DEVELOPMENT DATA WAREHOUSE AND REPORTING TOOLS IN BKKBN DISTRICT DEPARTMENT OF CIANJUR

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ABSTRACT

The data contained in each of the divisions that exist in the BKKBN in Cianjur still needsports and analyzed to obtain the information in accordance with the needs of each ofits divisions. In addition the data in each Division was not composed according an annual or monthly period, this had a significant impact upon the activities of theofficers in each of its divisions in the search for the required data for process analysis and reporting the results of analysis becomes very slow and may inhibit the process ofdecision making.

From existing problems required a data warehouse application on the BKKBN Cianjurwho help any divisions in the multidimensional information and concise. Knowledgeresources can be accessed easily and quickly can help improve performance and performance in doing data analysis in each of the divisions and support in the creation of a report that has a period of time in the form of tables and graphs. Construction of data warehouse schema using the constellation.

With the building of data warehouse application can be drawn the conclusion that the process of analysis of data about birth control pills and family prosper more easily,with the look of the display in the form of tables and graphs that are easy to understand are useful for decision-making, as well as maximizing the application ofdata warehouse is able to present data in the form of a report that has a specified time interval as needed.

Keyword: Data Warehouse, Constellation Schema, Multidimensional.

1. INTRODUCTION

Badan Kependudukan dan Keluarga Berencana Nasional (BKKBN) Cianjur is the Agency in charge to carry out the task of the Government in the field of family planning and the prosperous family in accordance with the legislation in force.

From the results of the interview with the head of BKKBN and the staff of the 3rdDivision that exists in the BKKBN in Cianjur, could be that the data collected in each Division of each sub still need in sports and analyzed to obtain the information in accordance with the needs of each of its divisions. In addition the data in each Division was not composed according an annual or monthly period, this had a significant impact upon the activities of the officers in each of its divisions in the search for the required data for process analysis and reporting the results of analysisbecomes very slow and may inhibit the process of decision making. Furthermore, inmaking a report analysis results in each of its divisions which have a period of timebecame less effective and efficient.

Of the problems that have been described, then it takes a data warehouse applicationon the BKKBN Cianjur who help any divisions in the multidimensional information and concise so as to maximize a decision being made, so that the programmes will bemade subsequently by the BKKBN Cianjur can run effectively and right on target, as well as support in the creation of multidimensional reports or have a period of time in the form of tables and graphs.

The purpose of the data warehouse development at BKKBN Cianjur is as follows:

1. The present information that is multidimensional and concise so that it canaccelerate the process of data analysis and a decision made by the top managementto determine programs like program KB, providing stock contraceptives, familymentoring, counseling adolescents reprod uctive health, and the well-being of thefamily would walk henceforth in

every town there are in Cianjur to make it moreeffective and right on target.
2. The report presents the results of the analysis that has a time interval such asmonthly and yearly for the BKKBN in Cianjur any divisions.

Restriction problems in data warehouse development at BKKBN Cianjur are as follows:

1. Data is data that is owned by BKKBN data i.e. Cianjur coaching family, pi k-krr, participants kb, stock contraceptives, uppks, target participants kb new (unmetneed) and the place of service.
2. Data processed from 2011-2015.
3. In the wake of System-based Client Server.
4. Testing the data warehouse uses OLAP (on-line Analytical Processing).
5. The DBMS using SQL Server.
6. Presentation of the report of the results of the analysis are presented in the form oftables and graphs.
7. Analysis and design software using object-oriented analysis.

1.1 Data Warehouse

The data warehouse is a complete storage place and consistent where the stored data related to each other and are designed based on query and analysis rather than the transaction process [1]. The data is transformed into information that can be accessed anytime and always up to date. This information will then be used for analysis to produce new information [8].

The data warehouse can also be regarded as a collection of subject-oriented data, integrated, can not be updated, has a dimension of time that is used to support management decision-making process and business intelligence. The purpose of the data warehouse are as follows [3]:

1. Provide easy access to information.
2. Efficient. Data warehouse must be streamlined so easily understood by the user not only by devoleper. In addition, users can combine the data in the data warehouse in various ways (slicing and dicing). To access the data warehouse is recommended should be done with a simple and easy to operate.
3. Providing consistent information.
4. The data warehouse contains only information that is relevant to user needs for decision-makers. Therefore, the credibility of the data contained in the data warehouse must be accounted for.
5. Able to adapt and resistant to change.
6. The changes that occur must be solved by the data warehouse. In other words, the data warehouse must be designed to be able to face any changes to the plan. This means that the change should not undermine or interfere with the data and applications that have been there before.
7. Able to secure the information.
8. The information stored in the data warehouse to be stored securely. In other words, such information should not fall into the wrong hands. Therefore, the data warehouse must be able to control every access of information.
9. Ability to provide support in decision-making.
10. This is the most important objective and must be present in each production of data warehouse. The data warehouse can be described as a collection of decision support technology, intended for any work related to information, be able to make decisions quickly and accurately.
11. *User friendly*.
12. As to the first purpose of the data warehouse, data warehouse must be designed to be operated easily by the user. Unlike operating system where the user often has no other choice but to use the new system, but the user data warehouse is usually an option. Therefore, the process of determining user data warehouse is a very important factor.

Architecture in the data warehouse are grouped into 5 sections as shown in Figure 1 [4]:

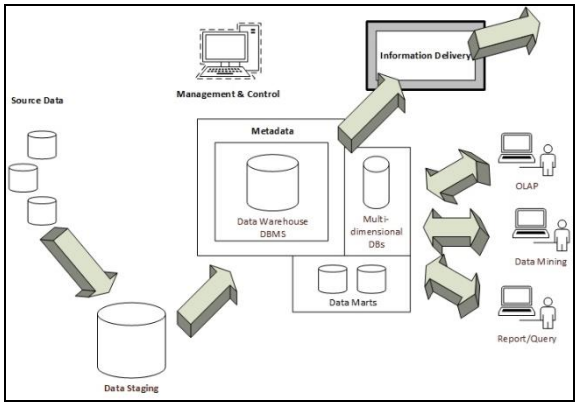


Figure 1 Data Warehouse Architecture

1.2 Data Warehouse Dimensional Model

Data warehouse Dimensional model consists of a fact table and table dimensions. The fact table is a table that contains a collection of foreign key from primary key contained in each dimension table, while the dimension table is a table containing detailed data that describes the foreign key found in the fact table. There are several models of the scheme contained in the data warehouse modeling, the star schema, snowflake schema, and constellation schema. An explanation of each model are as follows:

1. *Star Schema*

This scheme follows the shape of a star, where there is one fact table at the center of a star with

several dimension tables surrounding it. All the dimension tables associated with the fact table. The fact table has several primary keys in the dimension table. Here is an example of a star schema can be seen in Figure 2:

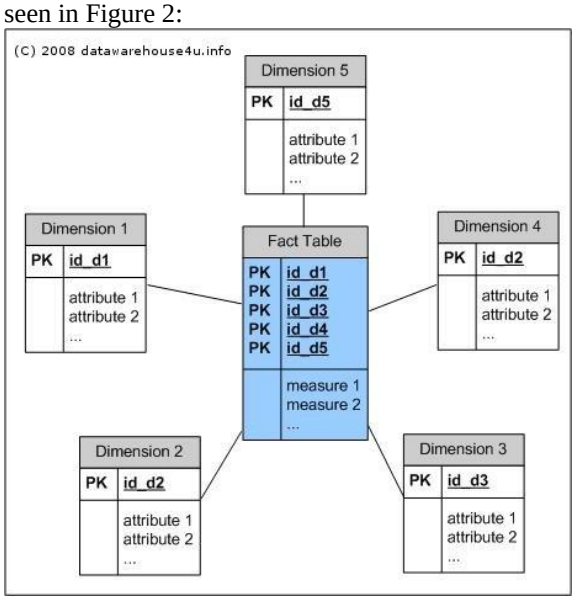


Figure 2 Star Scheme

2. *Snowflake Schema*

Snowball scheme is an extension of a star schema with an additional dimension tables that are not directly related to the fact table. The dimension tables associated with other dimension tables. The examples of snowball scheme can be seen in Figure 3 below:

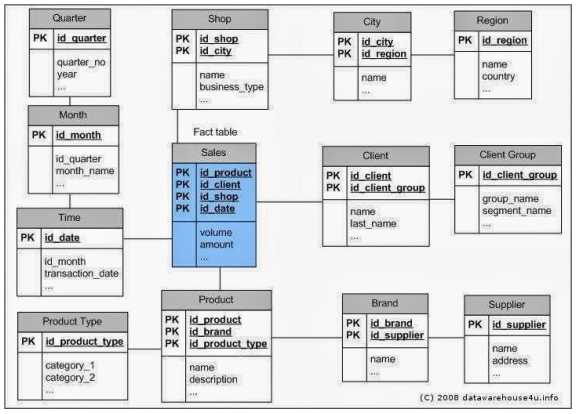
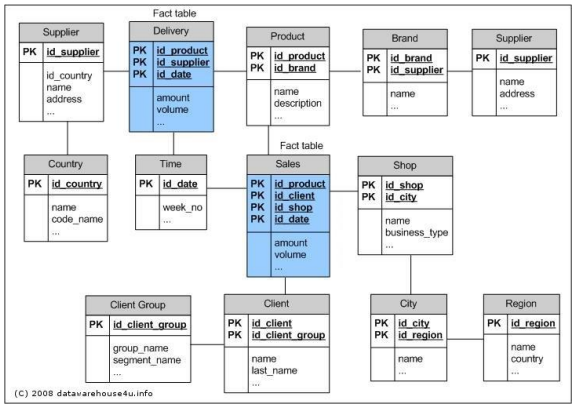


Figure 3 Snowflake Scheme

3. *Constellation* Schema

A schema is said to be a constellation scheme if there is one or more dimension tables are used together by one or more fact tables [5]. At this schema there are multiple fact tables that use one or more dimension tables. Examples constellation schema can be seen in Figure 4 below:



Gambar 4 Constellation Scheme

1.3 ETL Process In Data Warehouse

ETL process or so-called Extract, Transform, and Load is the process of converting data from OLTP databases into the data warehouse. If viewed from arstitektur data warehouse, ETL process is a process that is in the data staging.

ETL process is a process to modify, reformat and integrate data coming from one or several OLTP systems [6].

1. *Extraction*

   Extraction is a process where the process of searching for the source of the data and then using some criterias that have been granted to sort the data and also to look for good quality data, then the data is transported to another file or database [6*]*.

2. *Transformation*

   Data transformation is a phase that occurs when data has become of raw data (the results of extraction) is converted into a form that has been set in which the forms should be used in a data warehouse [4]. Here are some of the basic processes that must exist in the data transformation :

   a) Selection
   Select or sort the data results from the *extraction.*

   b) Splitting/Joining
   Splitting/joining include the types of data manipulation needs to be done in the selection process.

   c) Conversion
   This process is the most important stage. At this stage of conversion, the data selection will then be converted into a decent data used in the data warehouse.

   d) Summarization
   This stage is the stage of formation model that will be shown to the user.

   e) Enrichment
   This stage is the stage of reforming and streamlining existing field to make the field more useful in a data warehouse

3. Loading
   Loading is a physical process of moving data from OLTP systems into the data warehouse or data destination. Loading operation consists of inserting records into various dimension and fact tables that exist on the destination of data or data warehouse [3].

1.4 OLAP (*On-Line Analytical Processing*)

OLAP (On-Line Analytical Processing) is a technology that processes the data into multidimensional structures, providing quick answers to queries complex analysis with a view to organizing large amounts of data, to be analyzed and evaluated quickly and provide the speed and flexibility to support analysis in real time [2].

There are several characteristics of OLAP, as follow:

1. Allowing businesses see data from a logical standpoint and multidimensional data warehouse.
2. Facilitating complex queries and analysis for the user.
3. Allows the user to drill down to display more detailed data or roll-up to the aggregation of a dimension or multiple dimensions.
4. Provide a process of calculation and comparison data.
5. Displays the results in tables or graphs.

The Advantages of OLAP:

1. Improving the productivity of business end-user, IT developers, and entire organization.
2. Oversight and more timely access to strategic information can make decisions more quickly.
3. Reduce application development for the IT staff to make the end use may alter the schema and create their own models.
4. Organization control storage through corporate integrity data as OLTP application to update the data source level.

