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Implementation of Business Intelligence to Determine Evaluation of Activities (Case Study Indonesia Stock Exchange)

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Abstract: This study aims to examine how to evaluate the activities undertaken in IDX. By building the system "business intelligence implementation to determine the evaluation of activities ". Where in this study also used the algorithm Naive Bayes in the process of data classification activities that have been done. The approach to the development of this software is through the study of libraries, data collection, system design, system implementation, Test systems and analysis. The tools used in the development of this software are Pentaho, PostgreSQL (as a data processing tool), Microsoft Excel (as a tool for creating training data), XAMPP (as a Web server tool) and the encoding used in this software development is the PHP CodeIgniter framework (as the backend), Highcharts (as Dashboard views) and DataTables (as table views). In this study, authors build software that is expected to help the Directorate of Development (RPE) in conducting evaluation activities in IDX. The analysis of the study uses variables from budget-realization data and activity categories as comparators to figure out the activity status. The study also used IDX activity data in 2018 to implement a built-in system. The results of this study show that the realization of the budget and category of this activity strongly affects the activities that will be evaluated or not evaluated. Activities in each of the IDX representative offices are also potentially to be evaluated, depending on the value of the budget specified in the training data set.

Index Terms: Business intelligence, data warehouse, etl, classification, naive bayes classifier, activites evaluation

1. Introduction

Indonesia Stock Exchange (IDX) is the party that organizes and provides a system that also provides for bringing together the sale and purchase offers of other parties for the purpose of trading securities between them. One of the socialization and education activities undertaken by the Directorate of Development (RPE) [1-3], through the Investor development and education strategy Unit is to support socialization and education activities that have been implemented well in the Office Representatives throughout Indonesia or the Jakarta area[2,4-8]. To be able to help the effectiveness of activities needed tools consist of reporting system activities that can generate information against several divisions, namely between PIV with PWI [6,9], KEU [10,11], KOM [12,13] and RDP [14]. Activities as part of a program implemented by one or more working units as part of a measured target celebrity on a programme [15]. The organizers of the activities themselves can be agencies, agencies, Governments, organizations, private people, institutions, etc. Similarly, the activities undertaken or carried out by Indonesia Stock Exchange (IDX), which is essentially the activity of Indonesia Stock Exchange (IDX) is occurring in all representative offices which is divided into 34 units based on provinces in Indonesia . The number of activities carried out in the week or per month in a representative office, the reason to be able to apply business intelligence to get an evaluation related to the implementation of an activity the activities of the Indonesia Stock Exchange. Business Inteligence (BI) is defined as the method of converting data into information and subsequently to knowledge [11]. Business Intelligence (BI) has been a top priority of IT executives for several years [23]. The types of knowledge obtained are about the customer requirements and decisions, organizational performance in the industry and the global trends [12]. Another definition of BI, particularly the BI systems is, BI systems put together the gathering and storage of data and knowledge management with analytical tools to present a ready-foraction and complicated information to the planners and decision makers [12]. Business intelligence (BI) refers

to a managerial philosophy and a tool used to help organizations manage and refine business information with the objective of making more effective business decisions [14]. Business intelligence (BI) has been proliferated due to its increasing contribution to such as business performance determination, data integration from disparate sources, data warehousing, planning, forecasting, budgeting, and the decision making that guides business operation toward desired performance [24]. In determining the evaluation of the activity, it takes a classification of data to be taken a decision whether the activity has been conducted in the evaluation or not. Evaluation is a process of collecting useful information to make decisions and as a benchmark to the extent that objectives can be achieved [13]. From the explanation of the paragraph above, the problems that exist in this study include how to help determine the evaluation of activities in IDX the solution is to build a business intelligence system to determine the evaluation of IDX activities, how to evaluate IDX activities as expected by the solution is to design a business intelligence system that can determine the evaluation of IDX activities, and how the results of the evaluation activity that has been done by determining the evaluation status of activities that have been done by classifying using Naive Bayes algorithm.

As for problem limits in this research include this system is made with the scope of IDX, this system is also made to get decisions about the evaluation status or not of the activities that have been conducted. So in this study will be predicted regarding data analysis to determine the evaluation of the activities with the reference of the determined budget data. Information from business Intelligence will display a graph in the form of a pie or bar showing the activity on each type evaluated by what amount, in each province evaluated how many, at each representative office evaluated how many, this is expected to assist the relevant party, namely IDX to be able to determine the evaluation of the activities that have occurred to be taken a decision that can later affect the activities of conducted by such related representative office. The Following is a stage of research methodology, loaded in Fig. 1.

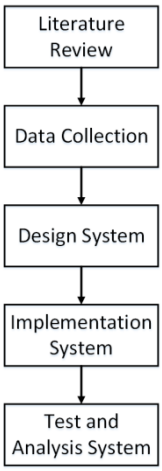


Fig. 1. Research Methodology

- **Literature Review**, The literature review aims to learn about the basics and methods of the Naive Bayes algorithm, and how to implement it with BI, which is obtained through journals, internet browsing and related readings with good topics Textbook or paper.
- **Data Collection**, The type of data used for this research is primary data. The primary data itself is data obtained that is collected and processed by itself from the research object. In this research data used is the activity data in 2018 from IDX.
- **Design System**, The design of this system aims to be able to design the stages of the development of business intelligence to obtain a status of activities.
- **Implementation System**, Implementation System is the stage of software creation, the continuation of the system design activities. This stage is a stage where the system is ready to operate, consisting of explanations about the implementation environment, and implementation of the program.
- **Test and Analysis System**, Testing and analysis of systems that have been created with predefined parameters.

2. Liretarure Review and Materials

This literature review is about the previous research related to BI, here are some literature reviews that writers have summarized. BI is a neat and systematic process where every organization can acquire, analyse, and disseminate information from significant internal or external sources of information to business activities and for decision making [25]. BI can present business information in a timely and easy-to-consume manner, also providing the ability to reason and understand the meaning behind business information through discovery, analysis, and ad hoc queries [26]. The characteristic of the BI is characterized by a framework that collects, transforms and exhibits organized information

from various sources. BI is a system and answer that helps decision makers to understand the situation of the company's economy [27]. BI is a framework that converts information into data, then learns.
Thus improving the company's basic decision making process [28]. And the following are supporting materials for the research to be built:

A. Business Intelligence

Business Intelligence is a series of activities to understand the business situation by conducting various types of analysis on data owned by the organization and external data from third parties to help determine the strategy, decision Business that is tactical, and operational and takes the necessary actions to improve business performance [1].

B. Data Warehouse

Data Warehouse is a concept and combination of technologies that facilitate organizations to manage and maintain historical data obtained from operational systems or applications. The use of Data Warehouse technology is almost required by all organizations, libraries are no exception. Data Warehouse allows the integration of various types of data from a wide range of applications or systems. This guarantees the mechanism of "one door for management to obtain information, and analyze it for decision making" [2].

C. ETL

ETL (Extract, Transform Load) three database functions that are combined into one tool that automates the process to pull data out of one database and place it into another database. The database functions are described following [3]:

1. Extract

Extract is the process of reading data from a specified source database and extracting a desired subset of data.

2. Transform

Transform is t the process of converting the extracted/ acquired data from its previous form into the form it needs to be in so that it can be placed into another database. Transformation occurs by using rules or lookup tables or by combining with other data.

3. Load

Load is the process of writing the data into the target database

D. Highcharts

Highcharts could satisfy our needs.It is based entirely on JavaScript.This tool has a relatively low resource overhead, and a faster response speed.Users do not need to install any plug completely, truly cross-platform. Developers are not limited by browser compatibility and development languages [4].

Highcharts written by pure JavaScript. Highcharts is simple and convenient to add interactive charts in the web site or web application. Highcharts interface is aesthetic. HighCharts had a good compatibility. It will be able to support most of the current browsers [5].

E. DataTables

DataTables works to produce dynamic data tables, where data can be directly sorted by column, besides that with DataTables also provides a search form which directly searches data from all the columns that appear without the need to query from database first [6].

