DATA WAREHOUSE SOFTWARE DEVELOPMENT AT CV.KARYA ANUGERAH TRITUNGGAL

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ABSTRACT

CV Karya Anugerah Tritunggal is a private company with strong growth focus in coals trading for industries market such as electricity, cement, and textile industries. Since established in 2000, the objective of company is to take the advantage of every opportunities created by the subsidiary's company. The company believes that they objective can be reach by three actions which are (1) built good business cooperation with several coals mining to fulfill the supply; (2) always fulfill the market demand; and (3) make major investment in mining sector. But in their current data business process, it is difficult to determine the strategic policy that will implement to run those actions because the operational data were separated in every division; which causes the information structure for final report incomplete and not integrated as one.

Data warehouse can integrate all separated data and support the company's reporting process and strategic decision making to be effective and efficient. This project was develop the data warehouse software for CV Karya Anugerah Tritunggal using Fact constellations schema modeling; OLAP (On-Line Analytical Processing) design for processing; and Drill down / Roll up also Slice and Dice technique for analys the data.

Based on the result of testing and implementation process, it can be concluded that this data warehouse software can help company not only to provide multidimensional information but also integrated information as the basic for strategic decision making.

Kata Kunci: *Data Warehouse*, OLAP, *Slice, Dice*

1) INTRODUCTION

CV Karya Anugerah Tritunggal is a private company with strong growth focus in coals trading for industries market such as electricity, cement, and textile industries. Since established in 2000, the objective of company is to take the advantage of every opportunities created by the subsidiary's company. The company believes that they objective can be reach by three actions which are (1) built good business cooperation with several coals mining to fulfill the supply; (2) always fulfill the market demand; and (3) make major investment in mining sector. The company therefore requires proper processing and analysis of the operational data particularly data purchase / procurement, production receivables of data, sales data, supplier data, and customer data.

The processing of data into information has a very important role in the company's strategic decision making so that the company is not experiencing a crisis of information, the company is required to process the data into integrated information, accessible, precise, fast, and reliable. Crisis information is not only caused by the quantity of data but can be caused also by the quality of the data received and the processing process. As time passes the company has had operational data accumulated and stack view CV. Karya Anugerah Tritunggal already have consumers quite a lot.

Results of interviews with mother Nur of operational divisions, it was found a problem that in current conditions, no follow-up to the operational data and the process of data processing is currently still not meet some standards of quality of data that is integrated, integrity, accesible, and timely. On the integrated standards of data quality, operational data existing in the CV. Karya Anugerah Tritunggal still works apart on each of the different divisions. Existing condition data processing companies to show the integrity of data standard of quality of each variable on the operational data is not supported by the use of data types, this can sometimes result in incorrect information at the time of making the report. Operational data a separate in each division effect on standards of data quality accesible, are less effective in accessing the desired data and it is difficult to analyze the business quickly and accurately. The next standards of data quality have not been fulfilled is timely, search the required data seems slow because the amount of data that accumulate and a separate each division so that data were not available on the time taken. This caused the results of the final report of the company was still a division reports every course, so make company

executives have difficulty and impressed slow in determining strategic policy because structure of the information that is reported as the final report is not intact and is not integrated. The problem occurs because of lack of knowledge about the utilization of abundant data. Therefore, the availability of abundant data will be utilized for the development of a data warehouse that can then be used as a business solution for determining the company's strategic decisions in the future.

The data warehouse is data that have the nature of a subject-oriented, integrated, time-variant, and is non volatile on the collection of data in support of decision making process management [3]. The use of data warehouse is almost required by each company, data warehouse allows the integration of various types of data from a wide variety of applications or systems that can ensure faster access for management to obtain information, and analyze it as a particularly strategic information for companies.

Based on the above problems, to overcome the problems faced CV. Karya Anugerah Tritunggal, the research here intends to make the Software Development Data Warehouse at CV. Karya Anugerah Tritunggal.

1.1 Purpose and Objectives

The purpose of this research is to develop software Data Warehouse at CV. Karya Anugerah Trinity. And The aims of this study is:

1) Present the information that is multidimensional and integrated to the operations manager.
2) Assist the operational manager in making the final report that is multidimensional and integrated.