OLAP can be used to do such. [2]:

1. *Roll-up*
   Consolidation involves grouping data.
2. *Drill-down*
   A form that is the opposite of consolidation to describe concise data into more detail data. The figures for roll-up and drill-down can be seen in Figure 5 below:

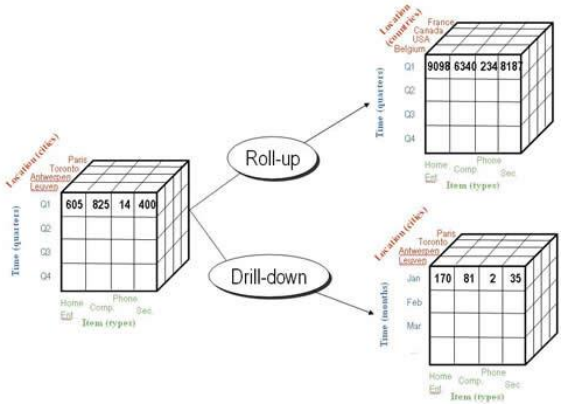


Figure 5 Roll-up and Drill-down

3. *Slicing* dan *dicing*
   Lays in the ability to view data from the viewpoint. Overview for slicing and dicing can be seen in Figure 6 below:

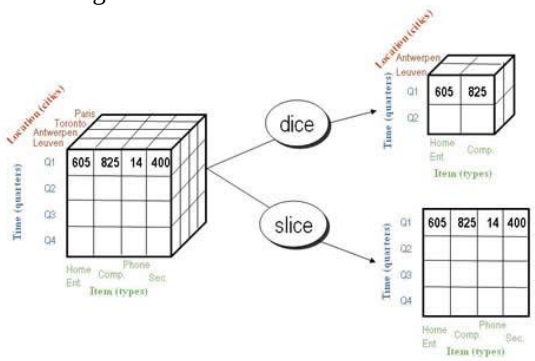


Figure 6 *Slicing* and *Dicing*

1.5 SSIS (*SQL Server Integration Service*)

SSIS (*SQL Server Integration Services*) is a platform to build a reliable system for data integration, extraction, transformation, and loading used in data warehousing [7]. SSIS offers a solution in dealing with the problem of data integration. In addition, this tool helps to boost the efficiency of the manufacturing time.

SQL Server Integration Services architecture in general contain various components, as follow:

1. *SSIS Deginer, a tool used to create and manage integration service package. On SQL Server 2012, this tool is integrated with Visual Studio 2010, which is a part of Bussiness Intelligence project.*
2. *Runtime Engine. This component is useful for running all the SSIS packages that have been made.*
3. *Task and executable binary.*
4. *Data Flow Engine and Data Flow. Components of the data flow is an encapsulation of data flow engine that provides a buffer in memory and in charge of moving the data from the data source to the destination data. While the data flow is a source of data, data destinations, and transformations.*

5. *Integration Services service. Allowing SQL Server Management Studio can be used to monitor and regulate the SSIS package SSIS storage used.*
6. *SQL Server Import and Export Wizard. This tool is used to copy data from source to destination data.*

2. RESEARCH CONTENTS

There are several stages of analysis in the development of data warehouse software as follow:

2.1 Information Requirements Analysis

Information requirement analysis is is the stage to analyze what is needed by BKKBN of Kabupaten Cianjur for the data warehouse to be built.

Based on the interviews with the head of BKKBN and the staff of the 3 divisions in Cianjur district BKKBN obtains strategic information needs as follows:

1. The amount of existing information and reports from government and private KB clinics in each district every month of every year.
2. The existing information and report of private practice doctors in each district every month of every year.
3. Information exists and report of privately practicing midwives in each district every month of every year.
4. Information of numbers of PUS stages KS category PRA S and KSI in each district every month of every year.
5. Information number of Family Planning participants per mix-contraception in each district every month each year.
6. Information number of Un Met Need in KS stages in each district every month of every year.
7. Information amount of supplies of contraceptives per contraceptives in each district every month of every year.
8. Information number of Bina Keluarga in each district family every month each year.
9. Information number of Bina Keluarga Remaja in every district every month each year.
10. Information on numbers of Bina Keluarga Lansia in each district every month of every year.
11. Information amount of Bina Latihan Ketenagakerjaan each month of employment annually.
12. Information number of group members, a meeting UPPKS stages KS PRA category S and KSI in each district every month of every year of her.
13. Information PIK-KRR number of categories erect, growing, strong in every district every month of every year

2.2 Data Source

OLTP databases are now located at BKKBN Cianjur district being the data source to build a data warehouse. Scheme relations in existing database can be seen in Figure 7:

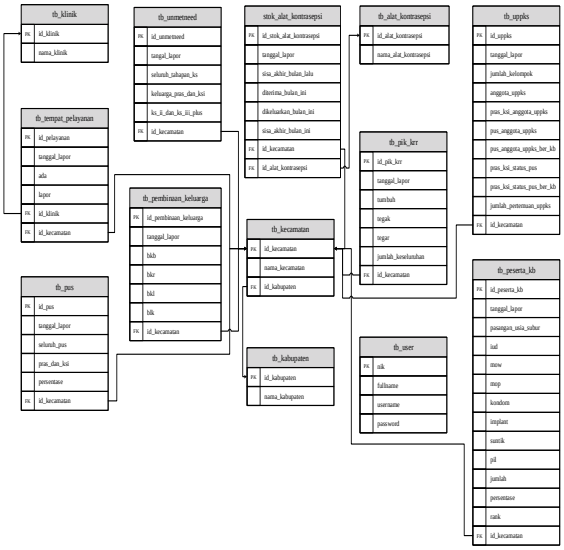


Figure 7 Relation Scheme of Table OLTP of BKKBN Kabupaten Cianjur

2.3 Data Warehouse Architecture Analysis

A used architecture for the construction of a data warehouse is a model of a two-layer architecture. Analysis of this architecture is divided into four layers, such as the layer source analysis, data analysis stagging, data mart layer analysis, and analysis using OLAP.

1. Source Layer Analysis
   On this layer, data is still in the form of operational data. Data source is used in the construction of a data warehouse is already in the form of logic that the data is in the database. Source of data used are derived from the database of OLTP BKKBN Kabupaten Cianjur.
2. Data Stagging Analysis
   On this layer, operational data will be extracted (through the ETL process) into the data warehouse.

a) Extract
   Extract process conducted for extracting the data or describe any data that existed at Data source to be used as a data warehouse. This process is the selection of data from the data source for the creation of a data warehouse, such as table of kabupaten, table of kecamatan, table of alat kontrasepsi, table of stok alat kontrasepsi, table of klinik, table of klinik tempat pelayanan, table of l pembinaan keluarga, tabel pus, table of peserta kb, table of pik-krr, table of unmetneed and table of uppks. User table is not extracted because it is not needed. The attributes that exist

in the table that will be extracted no change increase or decrease its attributes, it still remains the same as the data source. The process of extracting data from source data into the data warehouse is as follows:

Table 1 Table of Extract

No	Nama Tabel	Field
1	Table of Kabupaten	id_kabupaten
		nama_kabupaten
2	Table of Kecamatan	id_kecamatan
		nama_kecamatan
		id_kabupaten
3	Table of Alat Kontrasepsi	id_alat_kontasepsi
		nama_alat_kontrasepsi
4	Table of Stok Alat Kontrasepsi	id_stok_alat_kontasepsi
		tanggal_lapor
		sisa_akhir_bulan_lalu
		diterima_bulan_ini
		dikeluarkan_bulan_ini
		sisa_akhir_bulan_ini
		id_alat_kontasepsi
		id_kecamatan
5	Table of Klinik	id_klinik
		nama_klinik
6	Table of Tempat Pelayanan	id_tempat_pelayanan
		tanggal_lapor
		id_klinik
		ada
		lapor
		id_kecamatan
7	Table of Pembinaan Keluarga	id_pembinaan_keluarga
		tanggal_lapor
		bkb
		bkr
		bkl
		blk
		id_kecamatan
8	Table of PUS	id_pus
		tanggal_lapor
		seluruh_pus
		pras_dan_ksi
		persentase
		id_kecamatan
9	Table of Peserta KB	id_peserta_kb
		tanggal_lapor
		pasangan_usia_subur
		iud
		mow
		mop
		kondom
		implant
		suntik
		pil
		jumlah
		persentase
		rank
		id_kecamatan
10	Table of PIK-KRR	id_pik_krr
		tanggal_lapor
		tumbuh
		tegak
		tegar
		jumlah_keseluruhan
		id_kecamatan
11	Table of Unmetneed	id_unmetneed
		tanggal_lapor
		bulan
		seluruh_tahapan_ks
		keluarga_pras_dan_ksi
		ks_ii_dan_ks_iii_plus
		id_kecamatan
12	Table of Uppks	id_uppks
		tanggal_lapor
		jumlah_kelompok
		anggota_uppks
		pras_ksi_anggota_uppks
		pus_anggota_uppks
		pus_anggota_uppks_ber_kb
		pras_ksi_status_pus
		pras_ksi_status_pus_ber_kb
		jumlah_pertemuan_uppks
		id_kecamatan

b) Transform

Transform process which is conducted consists of two processes as follow:

1. *Cleaning*

Cleaning process is performed to clean up unused data from a table that has been extracted, which eliminates unused field. Here are the field names which omitted in the process of cleaning:

a. In the table of alat kontrasepsi does not require field id_stok_alat_kontrasepsi, sisa_akhir_bulan_lalu, diterima_bulan_ini, issued this month, id_kecamatan and tanggal_lapor.
b. In the table of tempat pelayanan does not require field id_tempat_pelayanan, id_kecamatan and tanggal_lapor.
c. In the table of Pembinaan keluarga does not require field id_pembinaan_keluarga, id_kecamatan and tanggal_lapor.
d. In the table of PUS does not require field id_pus, percentages, id_kecamatan and tanggal_lapor.
e. In the table of Peserta KB does not require participants id_peserta_kb field, percentages, rank, id_kecamatan and tanggal_lapor.
f. In the table of pik-KRR does not require field id_pik_krr, id_kecamatan and tanggal_lapor.
g. In the table of unmetneed does not require field id_unmetneed, id_kecamatan and tanggal_lapor.
h. In the table of UPPKS does not require field id_uppks, id_kecamatan and tanggal_lapor.

2. Conditioning

Conditioning process is performed to change the format of the operational data into the format of data marts. Tables are conditioned are on table stok alat kontrasepsi, tempat pelayanan, pembinaan keluarga, pus, pik-krr, peserta kb, unmetneed dan uppks. Conditioning process is carried out to ensure no data redundancy, resulting in a fact table can have more than one dimension table. In table 2 will be explained an example of the stages of conditioning on the table of stok alat kontrasepsi.

Tabel 2 Conditioning Table of Stok Alat Kontrasepsi

Tabel Stok Alat Kontrasepsi	
No	**Field**
1	tanggal_lapor
2	sisa_akhir_bulan_ini
3	id_alat_kontasepsi
4	id_kecamatan

fact_stok_alat_kontrasepsi	
No	**Field**
1	id_alat_kontasepsi
2	id_wilayah
3	id_waktu
4	sisa_akhir_bulan_ini

Tabel Stok Alat Kontrasepsi	
tanggal_lapor	date

dim_waktu	
id_waktu	int
tanggal	int
bulan	varchar
tahun	Int
fulldate	date

Tabel Stok Alat Kontrasepsi	
id_kecamatan	int

dim_wilayah	
id_wilayah	int
nama_kabupaten	varchar
nama_kecamatan	varchar

c. Loading

Once the data extracted and transformed, then the data is inputted into the *data warehouse*. The process of loading on the *data warehouse* application will be performed automatically after the transform is complete. Using Update technique, where the process will immediately update the *data warehouse* without changing existing data.

3. *Warehouse Layer Data Analysis*

At this layer, the data that has been through the ETL process will be stored in a logic centralized storage, the data warehouse. Tables will be needed in making the design of data warehouse, such as fact table of stok alat kontrasepsi, fact table of tempat pelayanan, fact table of pembinaan keluarga, fact table of pus, fact table of peserta kb, table fakta pik_kkr, fact table of unmetneed dan fact table of uppks. In addition there are the dimension tables that will be used together in multiple fact tables, there are fact table of wilayah, table of time dimension, table of dimensions of contraceptives, and table of clinical dimension. Schemes used in the construction of a data warehouse is a constellation scheme. The following constellation scheme in the construction of a data warehouse can be seen in Figure 8:

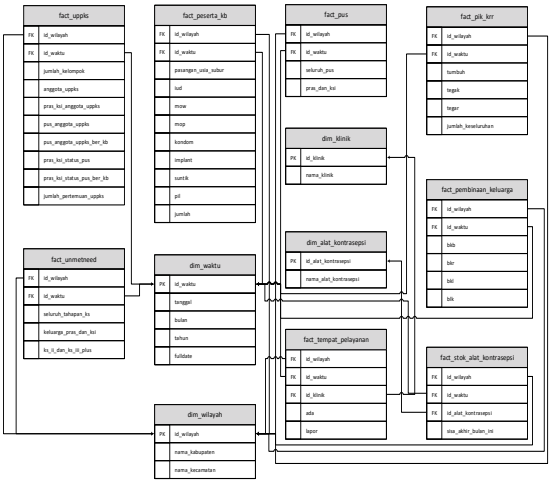


Figure 8 Constellation Scheme

Table 3 indicates the type of each existing table in Figure 8

Table 3 *Data Warehouse Scheme Explanation*

No	Table Name	Table Type
1	fact_stok_alat_kontrasepsi	Fact
2	fact_pelayanan	Fact
3	fact_pembinaan_keluarga	Fact
4	fact_pus	Fact
5	fact_peserta_kb	Fact
6	fact_pik_krr	Fact
7	fact_unmetneed	Fact
8	fact_uppks	Fact
9	dim_wilayah	Dimentional
10	dim_waktu	Dimentional
12	dim_alat_kontrasepsi	Dimentional
13	dim_klinik	Dimentional