F. Classification

The model in the classification has the same meaning as the black box, where there is a model that accepts input, then able to do the thought of the input and give the answer as an output of the results of his thinking [7].

1. Models that are already built during training can then be used to predict new class labels that are not yet known. In the construction of models during the training process required an algorithm.
2. The classification prediction is the processing to find a model (or function) that describes and characterizes the concept or class of data, for a particular benefit, that can use modeling to predict which object class the label does not Known.

Classification is a process of finding a model or function that describes or distinguishes the concept or class of data, with the intention of being able to estimate the class of an object whose label is not known. In achieving these objectives, the classification process forms a model capable of distinguishing data into different classes based on specific rules or functions. The Model itself can be a "if-then" rule, a decision tree, or a mathematical formula [8].

G. Bayes Classifier

Bayes is a simple, probabilistic-based predictive technique based on the implementation of the Bayes theorem (or Bayes rule) assuming strong (naïve) independence (independence). In other words, Naive Bayes, the model used is the "independent feature module" [9]. In Bayes (especially Naive Bayes), the intent of a strong independence on the feature is that a different feature in the same data. The Bayes prediction is based on the Bayes theorem with the following general (1) :

$$P(H|E) = \frac{P(E|H)*P(H)}{P(E)} \quad (1)$$

Here is a description of the above formula loaded in Table 1.

Table 1. Naive Bayes Classifier

Parameter	Description
P(H|E)	Conditional end probability (conditional probability) An H hypothesis occurs if the evidence is given by E
P(E|H)	The probability of an E proof occurs affects the H hypothesis.
P(H)	The initial probability (priori) hypothesis H occurs without regard to any evidence
P(E)	Initial probability (priori) proof E occurs regardless of hypotheses/evidence of others

The classification with Naive Bayes works on a probability theory that looks out the hallmark of the data as evidence in probability. This gives the characteristics of Naive Bayes as follows [10]:

1. The Naive Bayes method works firmly (robust) against isolated data which is usually a data with different characteristics (outliner). Naive Bayes can also handle wrong attribute values by ignoring the training data during model building process and predictions.
2. Tough facing irrelevant attributes.
3. Attributes that have correlation can degraded the performance of Naive Bayes classification because the independent assumption of the attribute is no longer present.

3. Designing of Research

The following is an overview of the system to be built, as shown in Fig. 2.

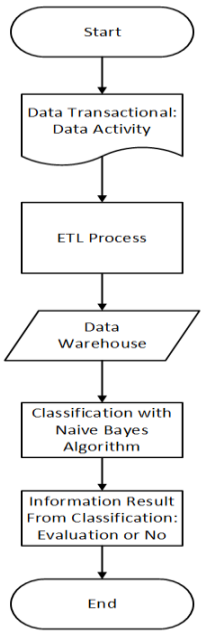


Fig. 2. Overview of Systems built

In the first phase, collecting transactional data, i.e. the activity data from that already done. Such data include activities data, activity type data, activity category data, representative office data, city data, provincial data and budget realization data. The second stage, perform ETL (Extract Transform Load) on the source data. This ETL process is the data from the source system and presents data in various forms for the transformation process. In this process it is done converting the data into a form of useful format for the transformation process by selecting which attribute to use. Third stage, then the result of ETL goes into the Data warehouse. Fourth stage, after that of data Warehouse then done classification using the Naive Bayes algorithm to determine evaluation of the activities already done, which is displayed in the form of dashboard.

A. Software Requirement

Software used to implement the system are as follows:

1. The operating system used Windows 10.
2. The programming language used is PHP Codeigniter.
3. The database used is MySQL.
4. Visual Studio Code (Tools for coding).

B. Profil Company

Indonesia Stock Exchange (Indonesian: Bursa Efek Indonesia) is a stock exchange based in Jakarta, Indonesia. It was previously known as the Jakarta Stock Exchange (JSX) before its name changed in 2007 after merging with the Surabaya Stock Exchange (SSX). As of October 2019, the Indonesia Stock Exchange had 656 listed companies. In December 2017, based on Single Identification Number there were 628,346 domestic investors, of which 51.33% were foreign investors and 48.67% domestic investors. Whereas in December 2019, the total stock investors are 1.1 million and increase 30 percent from previous year. Originally opened in 1912 as Vereniging Voor Effectenhandel In Batavia under the Dutch colonial government acting as a branch of Amsterdamse Effectenbeurs. it was re-opened in 1977 after several closures during World War I and World War II. After being reopened in 1977, the exchange was under the management of the newly created Capital Market Supervisory Agency (Badan Pengawas Pasar Modal, or Bapepam), which answered to the Ministry of Finance. Trading activity and market capitalisation grew alongside the development of Indonesia's financial markets and private sector - highlighted by a major bull run in 1990. On 13 July 1992, the exchange was privatised under the ownership of Jakarta Exchange Inc. As a result, the functions of Bapepam changed to become the Capital Market Supervisory Agency. On 22 March 1995 JSX launched the Jakarta Automated Trading System (JATS). In September 2007, Jakarta Stock Exchange and Surabaya Stock Exchange merged and named Indonesian Stock Exchange by Indonesian Minister of Finance. The current location of the Indonesian Stock Exchange is located in the IDX building in the Sudirman Central Business District, South Jakarta, near the current site of the Pacific Place Jakarta.

C. Database

Databases are the general data management that is computing on software [17]. This IDX database is named Idis database. The table of this Idis data, loading a table from the existing database that has been created where the data in this table, will be taken the table dimensions as needed when designing the table dimensions. Here is a table of Idis databases loaded in Table 2.

Table 2. List Table of Database Idis

Table Name	Table Component
BudgetActivity	Id
	Anggaran
	AuditTrailId
	DataId
	DepartmentId
	Description
	JenisKegiatanId
	KantorPerwakilanId
	Name
	PeriodeAnggaran
	State
WorkArea	Id
	AuditTrailId
	DataId
	DepartmentId
	Description
	Name
	State

TypeActivity	**Id** **AuditTrailId** **DepartmentId** **Description** **Name** **State** **KategoriKegiatanId** **MataAnggaranId** **Singkatan**
RepresentativeOffice	Id AuditTrailId DataId DepartmentId Description KodeKP Name State AreaKerjaId AdminKpId KanitId
CategoryActivity	Id AuditTrailId DataId DepartmentId Description Name State Order
BudgetComponent	Id AuditTrailId DataId DepartmentId Description Name State
City	Id AuditTrailId DataId DepartmentId Description Name ProvinsiId State
Province	Id AuditTrailId DataId DepartmentId Description Name State
BudgetRealization	Id AuditTrailId DataId DepartmentId Description KegiatanId KomponenAnggaranId Name Nilai State Quantity Keterangan

TrxActivity	**Id**
	AuditTrailId
	DataId
	DepartmentId
	Description
	Artikel
	KPPenyelenggaraId
	LinkPendaftaran
	Lokasi
	NomorBR
	Name
	SettlementNumber
	TargetOA
	State
	KuotaPeserta
	JenisKegiatanId
	KodeKegiatan
	Planned
	EndTime
	StartTime
	KotaId
	CreatedById
	Location
	RealisasiEndTime
	RealisasiKotaId
	RealisasiLokasi
	RealisasiPlanned
	RealisasiStartTime
	CreatedDate
	UpdatedDate
	RealisasiTargetOA
	KantorPerwakilan
User	Id
	AuditTrailId
	DataId
	DepartmentId
	Description
	Name
	Password
	State
	Username
PasswordHistory	Id
	UserId
	Password
	Created

D. Designing Data Warehouse

Data Warehouse obtains the data from a number of operational database systems which can be based on RDBMS/ERP Package, etc. The data from these sources are converted into a form suitable for data warehouse [16]. The process of warehousing data is a process used as a basic data for Business intelligence solutions. Therefore, it is necessary to design a data warehouse. Designing the Data warehouse itself is done by forming a new database As formation data to be processed for the implementation of BI. Data used to get the results to be analyzed is adjusted

Problems with this research. The table used is a table associated with the implementation of PT IDX activities. The table used is derived from the initial database of Idis databases, namely TrxActivity, TypeActivity, CategoryActivity, Province, City, Budget Realization. From this table, Not all attributes on the original data are used for the Data warehouse. From the attribute Processed into a data warehouse model, which is a 6 dimensional table

TrxActivity_Dim, TypeActivity_Dim, CategoryActivity_Dim, Province_Dim, City_Dim, BudgetRealization_Dim as well as 1 fact table Idis_fact as shown in Fig. 3.

