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Research paper



Modeling data mart using ETL (extract, transform, load) webservice concept on feeder with a dashboard

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Abstract

College in Indonesia do reporting students, lecturers, and lecture activities data to PDDIKTI (Bahasa: Pangkalan Data Pendidikan Tinggi/ Higher Education Database). FEEDER PDDIKTI doesn't have any measurement components such as KPI (Key Performance Indicator) which can be used for measure performance and evaluation of academic activities at college. Problem that occur there is a lot of academic data stored but when transform it to a report at the time of academic activities evaluation becomes difficult and takes a long time and requires a monitoring, evaluating and measuring tools that can be measure performance of the college. Data mart modeling using star schema bring through to analyze data from various perspectives according to the number of dimensions. Academic data within data mart sourced from FEEDER PDDIKTI after going through the ETL (Extract Transform Load) process by using web service then visualized into graphic form on the dashboard which there is a KPI inside to measure performance at college. Dashboard with KPI inside that has been built providing convenience in conducting analysis, monitoring and evaluation of academic activities with the level of user satisfaction achieved by 82%.

Keywords: *Data Mart; ETL; Web Service; Application; DIKTI; Star Schema*.

1. Introduction

In the era of rapid technological developments at this time the availability of accurate and fast information is needed to assist the executive in the process of strategic decision-making. The Executive Information System (EIS) allows executives to access data and information so that problem identification, solution exploration can be made and the basis of strategic planning processes [1].

The management of the university requires an accurate and fast academic report that makes it easy to make strategic decisions and to improve the quality of education. Requires a tool that can monitor, evaluate and measure performance at college. The problem is that there is an abundance of academic data stored but to present it in the report when the evaluation of academic activities becomes difficult and takes a long time. Academic evaluation can be presented with a dashboard so that it becomes easy for decision making. KPI (Key Performance Indicators) is an indicator to measure the success of an organization in implementing its objectives [2]. A dashboard is a page that shows graphs as KPIs from an organization and provides all important measurements needed to make key executive decisions [3].

Universities in Indonesia are reporting student data, lecturers and lectures on PDDIKTI (Higher Education Database). PDDIKTI provides application in the form of Feeder PDDIKTI which is a replacement of previous reporting method that is EPSBED (Evaluation of Self Study Based Evaluation Program) and Higher Education must use it when referring to Directorate General of Higher Education Directive no.2332/E1.2/KP/2015 about PDDIKTI Feeder and circular letter of the Directorate General of Higher Education with no.0543/E1.2/PL/2015 regarding the obligation to use PDDIKTI Feeder. PDDIKTI feeder uses web service technology in synchronizing data from universities acting as client to PDDIKTI server. The data reported to PDDIKTI must be valid and in accordance with existing standards or conditions. According to Law no. 12 Year 2012 on Higher Education, article 56 paragraph 1 describes the Database of Higher Education is a collection of data on the implementation of Higher Education throughout the universities are integrated nationally. PDDIKTI became one of the instruments of implementation of quality assurance and referral. For that reason the authors use the data - data contained in the PDDIKTI Feeder to create data mart modeling used for academic dashboard as well as in presenting academic reports that have been validated in support of leadership decisions.

Data marts are part of a data warehouse located at the departmental level of an enterprise, used for analysis, support for report generation and subject-oriented. Because data marts are part of the data warehouse, data marts support multidimensional data presentation, in which college management can view reports not only from one dimension but from multiple dimensions, which makes decisions more accurate. With the creation of data mart modeling for academic dashboard, private university management can perform OLAP (Online Analytic Processing) sourced from Feeder PDDIKTI by utilizing web service in process ETL (Extract, Transform & Load) data, conduct evaluation and monitoring on academic activities as well can determine strategic policy.

the scope of this research includes: Data mart modeling using star schema, The data used are academic data in the form of student data, lecturers, student values, schedule of lectures and new students sourced from Feeder PDDIKTI, KPI (Key Performance Indicator) refers to the Accreditation Matrix of Bachelor Degree (S1) BAN-PT with assessment element of Standard 3 (Student & Graduate) and Standard 4 (Human Resources) which in this re-

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search is only lecturer only with the objectives to be achieved: Building an academic mart data model that can be applied in private universities.
Produce an academic dashboard that can be used for decision making by private college management in order to improve the quality of education.