2) TINJAUAN PUSTAKA

Definition of Data warehouses can vary but have the same core, like the opinion of some experts the following:

Data warehouses are collections of data that have the nature of a subject-oriented, integrated, time-variant, and non volatile on the collection of data in support of management decision-making process [3].

The data warehouse is a relational database that is designed more to query and analysis from the transaction process, usually containing the data history of the transaction process and could also data from other sources. Data warehouses separate analysis workload from transaction workload and enables an organization to merge / consolidation of data from various sources [3].

The data warehouse is a method in the design of the database, which support the DSS (Decission Support System) and EIS (Executive Information System). Physically data warehouse is a database, but the data warehouse and database design is very different. In traditional database design using normalization, while the normalization of the data warehouse is not the best way [3].

From the definitions described above, it can be concluded that the data warehouse is a database that react with each other can be used for query and analysis, is the orientation of the subject, integrated, time-variant, unchanged used to assist decision makers.

2.1 Karakteristik *Data Warehouse*

According Inmon, Data warehouse is defined by the following characteristics [3]:

1. Subject Oriented
   Subject oriented means the data warehouse created or compiled based on the main subject in the corporate environment and not a process-oriented or application functions as happened in the operational environment. An example is an insurance company application consists of car, health, life, and loss. While the data warehouse set based on customers, policies, premiums and claims.
2. Integrated
   The data in the data warehouse is integrated because it comes from the system - the system of different applications within the company. Sources of such data is often inconsistent, for example because of different formats. This integrated data sources should be made consistent to provide uniform data on the users.
3. *Non Volatile*
   The data in the data warehouse is not updated in real time, but updated periodically from operating system. The new data are being added in addition to the database, not as a replacement. The database is constantly taking new data, add to it, and integrate it with the previous data.
4. *Time Variant*
   The data in the data warehouse is accurate and valid for a certain period of time. The data in the data warehouse consists of a series of snapshots, each showing the operational data taken at a certain time.

2.2 Process ETL(*Extraction, Transformation, Loading*)

Extraction, Transformation, and Loading (ETL) have a major role in the data warehouse. ETL is also a major component for successful data warehouse developed. ETL is a common terminology used in data warehouse that has a

process to extract the data from the source system, change it based on business requirements and present them in a data warehouse. ETL pull data from various data sources and put it into a data warehouse. ETL process is not a process that is done once, but periodically / have a schedule such as monthly, weekly, daily, even in a matter of hours. ETL is a complex combination from process and technology will consume most of the data warehouse and business development requires the ability from Business Analysts, Database and Application Developer Deasigners [4]. ETL Framework has three main processes Extraction, Transformation, and Loading [4].

a. Extraction
   The first step in the ETL scenarios by extracting the data contained in the data source. Source of data to be extracted from different kinds of data sources with various Database Management System, Operating System, and the protocol used. Therefore, in the process ektraks data must be carried out effectively.
b. Transformation
   At this stage, the process is carried out dry and conforming that such data be accurate so that the data is accurate, complete, consistent, and clear. Transformation has a process that data cleaning, transformation and integration. In this stage, defined granularity from fact tables, dimension tables, and schema data warehouse (Star Schema or Snowflake). The fact table is the center from data warehouse schema that generally contain a measure which is one property that contains calculations to measure the level of analysis. Dimension table is a table containing detailed data relating to the fact table. Data warehouse scheme is a scheme that connects a fact table and table dimensions.
c. Loading
   Loading data into the target multidimensional structure is the final stage in the ETL. In this stage, the Extraction and Transformation process is presented in a multi-dimensional structure that can be accessed by the user in the application system. Stages loading has a process Loading Loading Dimension and Fact.

2.3 Concept Modeling *Data Warehouse*

According Connolly, dimensional modeling using modeling concepts Entity-Relationship (ER) with some restrictions - an important limitation. Each dimensional models are composed of a table with a composite primary key sebuat, called the fact table, and a set of tables - smaller tables called dimension tables. Each table has a primary key dimension simple (non-composite) associated with one component from a composite key in the fact table. In other words, the primary key of the fact table is made from two or more foreign key [2].