Fig. 3 above shows the fact table of the Idis database that has been designed. The Data will be used for Extract Transform Load (ETL) process. From the design of the data warehouse indicates that there are 6 dimensions that will process: *TrxActivity_Dim, TypeActivity_Dim, CategoryActivity_Dim, Province_Dim, City_Dim, BudgetRealization_Dim*

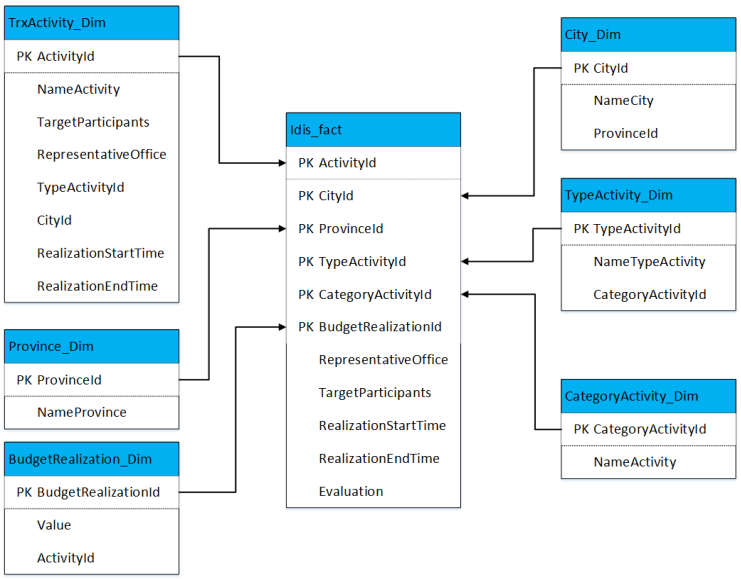


Fig. 3. Idis_Fact Table

4. Result and Discussion

A. Implementation Dimension Table

Dimension tables are strongly denormalized and are used to select the facts of interest based on the user queries. The fact table stores fact attributes its key is defined by importing the keys of the dimension tables [18]. The following are implementations of the created dimensions, where the dimension implementation of this table is sorted by design that has been created on desgining the Data warehouse. Here is a preview of the Created dimension table loaded in Fig. 4.

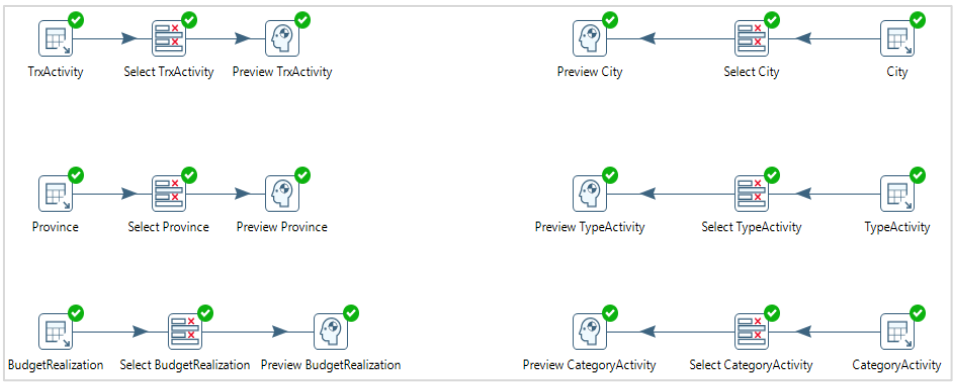
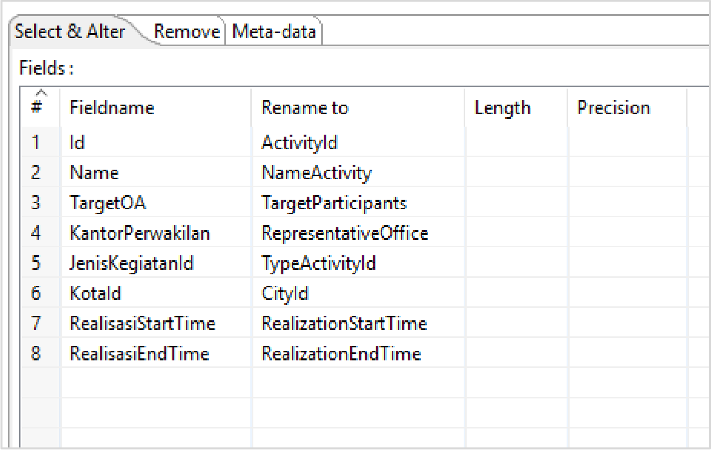


Fig. 4. Implementation Dimension Table

Here are the details of each dimension table that has been created:

1. Fig. 5 will showing implementation the first dimension, namely *TrxActivity_Dim*



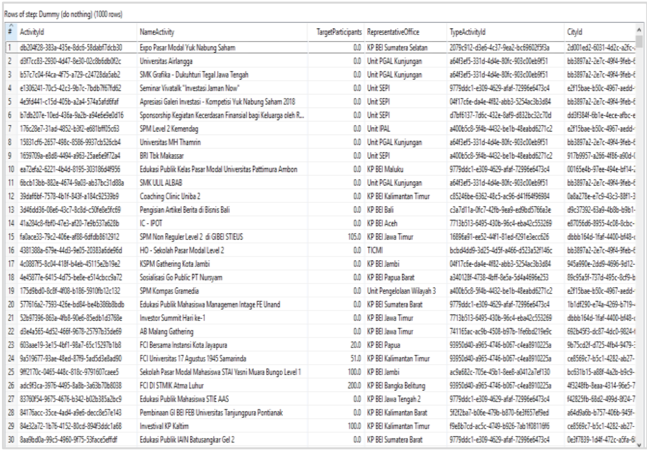
Select & Alter | Remove | Meta-data

Fields :

#	Fieldname	Rename to	Length	Precision
1	Id	ActivityId		
2	Name	NameActivity		
3	TargetOA	TargetParticipants		
4	KantorPerwakilan	RepresentativeOffice		
5	JenisKegiatanId	TypeActivityId		
6	KotaId	CityId		
7	RealisasiStartTime	RealizationStartTime		
8	RealisasiEndTime	RealizationEndTime		

Fig. 5. TrxActivity_Dim

Following is the result data of dimension *TrxActivity_Dim* in Fig. 6.