2. Related works/literature review

A data warehouse is a computer system that becomes a repository of past data from an organization or company such as sales transaction data, as well as other information obtained from daily operational activities. Used for business analysis activities that aim to improve the effectiveness and efficiency of a company or organization, as well as in decision making [4][5].
The characteristics of the data warehouse according to are as follows:

1) Subject Oriented: The data warehouse is designed to analyze data based on certain subjects in the organization, not on a particular application process or function.
2) Integrated: Data warehouse can store data from separate sources into a format that is consistent and integrated with one another.
3) Time Variant: Data is stored to present information from the past point of view (eg 5 - 10 years ago).
4) Nonvolatile: Data in the data warehouse is not updated in real time but is refreshed from the operating system on a regular basis.

OLAP is a multidimensional data analysis activity that aims to identify problems, measure performance and support decision making in organizations [6] [7].
Data mart is a database that is part of a data warehouse that contains data from a department to support analytical needs or a business function [7 - 10].
Star schema is "the logical structure of the dimensional data model with a fact table in the middle [7][9], surrounded by a dimension table consisting of reference data (which can be denormalized) the definition of fact tables and dimension tables as follows [11]:

1) Table of Facts is a table that contains business events or values in the columns can be measured such as income, costs, and goods.
2) Dimension Table, are tables that contain business objects (customers, products, shops) and all information related to the fact table

ETL (Extract, Transform, Load) refers to software tools that are specialized to perform three main functions such as extraction, transformation and loading data into the data warehouse automatically [4][8].
ETL is divided into three:

1) Extraction is the process of retrieving data from available internal or external data sources. The selection of data to be used is based on the design of the data warehouse and depends on the information needed in the analysis in business intelligence and decision support systems.
2) Transform, in this phase data cleaning and transformation is carried out. The purpose of the cleaning and transformation phase is to improve the quality of data extracted from various sources, through checking inconsistencies, inaccuracies, and missing values. Some of the criteria removed during the data cleaning phase are:

a) Inconsistencies between values recorded in various attributes that have the same meaning.
b) Duplicate data.
c) Missing data.
d) The existence of values that are not acceptable.
e) During the transformation phase, additional data conversion occurs to ensure homogeneity and integration with respect to different data sources. Furthermore, data aggregation and consolidation is done to get a summary that will reduce the response time required by the query and analysis in the data warehouse.

3) Load, the final phase is after extracted and modified, the data is loaded into the table in the data warehouse to make it available to analysts and decision support applications.

The Business Intelligence Lifecycle, is almost the same as an engineering project or a software-engineering project in general, which has six stages from the start to the implementation as illustrated in the following figure [12]:

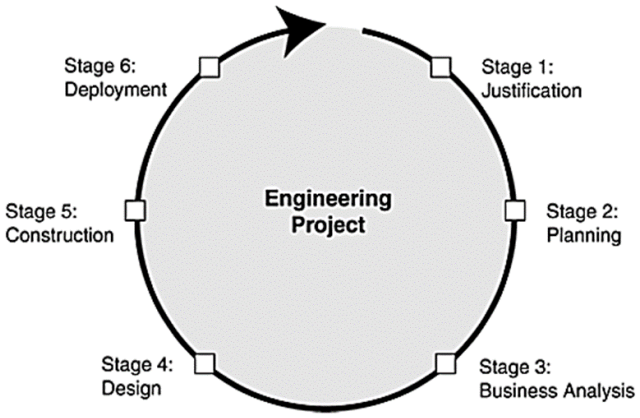


Fig. 1: Engineering Project.