1. Table fact
   According Ralph Kimball, Margy Ross fact table is the main table in the model dimension where numerical measurement of business performance that saved [5].



Image 1 Example Table Fact [6]

   Table fact generally have a primary key, and is usually called composite or concatenated key. Each table in the dimensional model has a composite key, and a table that has a composite key is the fact table. And each table that has a many to many relationship (many-to-many) should be the fact table and the other into a dimension table.
2. Table Dimension
   According Ralph Kimball, Margy Ross-dimensional table is a table that has many columns or attributes. This attribute describes the rows in the table dimension, and each dimension is defined by the primary key. Designated by notation PK, which serves as the basis for a link between the dimension tables to the fact tables [5].



Image 2 Example Table Dimensional [6]

3. Star schema
   According Thomas Connolly and Carolyn Begg, a star schema is a dimensional model of the data that has a fact table in the center, surrounded by denormalized dimension tables [2]. Besides the star schema easier for end - users to understand the structure of the database to the data warehouse is designed. The advantage of using the star schema:
   1. Response data faster than the design of the operational database.
   2. Simplify the modification or development in terms of continuous data warehouse.

3. End-user can customize the way of thinking and using data.
4. Simplify understanding and penulusuran metadata for users and developers.

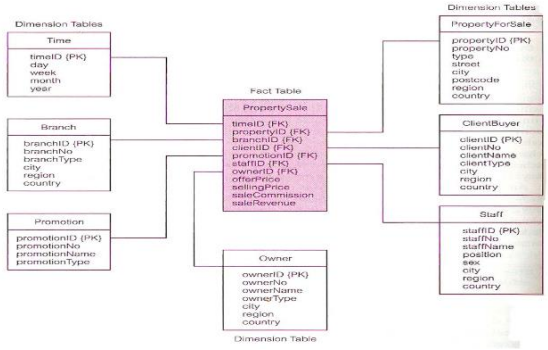


Image 3 star schema [2]

Some kind of a star schema, among others:

a. Simple star schema
In this scheme, each table should have a primary key that consists from one or more columns. Primary key from the fact table consists of one or more foreign key. A foreign key is the primary key in another table.

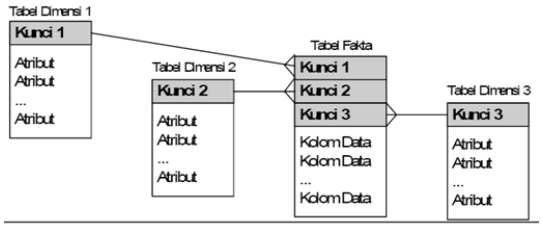


Image 4 Simple Star Schema [6]

b. Star schema with many tables facts
The star schema can also consist from one or more of the fact table. Due to the fact table because there are many, for example, in addition there is the fact table sales forecasting and result. Although there are more than one fact table, they still use the dimension tables together.

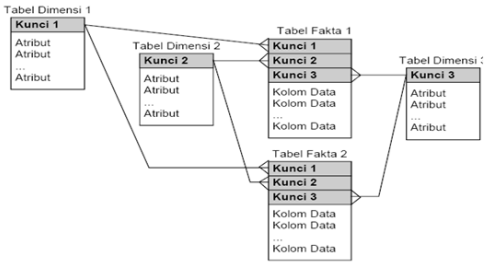


Image 5 Star Schema With Many Tables Fact [6]

4. Snowflake Schema
According Connolly snowflake schema is another form from a star schema where the dimension tables do not contain data that has didenormalisasi [2]. Snowflake Schema advantages, among others:
a. The data transfer speed of data from OLTP to the Metadata.
b. As the needs from high-level decision-making tool wherein * with a type like this the whole structure can be used completely.
c. Many of them think more comfortable designing in third normal form.