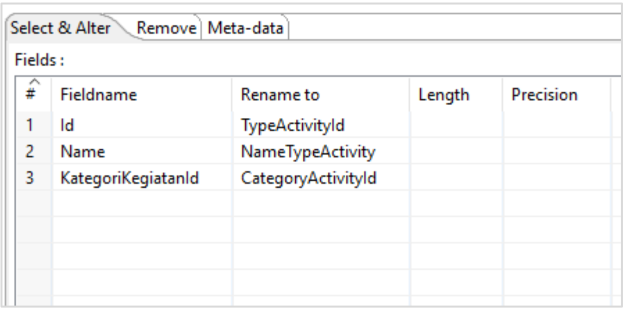


Rows of step: Dummy (do nothing) (1000 rows)

#	ActivityId	NameActivity	TargetParticipants	RepresentativeOffice	TypeActivityId	CityId
1	db204f28-383a-435e-8dc6-58dabf7dcb30	Expo Pasar Modal Yuk Nabung Saham	0.0	KP BEI Sumatera Selatan	2079c912-d3e6-4c37-9ea2-bc69602f5f3a	2d001ed2-6031-4d2c-a2fc-
2	d3f7cc83-2930-4d47-8e30-02c8b6db0f2c	Universitas Airlangga	0.0	Unit PGAL Kunjungan	a64f3ef5-331d-4d4e-80fc-903c00eb9f51	bb3897a2-2e7c-49f4-9feb-
3	b57c7c04-f4ca-4f75-a729-c24728da5ab2	SMK Grafika - Dukuhturi Tegal Jawa Tengah	0.0	Unit PGAL Kunjungan	a64f3ef5-331d-4d4e-80fc-903c00eb9f51	bb3897a2-2e7c-49f4-9feb-
4	e1306241-70c5-42c3-9b7c-7bdb7f67fd62	Seminar Vivatalk "Investasi Jaman Now"	0.0	Unit SEPI	9779ddc1-e309-4629-afaf-72996e6473c4	e2f15bae-b50c-4967-aedd-
5	4e5fd441-c15d-405b-a2a4-574a5afd6faf	Apresiasi Galeri Investasi - Kompetisi Yuk Nabung Saham 2018	0.0	Unit SEPI	04f17c6e-da4e-4f82-abb3-5254ac3b3d84	bb3897a2-2e7c-49f4-9feb-
6	b7db207e-10ed-436a-9a2b-a94e6e9e0d16	Sponsorship Kegiatan Kecerdasan Finansial bagi Keluarga oleh R...	0.0	Unit SEPI	d7bf6137-7d6c-432e-8af9-d832bc32c70d	dd3f384f-6b1e-4ece-afbc-e
7	176c28e7-31ad-4852-b3f2-e681bff05c63	SPM Level 2 Kemendag	0.0	Unit IPAL	a400b5c8-5f4b-4432-be1b-48eabd6271c2	e2f15bae-b50c-4967-aedd-
8	15831cf6-2657-498c-8586-9937cb526cb4	Universitas MH Thamrin	0.0	Unit PGAL Kunjungan	a64f3ef5-331d-4d4e-80fc-903c00eb9f51	bb3897a2-2e7c-49f4-9feb-
9	1659709a-e8d8-4494-a963-25ae6e9f72a4	BRI Tbk Makassar	0.0	Unit SEPI	a400b5c8-5f4b-4432-be1b-48eabd6271c2	917b9957-a266-4f86-a90d-
10	ea72efa2-6221-4b4d-8195-303186d4f956	Edukasi Publik Kelas Pasar Modal Universitas Pattimura Ambon	0.0	KP BEI Maluku	9779ddc1-e309-4629-afaf-72996e6473c4	00165e4b-97ee-494e-bf14-
11	6bcb13bb-882e-4674-9a03-ab37bc31d88a	SMK ULUL ALBAB	0.0	Unit PGAL Kunjungan	a64f3ef5-331d-4d4e-80fc-903c00eb9f51	bb3897a2-2e7c-49f4-9feb-
12	39daf6bf-7578-4b1f-843f-a184c92539b9	Coaching Clinic Uniba 2	0.0	KP BEI Kalimantan Timur	c85246be-6362-48c5-ac96-d41f64f96984	0a8a278e-e7c9-43c3-88f1-3
13	3d46dd36-08e6-43c7-8c8d-c50fe8e5fc69	Pengisian Artikel Berita di Bisnis Bali	0.0	KP BEI Bali	c3a7d11a-0fc7-42fb-9ea9-ed9bd5766a3e	d9c37392-63a9-4b8b-b9b1-
14	41a284c8-fbf0-47e3-af20-7e9b537a628b	IC - IPOT	0.0	KP BEI Aceh	7713b513-6495-430b-96c4-eba42c553269	e87056d6-8955-4c08-8cbc-
15	fa0ace33-79c2-406e-af88-6dfdb8612912	SPM Non Reguler Level 2 di GIBEI STIEUS	105.0	KP BEI Jawa Timur	16896a91-ee52-44f1-81ed-f291e3ecc626	dbbb164d-1faf-4400-bf48-
16	4381388a-679e-44d3-9e05-20383a6de96d	HO - Sekolah Pasar Modal Level 2	0.0	TICMI	bcbd4dd9-3d25-4d5f-a466-d523a52f146c	bb3897a2-2e7c-49f4-9feb-
17	4c0887f5-8c04-418f-b4eb-45115e2b19e2	KSPM Gathering Kota Jambi	0.0	KP BEI Jambi	04f17c6e-da4e-4f82-abb3-5254ac3b3d84	945a990e-2dd9-4696-9d12-
18	4e45877e-6415-4d75-be8e-e514cbcc9a72	Sosialisasi Go Public PT Nursyam	0.0	KP BEI Papua Barat	a340128f-4738-4bff-8e5a-5d4a4696e253	89c95a5f-737d-495c-8cf9-b
19	175d9bd0-8c8f-4f08-b186-5910fb12c132	SPM Kompas Gramedia	0.0	Unit Pengelolaan Wilayah 3	a400b5c8-5f4b-4432-be1b-48eabd6271c2	e2f15bae-b50c-4967-aedd-
20	577616a2-7593-426e-bd84-be4b386b8bdb	Edukasi Publik Mahasiswa Managemen Intage FE Unand	0.0	KP BEI Sumatera Barat	9779ddc1-e309-4629-afaf-72996e6473c4	1b1df290-e74a-4269-b719-
21	52b97396-863a-4fb8-90e6-85edb1d3768e	Investor Summit Hari ke-1	0.0	KP BEI Jawa Timur	7713b513-6495-430b-96c4-eba42c553269	dbbb164d-1faf-4400-bf48-
22	d3e4a565-4d52-466f-9678-25797b35de69	AB Malang Gathering	0.0	KP BEI Jawa Timur	741165ac-ac9b-4508-b97b-1fe6bd219e9c	692b45f3-dc87-4dc0-9824-
23	603aae19-3e15-4bf1-98a7-65c15297b1b8	FCI Bersama Instansi Kota Jayapura	20.0	KP BEI Papua	93950d40-a965-4746-b067-c4ea8910225a	9b75cd2f-d725-4fb4-9479-
24	9a519677-93ae-48ed-87f9-5ad5d3e8ad90	FCI Universitas 17 Agustus 1945 Samarinda	51.0	KP BEI Kalimantan Timur	93950d40-a965-4746-b067-c4ea8910225a	ce8569c7-b5c1-4282-ab27-
25	9ff2170c-0465-448c-818c-9791607caee5	Sekolah Pasar Modal Mahasiswa STAI Yasni Muara Bungo Level 1	100.0	KP BEI Jambi	ac9a682c-705e-45b1-8ee8-a0412a7ef130	bc631b15-a88f-4a2b-b9c9-
26	adc9f3ca-3976-4495-8a8b-3a63b70b8038	FCI DI STMIK Atma Luhur	200.0	KP BEI Bangka Belitung	93950d40-a965-4746-b067-c4ea8910225a	4f3248fb-8eaa-4314-96e5-7
27	83760f54-9675-4676-b342-b02b385a2bc9	Edukasi Publik Mahasiswa STIE AAS	0.0	KP BEI Jawa Tengah 2	9779ddc1-e309-4629-afaf-72996e6473c4	f42825fb-68d2-499d-8f24-7
28	84176acc-35ce-4ad4-a9e6-decc8e57e143	Pembinaan GI BEI FEB Universitas Tanjungpura Pontianak	0.0	KP BEI Kalimantan Barat	5f2f2ba7-b06e-479b-b870-6e3f657ef9ed	a64d9a6b-b757-406b-945f-
29	84e32a72-1b76-4152-80cd-894f3ddc1a68	Investival KP Kaltim	100.0	KP BEI Kalimantan Timur	f9e8b7cd-ac5c-4749-b926-7ab1f08116f6	ce8569c7-b5c1-4282-ab27-
30	8aa9bd0a-99c5-4960-9f75-53face5effdf	Edukasi Publik IAIN Batusangkar Gel 2	0.0	KP BEI Sumatera Barat	9779ddc1-e309-4629-afaf-72996e6473c4	0e3f7839-1d4f-472c-a5fa-6

Fig. 6. Result Data of TrxActivity_Dim

2. Fig. 7 will showing implementation the dimension, namely *TypeActivity_Dim*



Select & Alter | Remove | Meta-data

Fields :

#	Fieldname	Rename to	Length	Precision
1	Id	TypeActivityId		
2	Name	NameTypeActivity		
3	KategoriKegiatanId	CategoryActivityId		

Fig. 7. TypeActivity_Dim

Following is the result data of dimension *TypeActivity_Dim* in Fig. 8.