1) Justification

This process is a business justification process by identifying the strategic business objectives of an organization and measuring profits such as profitability or organizational efficiency. BI applications must support the strategic objectives of the business. There are four components in the justification stage, namely:

a) Business drivers: identify business strategic objectives, business driving factors such as vision and mission, then objective objectives of the BI application. Ensure that the BI application supports business strategic objectives.
b) Business analysis issues: analyze business problems and information needed to meet business strategic objectives by defining business information needs for high level management.
c) Cost-benefit analysis: estimate costs to build and maintain BI applications. Calculate the tangible and intangible benefits obtained by the organization.
d) Risk assessment: assessing risk in terms of technology, complexity, integration, organization, project team, and financial investment.

2) Planning

Planning process related to BI infrastructure used and BI project development planning. Enterprise Infrastructure Evaluation or BI infrastructure planning includes two components, namely:

a) Technical infrastructure: includes hardware specifications, software, middleware, database management systems, operating systems, network components, meta data repositories, and utilities.
b) Non-technical infrastructure: includes meta data standards, meta data naming standards, development of logical models on company data, guidelines for conducting methodologies, testing procedures and procedures for resolving problems with management.

BI project planning or project planning includes detailed project planning such as scheduling start times until the completion of the BI project, assigning personnel in the BI project work and planning expenditure costs.

3) Business Analysis

The process of analyzing business is divided into four components, namely:

a) Project Requirements Definition: conduct interviews with organizational executives to find out the information needs

needed, to find out the problems in the organization that have not been answered and to find out the types of reports needed.

b) Data Analysis: perform data quality analysis, data availability, data type, and cardinality between data on source data used in BI projects.

c) Application Prototyping: builds the appearance of the user interface display and the type of report on the BI project to determine the extent to which information needs can be conveyed. At this stage includes the tools used in building a BI project.

d) Meta Data Repositories Analysis: performs a needs analysis and analyzes the accessibility of the meta data contained in the source data used to display the report. Build a logical meta model or E-R (Entity Relationship) model to find out the cardinality between meta data objects.

4) Design

The data architecture design process in the BI project is divided into three components, namely:

a) Database Design: design a multidimensional database using star schema and snowflake schema, measure dimensions used for reporting, measure the depth of the drill-down query to display data in detail, choose the Database Management System (DBMS) to be used.

b) Extract Transform Load Design: selection of tools used for the ETL process, preparing ETL processes, namely changing different data source formats to be more common, checking unnecessary data redundancies and cleaning invalid data and performing process design ETL which is adjusted to the data needs in the previous stage.

c) Meta Data Repository Design: architectural selection is centralized or decentralized in the meta data warehouse and design in the meta data warehouse using Entity-Relationship Design or Object-Oriented Design.

5) Construction

The BI project development phase is divided into four components, namely:

a) Extract Transform Load Development: applying ETL process by using ETL tools that have been selected in the previous stage.

b) Application Development: the development of BI projects including reviewing the results of prototypes by recording the existing problems to then determine the final needs of a project and building a script to display reports, queries to process data and design the user interface and perform testing on the program so that no errors occur when the application is implemented at this stage.

c) Data Mining: the BI project implements data mining to complement the information needs of executives. This step involves testing algorithms, data mining techniques (data mining) such as clustering, prediction and organizing methods.

d) Meta Data Repository Development: the development of data access interfaces after a meta data warehouse is built which allows users to know information about business data in the BI database, statistical information from the ETL process that has been carried out and other processes related to meta data.

6) Deployment

a) Implementation: after the BI project is completed, it's time to implement it by holding training sessions for users, namely executives and preparing documentation and technical support.

b) Release Evaluation: after the BI project is implemented, the development team makes a final report which describes the performance and some parts that must be repaired or rebuilt.

Dashboard, application that describes the overall organizational performance as a KPI aimed at executives to support decision making [3] [8].