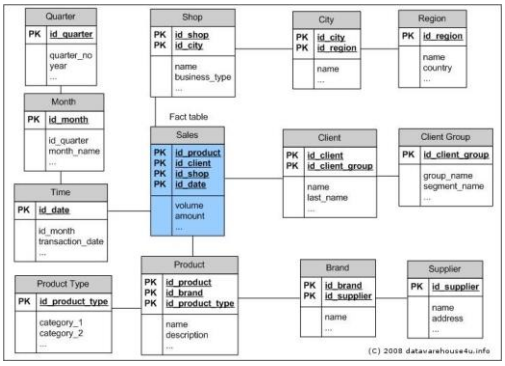


Image 6 snowflake schema [7]

5. Fact constellation schema
Fact constellation schema is a dimensional models in which there are more than one fact table that divides one or more dimension tables. This scheme is more complex than the star schema that contain multiple tables facts. In fact constellation schema, one dimension tables can be used in several tables to the fact that the design is more complex. The advantage of the fact constellation schema is the ability to model more accurate business using multiple fact tables. But the disadvantage is difficult in the management and design of complex.

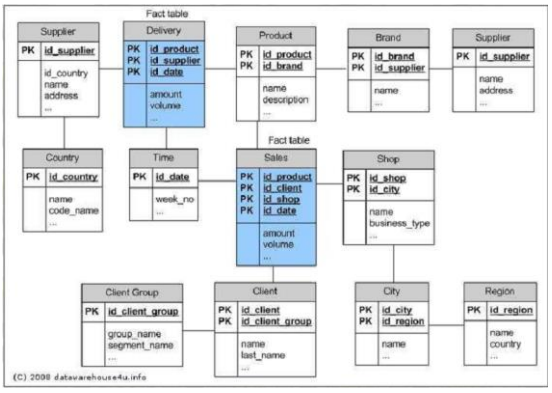


Image 7 Fact Constellation Schema [7]

3) ANALYSIS AND DESIGN

3.1 Problem Analysis

CV Karya Anugerah Tritunggal is a company engaged in coal trade for the industry. Companies need the information faster and more complete from the existing system at this time, based on research conducted at CV Karya Anugerah Tritunggal, there are some problems that arise, are as follows:

1. Operational Data are still separate each division making it difficult to obtain better information.
2. Less effective in accessing the required data and it is difficult to analyze the business quickly and accurately.
3. In the search for the required data seems slow, because the amount of data that accumulates and separately in each division so that the data were not available at time required.

3.2 information of needs analysis

Analysis of information needs is the stage of analyzing what information is needed by CV Karya Anugerah Tritunggal from data warehouse that will be built. Based on the results from interviews with Nur procurement division obtained the information needs required by the CV Karya Anugerah Tritunggal is as follows:

1. Information on numbers of each type of coal the most sold each month and year.
2. Information consumers who often buy coal in each month and year.
3. Information quantities of coal supplied by suppliers in each month and year.
4. Information on the amount of charge remaining in the transit transactions each month and year.
5. Information number of transport services in a bill amount each month and year.
6. Information transaction total sales each customer in each month and year.
7. Opera-freight services who often do transactions in each month and year.

3.2 Development of Data Warehouse

Architecture

The type of data warehouse is to be built is a type of functional data warehouse, where the source data to be stored in the data warehouse is external data, namely daily data from each activity in the form microsoft office excel file with format ".xls". Data warehouse type functional layer consists of a layer source, Data Staging, data warehouse layer and analysis. The following functional image data warehouse architecture.

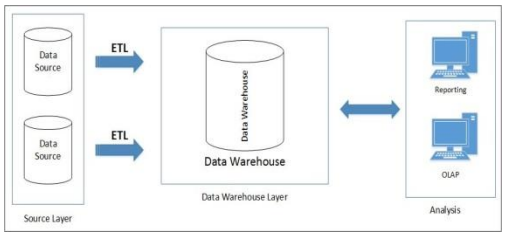


Image 8 Data Warehouse Fungsional

3.4 Source Layer

Source layer is a layer of a data source, where the core layer of the data is still in the form of external file. External data that will be used in the construction of a data warehouse is the data in the form of an excel file with xls format. Excel file will be imported into the database, Before importing excel file into the database, first column and the data content from each field or record that is analyzed in order to structure the table that will be built into the data warehouse in accordance with the file to be imported into the database.