Rows of step: Dummy (do nothing) 3 (52 rows)

#	TypeActivityId	NameTypeActivity	CategoryActivityId
1	168c38d6-e4b1-46d4-ae42-3e02adc8b7d6	KP - Sekolah Pasar Modal Syariah Level 1	bb53a64d-e593-4a63-a57f-e47a076e461a
2	ac9a682c-705e-45b1-8ee8-a0412a7ef130	KP - Sekolah Pasar Modal Level 1	bb53a64d-e593-4a63-a57f-e47a076e461a
3	0a38e155-6b99-4301-854e-ad185d490cc4	HO - Sekolah Pasar Modal Level 1	bb53a64d-e593-4a63-a57f-e47a076e461a
4	b2173dfc-a69f-4fec-a1b2-52762e1d95c1	Media Gathering	1238a828-00f3-45f5-9bfb-147725803c6f
5	b1d8b297-eb79-472e-8af3-066716f28ae5	Edukasi Publik Syariah	2af13fdc-dc3a-4f88-aff1-bc69e8c46964
6	15f4b30b-bbc6-4be9-bfcf-5ceb0113d265	KP - Gallery Visit - Pelajar	2af13fdc-dc3a-4f88-aff1-bc69e8c46964
7	c3a7d11a-0fc7-42fb-9ea9-ed9bd5766a3e	Media Promosi	2af13fdc-dc3a-4f88-aff1-bc69e8c46964
8	16896a91-ee52-44f1-81ed-f291e3ecc626	KP - Sekolah Pasar Modal Level 2	1d918d98-61f9-47b6-8d26-ee58c40defdc
9	7713b513-6495-430b-96c4-eba42c553269	Forum Investor	1d918d98-61f9-47b6-8d26-ee58c40defdc
10	3480edd7-14c1-4abb-81ae-cb893e3669b7	Forum Investor Syariah	1d918d98-61f9-47b6-8d26-ee58c40defdc
11	36b3d1ef-6091-4bec-8d7c-96c3dcfb7ee8	Workshop	1d918d98-61f9-47b6-8d26-ee58c40defdc
12	034d9d99-ef69-4957-a270-a9cc49e15ff0	KP - Gallery Visit - non pelajar	2af13fdc-dc3a-4f88-aff1-bc69e8c46964
13	20070dd4-38db-48ba-89cf-3c04e42135ec	CSR	1238a828-00f3-45f5-9bfb-147725803c6f
14	6a2d2308-6446-4097-bfff-1310f03a5ef3	Lainnya	1238a828-00f3-45f5-9bfb-147725803c6f
15	cbe6cb83-584d-456d-9fb1-7c00024caf06	Sponsorship Galeri Investasi (GI)	1e8455a9-0251-49ce-9734-65e8ec0d28aa
16	d7bf6137-7d6c-432e-8af9-d832bc32c70d	Sponsorship Non-Galeri Investasi (Non-GI)	1e8455a9-0251-49ce-9734-65e8ec0d28aa
17	7f7a2916-9e60-4ded-bd31-6f942f822185	HO - Gallery Visit - non pelajar	2af13fdc-dc3a-4f88-aff1-bc69e8c46964
18	a64f3ef5-331d-4d4e-80fc-903c00eb9f51	HO - Gallery Visit - Pelajar	2af13fdc-dc3a-4f88-aff1-bc69e8c46964
19	d6f7d486-69d1-490b-a77d-529c6f3237c7	Investor Summit / Public Expose	1d918d98-61f9-47b6-8d26-ee58c40defdc
20	f9e8b7cd-ac5c-4749-b926-7ab1f08116f6	INVESTIVAL YNS KP	2af13fdc-dc3a-4f88-aff1-bc69e8c46964
21	2079c912-d3e6-4c37-9ea2-bc69602f3f3a	Branding Yuk Nabung Saham Kantor Perwakilan	2af13fdc-dc3a-4f88-aff1-bc69e8c46964
22	6b941c1b-e2d2-4fbd-98e1-cf88f6f41c33	Relaunching Galeri Investasi	97d4fd16-9175-4034-881f-0c60454733f2
23	d12412d8-1860-4cec-a932-d2d1eeceb855	Training Sertifikasi WPPE/WMI	c8e59f3c-afed-45e7-bbc9-b32681974089
24	25b0d422-25de-4935-999e-0d2aaf9ea14a	Ujian Sertifikasi WPPE/WMI	c8e59f3c-afed-45e7-bbc9-b32681974089
25	0f00ee62-4853-4172-b2fe-08b3dbe57dfb	Kerja sama TICMI - Universitas	c8e59f3c-afed-45e7-bbc9-b32681974089
26	a340128f-4738-4bff-8e5a-5d4a4696e253	Sosialisasi Go Public One on One	4bbd5c71-a239-4c19-8e43-7e3df269125b
27	518118b7-4d77-4836-b8db-213f94fb46c1	Business Meeting	4bbd5c71-a239-4c19-8e43-7e3df269125b
28	0add7482-5067-457d-8485-50587e58a727	Peresmian GI BEI	97d4fd16-9175-4034-881f-0c60454733f2
29	93950d40-a965-4746-b067-c4ea8910225a	KP - Forum Calon Investor	bb53a64d-e593-4a63-a57f-e47a076e461a
30	04f17c6e-da4e-4f82-abb3-5254ac3b3d84	GI Gathering	1238a828-00f3-45f5-9bfb-147725803c6f

Fig. 8. Result Data of TypeActivity_Dim

3. Fig. 9. will showing implementation the dimension, namely *CategoryActivity_Dim*

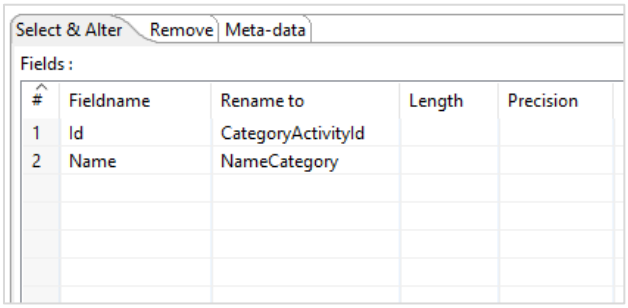


Fig. 9. CategoryActivity_Dim

Following is the result data of dimension *CategoryActivity_Dim* in Fig. 10.

Rows of step: Dummy (do nothing) 4 (10 rows)

#	CategoryActivityId	NameCategory
1	2af13fdc-dc3a-4f88-aff1-bc69e8c46964	Literasi
2	bb53a64d-e593-4a63-a57f-e47a076e461a	Inklusi
3	1d918d98-61f9-47b6-8d26-ee58c40defdc	Aktivasi
4	1e8455a9-0251-49ce-9734-65e8ec0d28aa	Sponsorship
5	4604d4ce-d1d8-4be1-ae8f-67a9387ce8dc	GI-AB Gathering
6	97d4fd16-9175-4034-881f-0c60454733f2	Peresmian Galeri Investasi
7	1238a828-00f3-45f5-9bfb-147725803c6f	Lainnya
8	4bbd5c71-a239-4c19-8e43-7e3df269125b	Pengembangan Calon Emiten
9	c8e59f3c-afed-45e7-bbc9-b32681974089	Kerjasama dengan TICMI
10	e6824e50-27a9-403c-b473-771fc851166a	Pendalaman Pasar Modal

Fig. 10. Result Data of CategoryActivity_Dim

4. Fig. 11. will showing implementation the dimension, namely *Province_Dim*

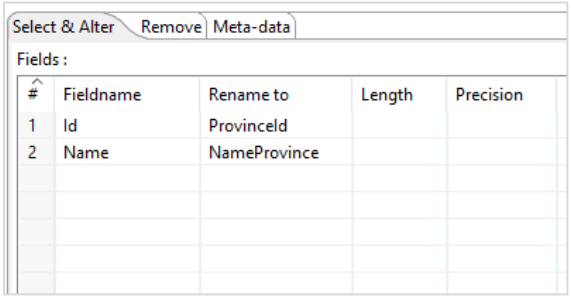


Fig. 11. Province_Dim

Following is the result data of dimension *Province_Dim* in Fig. 12.