KPI (Key Performance Indicators), an indicator needed to measure performance and determine organizational success [2] [13] [14] [16]. Four layers of performance measurement illustrated in the following figure:

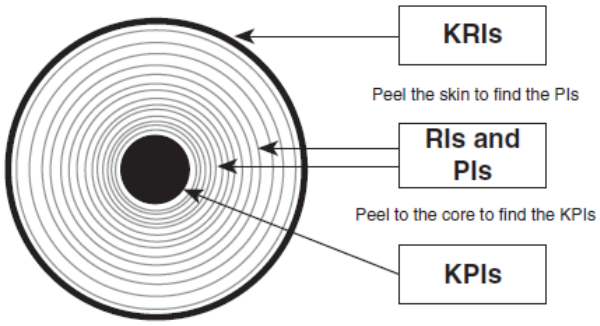


Fig. 2: Performance Measurement Layer.

Explanation of the picture above is:

1) Key Result Indicator (KRI)

KRI provides ideal information for company management, in this case the results achieved from various actions and shows whether the organization has moved in the right direction. At this stage it does not explain the actions that must be taken to improve the results achieved by the organization.

2) Performance Indicator (PI)

PI is as a complement to non-financial KPIs by showing what must be done to organizational performance and adjusting organizational strategy. Performance indicators can include:

a) Percentage of sales increase of 10% for top customers.

b) The number of employees participating in the business scheme is recommended for 30 days.

c) Set up calls for next week, the next two weeks.

d) Number of late shipments to major customers.

3) Result Indicator (RI)

RI includes activities, and all financial performance measurements (eg daily or weekly sales analysis). Examples of coverage in RI are:

a) Net profit on the main product line.

b) Results of sales made yesterday.

c) Complaints obtained from key customers.

4) Key Performance Indicator (KPI)

Shows a set of measurement steps that focus on the organizational performance aspects that are most important to the success of the organization today and in the future.

3. Method

Framework

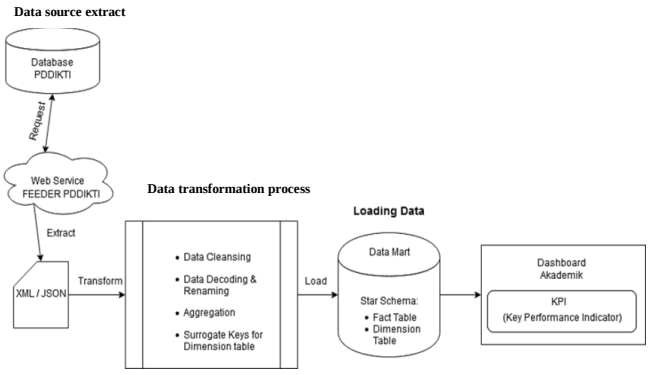


Fig. 3: Framework.

An explanation of the above framework of thought is:

1) Data Source Extract

Source data is extracted into XML format (eXtensible Markup Language) by utilizing web service technology in PDDIKTI Feeder. The data used in this study is academic data in the form of student data, lecturers, student grades, class schedules, and new students. At this stage the data staging process or temporary data placement is carried out before going to the transformation stage.

2) Data Transformation Process

In this process, data cleaning is done to the values that are empty (null values), do data validation and selection of data that is not appropriate, make changes to the data format to match the tables in the data mart, aggregate or summarize the data, make surrogate keys for dimension tables so that the data in the fact table can be identified according to the dimension table.

3) Data Loading

At this stage data loading is carried out into a data mart wherein there is a dimensional data model in the form of a star schema consisting of fact tables and dimension tables.

4) Academic Dashboard

The data mart that has been formed is then used to display reports on the academic dashboard, the need for performance analysis and monitoring that refers to KPI (Key Performance Indicator).

Business Intelligence Lifecycle Method

Business Drivers, This stage explains at a glance information about PDDIKTI and the PDDIKTI system flow.

The Higher Education Data Base (PDDIKTI) is a data collection on the implementation of Higher Education throughout the nationally integrated Universities. PDDIKTI is one of the instruments for implementing quality assurance [15].

