'Save' button. 6. The system saves the addition of the dataset to the database.
Invariant A:	A3. The Finance Staff press the 'Change' button. A4. The system displays the 'Change Dataset' form. A5. The Finance Staff changes the company name data or variable-value, then presses the 'Save' button. A6. The system saves the dataset changes to the database.
Invariant B:	B3. The Finance Staff selects the dataset to be deleted, then presses the 'Delete' button. B4. The system deletes the selected dataset from the SMEs database.

TABLE V. DESCRIPTION THE TAXPAYER

Use Case Name	Determining the taxpayer
Requirements	B1
Goal	To determine the UMKM taxpayer
Pre-conditions	The data for variables, values, and datasets have been filled in.
Post-conditions	The system for determining SMEs taxpayers
Failed end conditions	Business actors do not fill in the variable fields according to their business criteria.
Primary Actors	Businessmen
Main Flow / Basic Path	1. Business actors choose the “Classification” menu. 2. The system displays the calculation form for determining SMEs taxpayers. 3. Business actors enter data in the variable field according to their business criteria, then press the 'Process' button. 4. The system displays the calculation results of the classification of SMEs taxpayers based on their business category.

TABLE VI. DESCRIPTION UPDATING ACCOUNT

Use Case Name	Updating Account
Requirements	A5
Goal	To change the Finance Staff account
Pre-conditions	Finance staff has account and system access rights
Post-conditions	The system updates the Finance Staff data
Failed end conditions	Finance staff does not enter the old password
Primary Actors	Financial staff
Main Flow / Basic Path	1. Finance staff select the 'Account' menu. 2. The system displays the Finance Staff account form. 3. Finance staff change their own account data. 4. The system updates the Financial Staff data in the database.

TABLE VII. DESCRIPTION LOGOUT

Use Case Name	Logout
Requirements	A6
Goal	Finance Staff may exit the system.
Pre-conditions	Finance staff have done finished using the system.
Post-conditions	The system displays the login page.
Failed end conditions	-
Primary Actors	Finance Staff and Operator
Main Flow / Basic Path	1. Finance staff select the 'Logout' menu. 2. The system issues access to Finance Staff.

C. *System Implementation*

The application of the interface serves to facilitate interaction between the Finance Staff and the system that has been created.

1. Finance Staff Login Page

The login page display is a page for access to the main page of the SMEs taxpayer determination system which can be seen in Figure 3.

Fig. 3. Login Page

2. Variable Data Page

Pages used in managing variable data. The display of the variable data page can be seen in Figure 4.

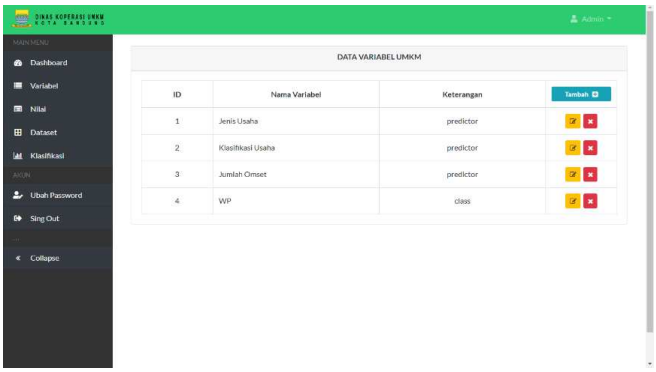

Fig. 4. Variabel Data Page

3. Value Data Page

Pages used in managing datasets. The display of the dataset page can be seen in Figure 5.

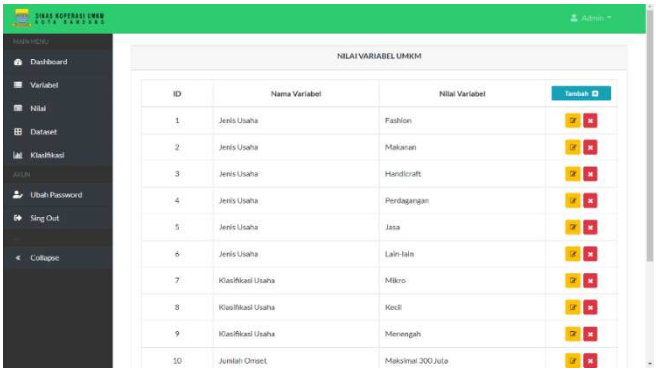

Fig. 5. Value Page

4. Dataset page

The page used in determining SMEs taxpayers. The display of the Finance Staff account page can be seen in Figure 6.

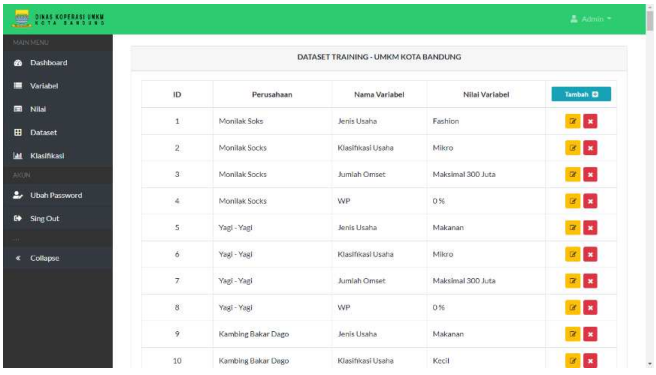

Fig. 6. Dataset Page

5. Calculation Page

The page used in determining SMEs taxpayers. The display of the Finance Staff account page can be seen in Figure 7.

Fig. 7. Calculation Page

6. Account Page

The page used in updating user accounts by the Finance Staff with a view from the Finance Staff account page can be seen in Figure 8.

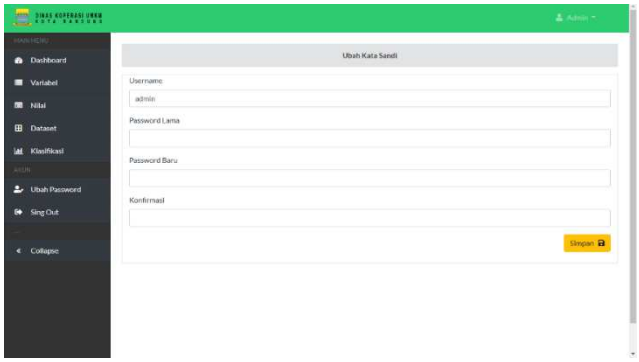

Fig. 8. Account Page

IV. Conclusion

Making a system for determining SMEs taxpayers using the Naïve Bayes method Using the website at BAPPEDA UPTD Bandung Region (Indonesia). From the research that has been discussed, it can be concluded that the parameters or variables are determined in providing an understanding of paying tax rates to SMEs in the Central Bandung area according to their business scale. This is in accordance with Law Number 7 of 2021 concerning the Harmonization of Tax Regulations (UU HPP) which stipulates that taxpayers who have a turnover of less than IDR 500 million a year are not subject to income tax. However, if the business has a turnover of Rp. 500 million and above, it is mandatory to pay taxes for SMEs at a rate of 0.5%. In the SMEs taxpayer determination system that is made to meet the expectations of the Head of BAPPEDA UPTD Central Bandung area in accordance with organizational functions in technical implementation. This system has been successfully tested at the final stage with all the tests being valid and in line with expectations. The website-based system that was built can calculate SMEs taxpayers in the Central Bandung area. In this system there is a classification feature in determining taxpayers for SMEs using the Naïve Bayes method. For further researchers, it is hoped that this classification method can be combined with other methods such as the K-Nearest Neighbor method to see a comparison of the accuracy values.

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