Rows of step: Dummy (do nothing) 2 (34 rows)

#	ProvinceId	NameProvince
1	b0868c34-b76a-4ffe-9200-84e8b451049b	Jawa Barat
2	ac774889-ff02-4ca4-8445-c540ff93f5bc	Jawa Tengah
3	435fe3e0-e76d-40bc-bfc9-15df213c4837	Aceh
4	487a6566-ee84-4d3f-8123-2080bf22f83b	Bali
5	47ef3082-77e7-4e58-8945-f52fe89bd7d3	Banten
6	e7df3e08-f76c-4dde-8e7a-180de2d1b23c	Bengkulu
7	4bc4a8a1-9791-4e71-a992-e1ea36170d01	Gorontalo
8	74cb5f5c-eb06-4e8f-8390-0d9649cae9e1	Jakarta
9	b50f19b3-b794-4780-b4da-2d40a8b71af5	Jambi
10	e1e966d0-576a-4a97-8142-9c0ae02a6a7e	Jawa Timur
11	255a9cf6-8560-4d5f-873e-5eeaa6c041ad	Kalimantan Barat
12	2cb128c8-f718-472f-97ec-8b501d70566a	Kalimantan Selatan
13	d8e94afd-ce28-45d9-a438-50b57cd7f336	Kalimantan Tengah
14	5dd93d8a-4a02-4f45-9cbc-d49666c70a26	Kalimantan Timur
15	c2090d47-84b3-405b-b3e5-f83800e27ad6	Kalimantan Utara
16	34743b50-f8aa-44d6-be5c-25472d1df6d9	Kepulauan Bangka Belitung
17	649d5966-5877-4d86-958b-1dfe421247ca	Kepulauan Riau
18	f77b7953-9b92-453c-950a-adaf8f575434	Lampung
19	944a07b5-ff24-427e-b43c-4c76e02919ea	Maluku
20	22e56a6b-5b02-4ddc-b9a5-c14d5e7bf1cc	Maluku Utara
21	58b40f1d-20c5-436d-93c7-a565301a6f62	Nusa Tenggara Barat

Fig. 12. Result Data of Province_Dim

5. Fig. 13 will showing implementation the dimension, namely *City_Dim*

Select & Alter | Remove | Meta-data

Fields :

#	Fieldname	Rename to	Length	Precision
1	Id	CityId		
2	Name	NameCity		
3	ProvinsiId	ProvinceId		

Fig. 13. City_Dim

Following is the result data of dimension *City_Dim* in Fig 14.

Rows of step: Dummy (do nothing) 6 (1000 rows)

#	CityId	NameCity	ProvinceId
1	08b3cfb3-f509-4d9e-8cfa-dde1320f25bc	Bangli	487a6566-ee84-4d3f-8123-2080bf22f83b
2	fc89290f-84a9-4981-a597-c0ea13abf986	Buleleng	487a6566-ee84-4d3f-8123-2080bf22f83b
3	d9c37392-63a9-4b8b-b9b1-f5a0a922028d	Denpasar	487a6566-ee84-4d3f-8123-2080bf22f83b
4	e4cbb100-cf51-4c08-addd-378745dd03d7	Gianyar	487a6566-ee84-4d3f-8123-2080bf22f83b
5	190485db-a322-41c0-961c-3a405dcefc7c	Jembrana	487a6566-ee84-4d3f-8123-2080bf22f83b
6	f28cc9f1-3736-47ab-bef0-73358ffffaf0	Karang Asem	487a6566-ee84-4d3f-8123-2080bf22f83b
7	ab54f07f-cf64-4e87-ac6a-19897b9274c9	Klungkung	487a6566-ee84-4d3f-8123-2080bf22f83b
8	dd649e70-6498-4dd1-9bd2-096d6fdbe37f	Tabanan	487a6566-ee84-4d3f-8123-2080bf22f83b
9	a8cb755e-9d3f-4e82-82f5-5eaa12bd3cae	Cilegon	47ef3082-77e7-4e58-8945-f52fe89bd7d3
10	c7da81e2-1bc2-4e8c-a0e7-b59f6432cda2	Lebak	47ef3082-77e7-4e58-8945-f52fe89bd7d3
11	208ecefc-8e12-4717-a6dc-8833b4abda0b	Pandeglang	47ef3082-77e7-4e58-8945-f52fe89bd7d3
12	a79da07b-5065-45da-a7de-1e0273a5c2c6	Serang	47ef3082-77e7-4e58-8945-f52fe89bd7d3
13	8d48e915-f095-4f65-a7b3-6d23ffc3fa7f	Tangerang	47ef3082-77e7-4e58-8945-f52fe89bd7d3
14	2bd3b222-2777-433e-b15c-336d080c19b8	Tangerang Selatan	47ef3082-77e7-4e58-8945-f52fe89bd7d3
15	30d52350-cef0-4eec-be17-6e40daeb05bc	Bengkulu	e7df3e08-f76c-4dde-8e7a-180de2d1b23c
16	6fa40c16-4d93-459c-a5bd-5fd51ad5a648	Bengkulu Selatan	e7df3e08-f76c-4dde-8e7a-180de2d1b23c
17	ac4eb22f-112e-4924-b231-f7ece8e4806f	Bengkulu Tengah	e7df3e08-f76c-4dde-8e7a-180de2d1b23c
18	3f2cb179-bee4-4c67-9fc4-a438fe176fda	Bengkulu Utara	e7df3e08-f76c-4dde-8e7a-180de2d1b23c
19	404516d5-da4c-4df4-bb24-eeb8c0190fbf	Kaur	e7df3e08-f76c-4dde-8e7a-180de2d1b23c
20	6d6bc963-0735-449b-8c12-14be59c0d71e	Kepahiang	e7df3e08-f76c-4dde-8e7a-180de2d1b23c
21	f608a1b1-8468-4154-8319-5df2181fbce4	Lebong	e7df3e08-f76c-4dde-8e7a-180de2d1b23c

Fig. 14. Result Data of City_Dim

6. Fig 15. will showing implementation the dimension, namely *BudgetRealization_Dim*

Select & Alter | Remove | Meta-data

Fields :

#	Fieldname	Rename to	Length	Precision
1	Id	BudgetRealizationId		
2	Nilai	Value		
3	KegiatanId	ActivityId		

Fig. 15 BudgetRealization_Dim

Following is the result data of dimension *BudgetRealization_Dim* in Fig. 16.