In article 56 paragraph 2 of Law No. 12 of 2012 concerning Higher Education states that the Higher Education Data Base as referred to in paragraph (1) functions as a source of information for:

1) Accreditation institution, to conduct study program and university accreditation;
2) The Government, to regulate, plan, supervise, monitor, and evaluate and guide and coordinate the Study and Higher Education Programs; and
3) Community, to find out the performance of Study Programs and Universities.

The preparation of the PDDIKTI system usage manual is intended as a guide to using and managing the PDDIKTI system in each university.



Fig. 4: PDDIKTI System Flow.

Explanation:

Information

1) Online report application system (Forlap), The data in the online report (Forlap) application system as a whole is managed by DIKTI. The data contained in this Forlap application is Lecturer data, Student data, Lecture data. For lecturer data, it is only managed by DIKTI. This is so that there is no lecturer data that is the same and there is no data from lecturers who are permanent lecturers in more than one university. This forlap system can be accessed by all universities in Indonesia.
2) Feeder application system, this feeder application is an application that is used to manage Student data and Lecture data of each University. Where this application is managed by each college, which can then be displayed also in the Forlap application.
3) Web service, In the web service the relationship between client and server does not occur directly. The relationship between the client and server is bridged by a web service file in a certain format. So that access to the database will be handled not directly by the server, but through an intermediary called a web service. The role of this web service will facilitate distribution as well as the integration of databases spread across multiple servers at once.
4) Synchronization Application, this application is used when synchronizing the data between the data in the Feeder application and those in the Forlap DIKTI application. For example, during the synchronization process, the lecturer data in the Feeder Application is synchronized with the lecturer data in the DIKTI. So that the lecturer data in the Feeder Application will be the same as the lecturer data owned by DIKTI.
5) Kopertis and Service can access the Forlap application and access the data, but its nature can only monitor the data and can provide comments if there is student data or lecture data that is inappropriate and must be re-checked by the DIKTI

Data Analysis

analyze and determine the tables in the PDDIKTI FEEDER as a data source for data marts that are only related to KPI (Key Performance Indicator) that has been previously determined.

In terms of data quality, data from PDDIKTI FEEDER has been valid, because every college that reports to PDDIKTI through the FEEDER PDDIKTI application must meet the standards set by PDDIKTI. In terms of data availability, all information on user needs based on KPIs that have been summarized can be fulfilled because KPIs that have been summarized relate to academic activities contained in the PDDIKTI FEEDER.

Database Design

Multidimensional schema on data mart using Star Schema. There are five Star Schema in the data mart consisting of five fact tables and 10 dimension tables.

Activity Diagram

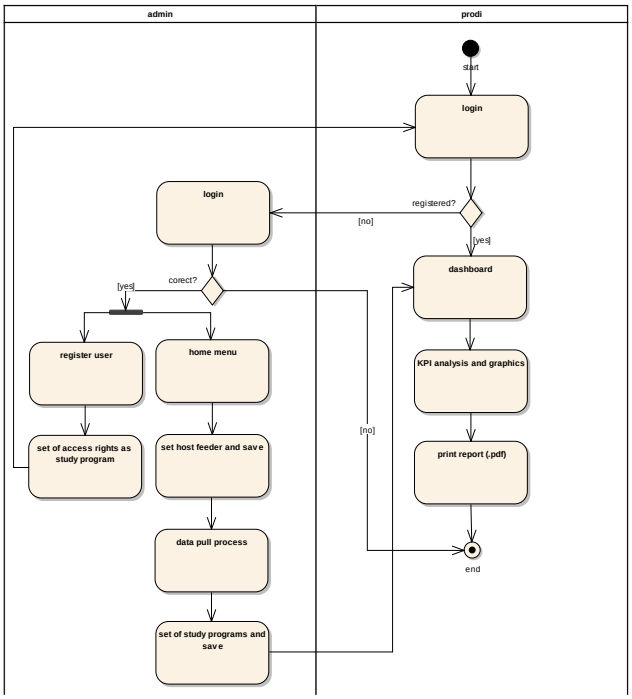


Fig. 5: Activity Diagram Access PDDIKTI.