2.4 Software Requirements Specification

Software requirements specification Analysis contain a description of the software needs to be built both functional requirements and non-functional requirements. Software requirements specification table can be seen in Table 4 and Table 5.

Table 4 Functional Specifications Software Requirements

Kode Kebutuhan	Kebutuhan
SKPL-F-1	User dapat melakukan login kedalam sistem
SKPL-F-2	User dapat melakukan proses etl dalam sistem
SKPL-F-3	User dapat melakukan proses analisis data
SKPL-F-4	User dapat menyimpan data kedalam format excel dan pdf
SKPL-F-5	User dapat menampilkan data dimensi dan fakta
SKPL-F-6	User dapat melihat informasi data di dalam chart

Table 5 Non-Functional Software Requirement Specification

Requirements Code	Requirements
SKPL-NF-1	The system can run on Windows platforms.
SKPL-NF-2	The system can run on medium hardware specification.
SKPL-NF-3	The programming language used is C #.

2.5 Functional Requirements Analysis

Functional requirements analysis intend to outline the activities process and requirement that will be applied to the system to be built.

2.5.1 Use Case Diagram

Use case diagram is a description of the system functionality or behavior. *Use case diagrams* in the software can be seen in Figure 9 below.

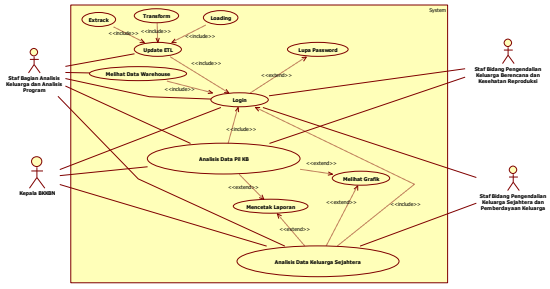


Figure 9 Use Case Diagram

2.5.2 Activity Diagram

Activity diagram models the workflow of the order activity in a process that refers to the existing use case diagram. Below are the sample of *activity diagram* from *Update* ETL can be seen on Figure 10.

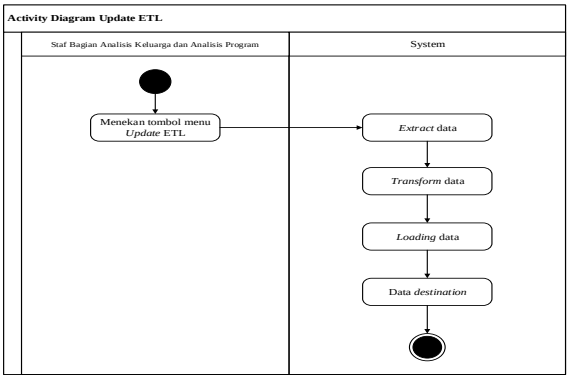


Figure 10 *Activity Diagram of Update* ETL

2.5.3 Sequence Diagram

Sequence diagram describes the interaction between each object in every use case in a time sequence. This interaction is by sending a series of data between objects that interact. Here is an example sequence diagram of updates ETL can be seen in Figure 11.

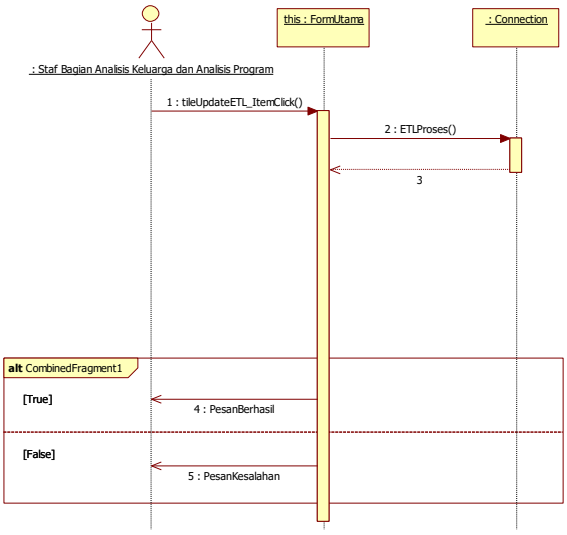


Figure 11 *Sequence Diagram of Update* ETL

2.5.4 Class Diagram

Class diagram describe the structure and relationships between objects in the system. This structure includes attributes and methods that exist in each class. Class diagram of software data warehouse to be built can be seen in Figure 12..