Rows of step: Dummy (do nothing) 7 (1000 rows)

#	BudgetRealizationId	Value	ActivityId
4	7d956198-8282-4158-93f5-7dacd5b6981b	200000.0	d4b1586b-6a68-4b95-a57a-21c1b0a5f864
5	07431225-4fef-4d01-a337-f9e22c7ac77a	2716000.0	1cb7c613-180c-4519-9b4e-b57e2d7056e4
6	2d860553-5268-43ee-9120-c2e3aeb1c40e	250000.0	47d72ebf-3017-4a8a-bec6-0adf5effa532
7	aca37599-b88e-4773-9c62-1707eba35490	600600.0	3b14f776-35f2-4c9a-87d2-e4588d02034d
8	d608216b-2e39-4595-a6c8-3b425b125b16	150000.0	2f5246c1-95ce-4dee-88b7-15bda571aeb4
9	9f8c9d04-81b3-4d91-bf00-d6a0fcf48031	250000.0	c7c1e4e5-a974-4024-8b43-8974e08fe3f5
10	565f66f7-37b4-40c6-8404-124b7b059eda	669000.0	155c30d5-78f5-4b16-b6f3-e7c7ac720d5a
11	09ff8c67-d913-4733-b808-a0c89fffebc4	750000.0	04ecc26e-a259-40db-9e74-36cb06f634be
12	47668bd5-d286-444b-a8b9-6a7fd560184b	14355.0	a53a8840-98ca-4178-8033-0cfc38087395
13	7e758cbf-69cf-4b19-b72a-646e66a365e6	232500.0	d0a4e698-157e-4747-8d37-67ccfd246139
14	8ce83bfe-3746-41c2-b829-95bccc7dbca2	2500000.0	02220116-d9da-4aa4-96cd-c4fffa20ae70
15	9a6004c7-1227-46df-9424-a4982cc09158	180000.0	00c8f05b-4988-4326-afbd-2ab9ed60584b
16	0c29141a-762f-4b13-b185-de0c3bbce4c1	30000.0	6ce0dd16-eddf-4ed7-9639-9c61392dc9d8
17	6d3730a4-2344-4c72-ad0c-a8045d1c7359	8700.0	d9173108-fed0-4190-b84b-3e919d3abfb9
18	2fb10361-92a8-4372-82f5-f8c124dc7121	331000.0	639f6b1f-6640-40b2-b7c5-9fbfa302498e
19	9c4f44c7-c059-4511-b8be-3609cc855f8a	450000.0	822b7438-b22d-4f6b-a4b6-cf43e869dd80
20	c0060248-bbe5-4083-aef4-10adcb99d2d3	19000.0	3b5f843b-f13b-48ad-9a63-d2610782a93c
21	5b96579e-1a52-4c34-9e96-1b7968626cb5	18150.0	36f88c47-b3a5-4858-bf3e-b48bb92cf627
22	f94e40ab-4681-44af-85e8-573d316cc21a	1740000.0	036de43e-e539-48d3-acf0-6cf1384072ee
23	5108fb08-381e-466c-8cc8-6927ce064bc3	2212500.0	16b3b4df-e365-43c4-a779-bf19e981ee5d
24	32867c7c-c782-4821-9550-9001b102cda1	9570.0	46fe3892-3916-4cac-a05f-aea12a7e2429
25	31d728b0-9688-4f3a-95df-2ddb37aa1249	1671000.0	54d6c020-988d-48ca-9a0b-194733f16a95
26	8c015140-38dd-47be-9f40-9d9e79282d42	1100000.0	f94464d6-b361-4508-a1fa-3384d0f8c7c6
27	a03b66cd-10df-4a3c-9b03-67b9cff676af	348000.0	2e669afb-be46-41bc-a426-cafddfce5ed1
28	0fa8f758-12bf-4941-b95a-467585d4f827	540200.0	0eb7e7fe-9964-4705-ab71-3279f0453a0e
29	e6bceae5-99c9-4ea8-a221-b1de8295e268	6894000.0	cc384340-24e5-4f47-a268-e10e96704f75
30	31fa0922-710c-4b4e-882b-e9945e9cfd4c	31602000.0	7b615497-511a-4a58-8f44-1bacbc9575f5

Fig. 16. Result Data of BudgetRealization _Dim

B. Implementation ETL

ETL processes take up to 80% of the effort in BI projects [19]. A high performance is thereby vital to be able to process large amounts of data and to have a up-to-date database [20]. On the implementation of ETL (Extract Transform load) load the dimension table created in the previous step.. Here is an implementation of the built-in etl loaded on Fig. 17 Implementation ETL:

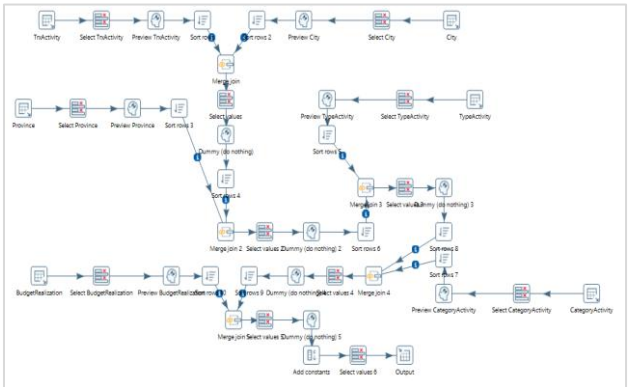


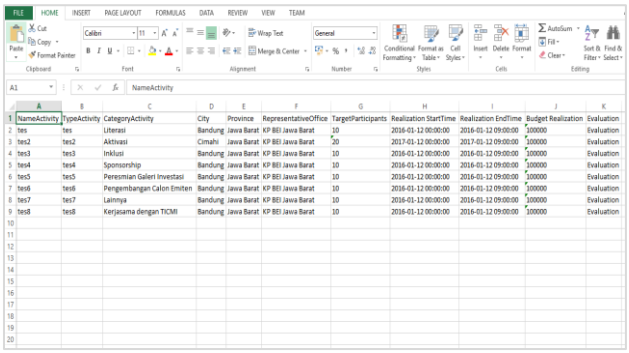
Fig. 17. Implementation ETL

From the picture above, it can be seen that in the process of implementing ETL is done merging of the created dimension table, then obtained the output according to the design of the fact table that has been created.

C. Implementation Naive Bayes

Naive Bayes is among the simplest probabilistic classifiers. It often shows amazingly well in many real-world applications, in the face of the strong assumption that all features are provisionally independent given the class [21]. In this Naive Bayes implementation there are several steps to do. Here is an implementation of the built-in naive bayes classifier:

1. Define the training data, which contains predefined training data that is in the form of spreadsheet files. Loaded on Fig. 18.



NameActivity	TypeActivity	CategoryActivity	City	Province	RepresentativeOffice	TargetParticipants	Realization StartTime	Realization EndTime	Budget Realization	Evaluation
tes	tes	Literasi	Bandung	Jawa Barat	KP BEI Jawa Barat	10	2016-01-12 00:00:00	2016-01-12 09:00:00	100000	Evaluation
tes2	tes2	Aktivasi	Cimahi	Jawa Barat	KP BEI Jawa Barat	20	2017-01-12 00:00:00	2017-01-12 09:00:00	100000	Evaluation
tes3	tes3	Inklusi	Bandung	Jawa Barat	KP BEI Jawa Barat	10	2016-01-12 00:00:00	2016-01-12 09:00:00	100000	Evaluation
tes4	tes4	Sponsorship	Bandung	Jawa Barat	KP BEI Jawa Barat	10	2016-01-12 00:00:00	2016-01-12 09:00:00	100000	Evaluation
tes5	tes5	Peresmian Galeri Investasi	Bandung	Jawa Barat	KP BEI Jawa Barat	10	2016-01-12 00:00:00	2016-01-12 09:00:00	100000	Evaluation
tes6	tes6	Pengembangan Calon Emiten	Bandung	Jawa Barat	KP BEI Jawa Barat	10	2016-01-12 00:00:00	2016-01-12 09:00:00	100000	Evaluation
tes7	tes7	Lainnya	Bandung	Jawa Barat	KP BEI Jawa Barat	10	2016-01-12 00:00:00	2016-01-12 09:00:00	100000	Evaluation
tes8	tes8	Kerjasama dengan TICMI	Bandung	Jawa Barat	KP BEI Jawa Barat	10	2016-01-12 00:00:00	2016-01-12 09:00:00	100000	Evaluation