The Activity Diagram above illustrates the system for making PDDIKTI Actions. The process starts from the Prodi Actor as follows:

1) Prodi, login to PDDIKTI
2) if the user is not registered, then register (next step 6)
3) if it is registered, it will enter the KPI dashboard
4) KPI analysis in graphical form
5) print report based on KPI's choice
6) Admin, make a account for Prodi
7) Admin, configure the host feeder dikti
8) data retrieval from PDDIKTI to Feeder
9) determine the number of study programs available in PDDIKTI

UseCase



Fig. 6: Use Case Dashboard KPI.

Name of UseCase	Dashboard KPI	
Actors	Prodi and Admin	
Description	Study program summarizes data and admin configuration of the host feeder	
Normal Course	Prodi 1) Data summary 2) Analysis lecturer, student and graduates 3) Monitoring academic activity	Admin 1) Configure host 2) Data pull 3) Set of study program 4) KPI graphics
Pre-Condition	Prodi, looks an information	
Post-Condition	System (admin), provides information based on KPI	
Assumtion	-	

ETL Design

Mapping in the columns contained in the PDDIKTI FEEDER table on the columns contained in the destination table (fact tables & dimension tables in the data mart).

4. Results

ETL Development

The application phase of the ETL (Extract Transform Load) process from the tables contained in the data source is the PDDIKTI FEEDER into the target table in the data mart. This stage is a continuation of the ETL Design. The author uses PHP (PHP: Hypertext Prepocessor) script in ETL process from FEEDER PDDIKTI into data mart through web service intermediaries. Following is the process of implementing ETL which is divided into 15 processes according to the ETL design process:

ETL Table dim_perguruan_tinggi

```
//fungsi Get Data dari web service
$result = $proxy->GetRecordset($tok, $table, $filter, $order, $limit, $offset);
$arr = $result['result'];

//load data ke dalam data mart
foreach ($arr as $key){
 $_SESSION['nm_lemb'] = $key['nm_lemb'];
 $insrt = "insert into dim_perguruan_tinggi (pt_key, nama_pt, NPSN)
 values('$key[id_sp]', '$key[nm_lemb]', '$key[npsn]')";
 $qws = mysql_query($insrt);
}
```

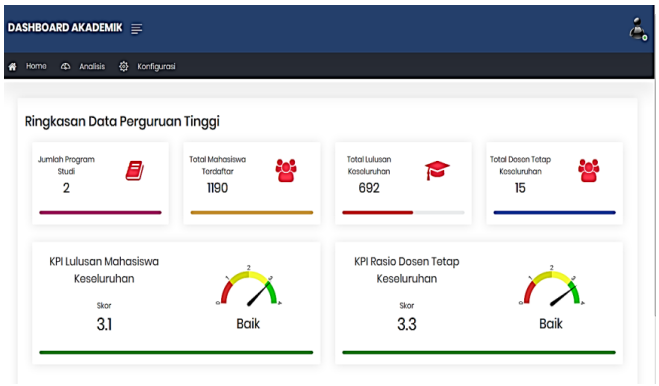


Fig. 7: Dashboard.

College summary data in the form of total number of study programs, total students enrolled in tertiary institutions, total graduates and total permanent lecturers as well as graphs in the form of gauges that display KPI (Key Performance Indicator) Student Graduates and the Overall Permanent Lecturer Ratio where detailed information Regarding the above KPI can be seen in the Lecturer Analysis and Student & Graduates Analysis menu.