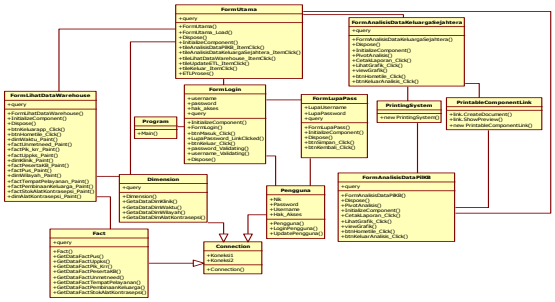


Figure 12 *Class Diagram*

2.6 Database Implementation

Implementation of the database describes the entire query that is used when creating a data warehouse. Here is a sample table of dim_wilayah implementation can be seen in Table 6.

Table 6 Table of dim_wilayah Implementation

Create dim_wilayah

```
CREATE TABLE [dbo].[dim_wilayah](
      [id_wilayah] [int] NOT NULL,
      [nama_kabupaten] [varchar](50) NOT
NULL,[nama_kecamatan] [varchar](50) NOT NULL,


CONSTRAINT [PK_dim_wilayah] PRIMARY KEY
CLUSTERED
(
      [id_wilayah] ASC
)WITH (PAD_INDEX = OFF,
STATISTICS_NORECOMPUTE = OFF, IGNORE_DUP_KEY
= OFF, ALLOW_ROW_LOCKS = ON, ALLOW_PAGE_LOCKS
= ON) ON [PRIMARY]
) ON [PRIMARY]
```

2.7 Interface Implementation

Interface Implementation is done by showing each display and encoding system built in the form of program files. Here are sample implementations of the application interface data warehouse can be seen in Figure 13, Figure 14 and Figure 15.

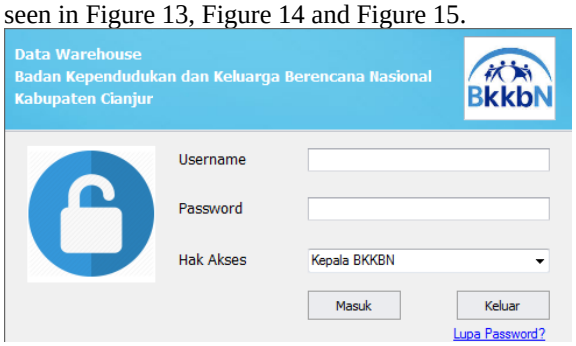


Figure 13 *Login* Page

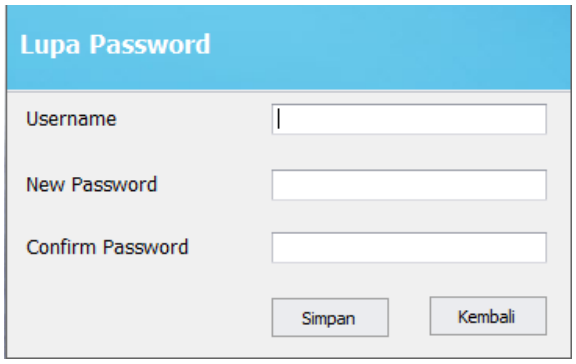


Figure 14 Forgot *Password* Page



Figure 15 *Update* ETL Page

3. CLOSURE

3.1 Conclusion

Based on the conducted analysis and testing can be concluded that:

1. Data warehouse application can accelerate the process of analyzing data concerning Pill and prosperous family more easily, with the viewing of the display in the form of tables and graphs that are easy to understand which is useful to maximize decision making to determine what programs will be taken next.
2. The data warehouse application can present the data in a report that has a certain time interval as needed to facilitate the BKKBN of Cianjur Regency for analyzing the further data.

3.2 Suggestion

Here are advice that can be given to develop a further system, as follow:

1. The system not only analyzes the data of Pill KB and Family Welfare, but also analyze population in the district of Cianjur.
2. The system can automatically update the ETL process at a specific time, eg every 4th of each month.

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