Fig. 18. Data Training File Shapes Spreadsheet

2. Upload your spreadsheet file training data into the system. Loaded on Fig. 19.

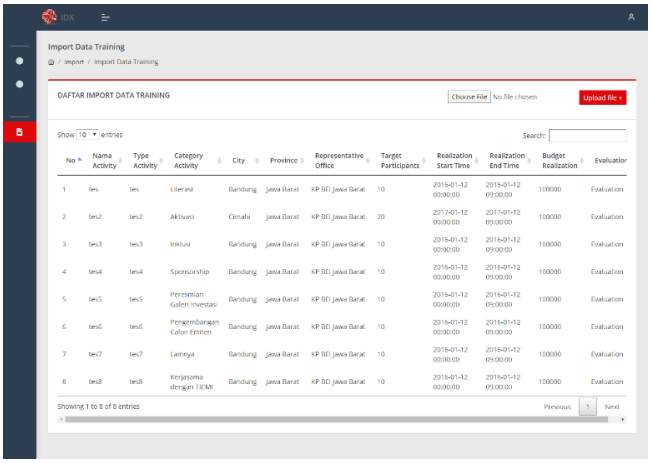


Fig. 19. Uploading Files Data Training

3. Specifying data testing, extracted from data already displayed on the original dashboard. Loaded on Fig. 20.

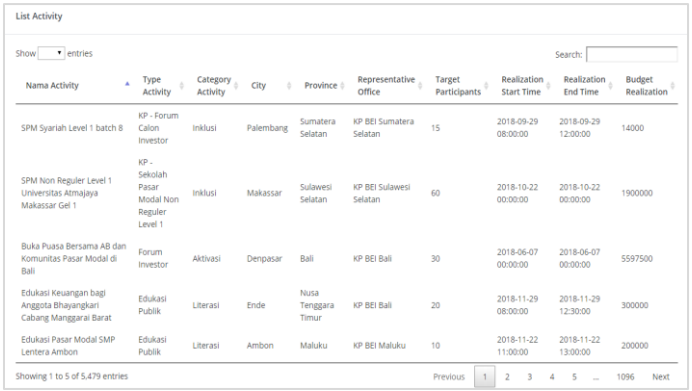


Fig. 20. Data Testing

4. Comparing data between training data and later data testing, the results will be noticeable where activities should be evaluated and activities that should not be evaluated. Loaded on on Fig. 21

Nama Activity	Type Activity	Category Activity	City	Province	Representative Office	Target Participants	Realization Start Time	Realization End Time	Budget Realization	Evaluation
SPM Syariah Level 1 batch 8	KP - Forum Calon Investor	Inklusi	Palembang	Sumatera Selatan	KP BEI Sumatera Selatan	15	2018-09-29 08:00:00	2018-09-29 12:00:00	14000	No Evaluation
SPM Non Reguler Level 1 Universitas Atmajaya Makassar Gel 1	KP - Sekolah Pasar Modal Non Reguler Level 1	Inklusi	Makassar	Sulawesi Selatan	KP BEI Sulawesi Selatan	60	2018-10-22 00:00:00	2018-10-22 00:00:00	1900000	Evaluation
Buka Puasa Bersama AB dan Komunitas Pasar Modal di Bali	Forum Investor	Aktivasi	Denpasar	Bali	KP BEI Bali	20	2018-06-07 00:00:00	2018-06-07 00:00:00	5597500	Evaluation
Edukasi Keuangan bagi Anggota Bhayangkari Cabang Manggarai Barat	Edukasi Publik	Literasi	Ende	Nusa Tenggara Timur	KP BEI Bali	10	2018-11-29 08:00:00	2018-11-29 12:30:00	50000	No Evaluation
Edukasi Pasar Modal SMP Lentera Ambon	Edukasi Publik	Literasi	Ambon	Maluku	KP BEI Maluku	10	2018-11-22 11:00:00	2018-11-22 13:00:00	50000	No Evaluation

Fig. 21. Result Compare Data Training & Data Testing

D. Implementation Intelligence Dashboard

Intelligence Dashboard can be used for data analysis and decision making [22]. On the implementation of this dashboard intelligence, there are 2 dashboards displayed. Here is an implementation of the built-in intelligence dashboard:

1. Dashboard Original

Dashboard Original this is dashboard that displays the original data of activities or data activities that have not been applied classification activity evaluation. Loaded on Fig. 22.

Fig. 22. Implementation Intelligence Dashboard Activity Originial

2. Dashboard Evaluation

Dashboard Evaluation this dashboard that displays activity data that has been evaluated and activity data that does not include evaluation. Loaded on on Fig. 23.

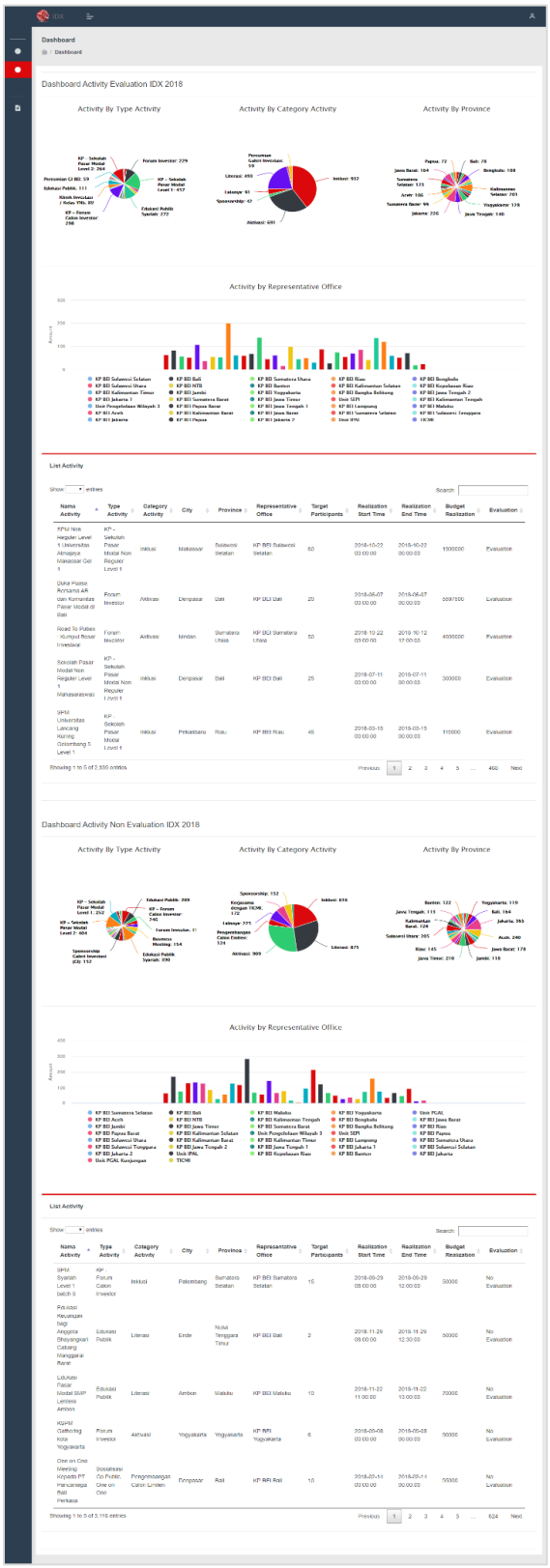


Fig. 23. Implementation Intelligence Dashboard Activity Evaluation

E. Testing Result

Based on the results of the tests, the system can run and operate properly as expected. From data testing and training that has been compared to produce the expected output. Based on the desired usage scenario. Releasing functions that have been designed, can run well with enough good performance.

5. Conslusion

In this study, business intelligence system is expected to assist IDX in conducting evaluation activities. From the analysis of data that has been done can be concluded that the activities in each IDX representative office could potentially be evaluated. The realization of budgets and activity categories becomes the key to whether or not the activity is potentially evaluated. Fore this system can be redeveloped by adding a report feature that can be created in the form of a spreadsheet file or an image for example, so the output can be made easier in printing from the results of a built business intelligence.

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