5. Discussion

The data in the education unit table contained in the PDDIKTI FEEDER is extracted using the GetRecordset function, the GetRecordset function is a function of the PDDIKTI FEEDER web service that is used to get all the data in the table in FEEDER PDDIKTI, this function is the same as the command to display all data in table in the database (example: select * from table). After the education unit data in the PDDIKTI FEEDER has been extracted, then the data is loaded into the dim_perguruan_tinggi table contained in the data mart by using the foreach looping function in which there is an insert query, matching columns in the data source table (PDDIKTI FEEDER) to column in the target table (Data Mart) in the implementation of the ETL process at this stage and the 14th phase of the implementation of the ETL process in accordance with the ETL design mapping

The data in the SMS table contained in the PDDIKTI FEEDER is extracted using the GetRecordset function, after the SMS data in the PDDIKTI FEEDER has been extracted, then join with the education level table at the PDDIKTI FEEDER to get the data in the nama_jenj_didik column. The data in the nama_jenj_didik column is in the form of education level of a study program (example: Bachelor or Master) which is useful to identify the level of education of the study program in the dim_prodi table on the data mart. What is meant by join at this stage is the reuse of the GetRecordset function by giving the table parameters in the form of education and filters in the form of id_jenj_didik contained in

the sms table in the foreach loop function. After the join process is complete the next process is loading the data into the dim_prodi table contained in the data mart using the insert query.
Data in the student table contained in the PDDIKTI FEEDER is extracted using the GetRecordset function, after the student data at the PDDIKTI FEEDER has been extracted, then the data is loaded into the dim_mahasiswa table contained in the data mart by using the foreach loop function in which there is an insert query.
The data in the lecturer table contained in the PDDIKTI FEEDER is extracted using the GetRecordset function, after the extraction of the lecturer data at the PDDIKTI FEEDER, then loading the data into the dim_dosen table contained in the data mart by using the foreach loop function in which there is an insert query.
The data in the inbound path table contained in the PDDIKTI FEEDER is extracted using the GetRecordset function, after the path data entered in the PDDIKTI FEEDER has been extracted, then join with the education level table at the PDDIKTI FEEDER to get the data in the nama_jenj_didik column. Data in nama_jenj_didik column is in the form of education level of a study program (for example: bachelor or master) which is useful to identify the level of education in the student entrance in the dim_jalur_masuk table contained in the data mart. What is meant by a join at this stage is the reuse of the GetRecordset function by giving the table parameters in the form of education and filters in the form of id_jenj_didik which are contained in the path_input table in the foreach loop function. After the join process is complete the next process is loading the data into the dim_jalur_masuk table contained in the data mart by using an insert query.
The data in the Mata_kuliah table contained in the PDDIKTI FEEDER is extracted using the GetRecordset function, after the data has been extracted from the PDDIKTI FEEDER, then the join is performed with the education, education and curriculum tables and SMS at the PDDIKTI FEEDER to get the data in the nama_jenj_didik column for education_data table, data on columns fk__id_kurikulum_sp, smt, and a_wajib for mata_kuliah_kurikulum table, as well as data in nm_lemb column for sms tables. Data in nama_jenj_didik column in the form of education level of a study program (example: Bachelor or MAster) which is useful to identify the level of education in the student entry path, the data in the column fk__id_kurikulum_sp in the form of the curriculum name of the course which is useful for analyzing the curriculum in the course, data in the column smt in the form of semester for each subject, the data in a_wajib column is the type of compulsory subject that students must take, and the data in nm_lemb column is the name of the course study program which is useful for identifying and analyzing courses based on the study program in dim_matakuliah table contained in the data mart . What is meant by join at this stage is the reuse of the GetRecordset function by giving the table parameters in the form of education level, mata_kuliah_ curriculum, and sms as well as filter parameters in the form id_jenj_didik, id_mk and id_sms contained in the mata_kuliah table in the foreach loop function. After the join process is completed the next process is loading data into the dim_matakul table contained in the data mart by using an insert query
The data in the semester table contained in the PDDIKTI FEEDER is extracted using the GetRecordset function, after the semester data in the PDDIKTI FEEDER has been extracted, and then the data is loaded into the dim_periode table contained in the data mart using the insert query that is in the foreach looping function.
Data on the student status table contained in the PDDIKTI FEEDER is extracted using the GetRecordset function, after the student status data at the PDDIKTI FEEDER has been extracted, and then the data is loaded into the dim_status_mahasiswa table in the data mart using the insert query that is in the foreach loop function.
Data on the Type_Registration table contained in the PDDIKTI FEEDER is extracted by using the GetRecordset function, after the registration_data type in the PDDIKTI FEEDER has been extracted, then loading the data into the dim_status_awal table contained in the data mart by using the insert query that is in the foreach looping function.
The data in the outgoing type table contained in the PDDIKTI FEEDER is extracted using the GetRecordset function, after the data type out of the PDDIKTI FEEDER has been extracted, then loading the data into the dim_status_keluar table contained in the data mart by using the insert query that is in the foreach loop function.
Data on the Student_pt table contained in the PDDIKTI FEEDER is extracted using the GetRecordset function, after the student_pt data on the PDDIKTI FEEDER has been extracted, then join with the power table in the PDDIKTI FEEDER to get the data in the id_smt column. The data in the id_smt column is an academic year that is useful to identify the academic year when the student has graduated and to calculate the study time of students who have graduated with the semester_awal column and outgoing period aggregation in the fact_mhsw_terlist listed in the data mart. What is meant by join at this stage is the reuse of the GetRecordset function by giving the table parameters in the form of load and filter parameters in the form of date_first_kul and end_kul with outgoing data contained in the student_pt table in the foreach loop function. After the join process is complete the next process is loading data into the fact_mhsw_terdlist listed in the data mart by using an insert query.
The data in the lect_pt table contained in the PDDIKTI FEEDER is extracted using the GetRecordset function, after the lect_pt data has been extracted at PDDIKTI FEEDER, then the data is loaded into the fact_dosen_terlist listed in the data mart using the insert query that is in the foreach looping function.
The data in the power table contained in the PDDIKTI FEEDER is extracted using the GetRecordset function, after the data has been extracted at the PDDIKTI FEEDER, it has been extracted, then the data is loaded into the fact_daya_tampung table contained in the data mart using the insert query that is in the foreach loop function.
The data in Table kelas_kuliah contained in PDDIKTI FEEDER extracted using GetRecordset function, after the data kelas_kuliah on PDDIKTI FEEDER finished extracted, then do join with the FEEDER PDDIKTI ajar_dosen tables to obtain the data in columns and jml_tm_renc id_reg_ptk. Data in the column id_reg_ptk be unique id lecturers who registered to teach in courses that are useful to identify faculty who teach in the lecture schedules and data in columns jml_tm_renc be the number of planned face-to-face on a lecture schedules that are useful for analyzing the number of planned lectures in the table fact_jadwal contained on data mart. Referred to join at this stage is the reuse of GetRecordset function by giving parameter tables and parameters such ajar_dosen id_kls filter form contained in the table kelas_kuliah in foreach looping functions. After the join process is complete the next process is loading data into the fact_jadw table contained in the data mart by using an insert query.
The data in the student table contained in the PDDIKTI FEEDER is extracted using the GetRecordset function, after the data of the student's lecture at the PDDIKTI FEEDER has been extracted, then the aggregation between id_smt column and the column starts_smt in the lecture_ students table in the foreach looping function to get the semester data that is useful for identifying semester students and to analyze students based on semester, then loading data into fact_hasil_studi table contained in data mart by using insert query.

6. Conclusions

a) Data mart modeling with PDDIKTI and KPI FEEDER data sources (Key Performance Indicator) which refers to the BAN-PT Bachelor Degree Accreditation Assessment (S1) Matrix with elements of assessment Standard 3 (Students & Graduates) and Standard 4 (Human Resources) and referring to published journal reviews that relate to academic ac-

tivities contained in FEEDER PDDIKTI, can be applied in all universities, but in all universities in Indonesia due to PDDIKTI and BAN-PT as instruments for implementing higher education quality assurance followed by all universities in Indonesia.

b) The application built makes it easy for users to analyze, monitor and evaluate academic activities so that in making strategic decisions faster and more accurate.

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