3.5 Data Staging

At the core layer, the external data is already imported into the database will be extracted, transformed and then loaded into the data warehouse. This process is better known as the ETL process. ETL process is a process that is very important in building a data warehouse, the higher the level of truth ETL process more accurate information extracted from data warehouse.

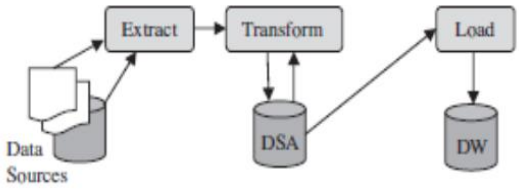


Image 9 Framework ETL [4]

ETL process describes the steps that will be done in the process of staging. As explained below:

1. Proses *Extraction*

The first step in the ETL process is to extract data from data sources. This process is the selection of data from existing data sources for the manufacture of Datawarehouse. The attributes that exist in the table will be extracted no change increase or decrease their attributes, tables in the extract is still the same as the source data. The process of extracting data from the source data into the Datawarehouse is as follows:

1. Process extract the table jenis batubara
Process extract the coal type table, conducted the retrieval of data from OLTP database. Column in the extract is id_jbatubara column, nama_batubara, and keterangan. The results from the data in the table extract coal types can be seen in Table 1.

Table 1. *Extract* table jenis batubara

Nama Tabel	Field
Tabel jenis_batubara	id_jbatubara
	nama_batubara
	keterangan

2. Process extract the table konsumen
Process extract the coal type table, conducted the retrieval of data from OLTP database. Column in the extract is id_konsumen column, nama_konsumen, alamat konsumen and no_telepon . The results from the data in the table extract coal types can be seen in Table 2.

Table 2. *Extract* table konsumen

Nama Tabel	Field
Tabel konsumen	id_konsumen
	nama_konsumen
	alamat_konsumen
	no_telepon

3. Process extract the table suplier
Process extract the coal type table, conducted the retrieval of data from OLTP database. Column in the extract is id_suplier column, nama_suplier, alamat_suplier, dan no_telepon. The results from the data in the table extract coal types can be seen in Table 3.
.

Table 3. *Extract* table suplier

Nama Tabel	Field
Tabel suplier	id_suplier
	nama_suplier
	alamat_suplier
	no_telepon

4. Process extract the table jenis pengiriman
Process extract the coal type table, conducted the retrieval of data from OLTP database. Column in the extract is id_jpengiriman column , nama_jenis_pengiriman, dan keterangan. The results from the data in the table extract coal types can be seen in Table 4..

Table 4. *Extract* table jenis pengiriman

Nama Tabel	Field
Tabel jenis_pengiriman	id_jpengiriman
	nama_jpengiriman
	keterangan

5. Process extract the table pembelian
Process extract the coal type table, conducted the retrieval of data from OLTP database. Column in the extract is id_pembelian column, tanggal_pembelian, id_suplier, id_jpengiriman, nama_jenis_pengiriman, id_jbatubara, KG, harga_beli, total, dan id_tanggal_pembelian. The results from the data in the table extract coal types can be seen in Table 5.

Table 5. *Extract* table pembelian

Nama Tabel	Field
Tabel pembelian	id_pembelian
	tanggal_pembelian
	id_suplier
	id_jpengiriman
	id_jbatubara
	KG
	harga_beli
	total
	id_tanggal_pembelian

6. Process extract the table penjualan
Process extract the coal type table, conducted the retrieval of data from OLTP database. Column in the extract is id_penjualan column, tanggal_penjualan, id_konsumen, id_jbatubara, KG, harga_jual, total, dan id_tanggal_penjualan, id_angkutan. The results from the data in the table extract coal types can be seen in Table 6.

Table 6. *Extract* table penjualan

Nama Tabel	Field
Tabel penjualan	id_penjualan
	tanggal_penjualan
	id_konsumen
	id_jbatubara
	KG
	harga_jual
	total
	id_tanggal_penjualan
	id_angkutan

7. Process extract the table angkutan
Process extract the coal type table, conducted the retrieval of data from OLTP database. Column in the extract is id_angkutan column, tanggal_angkutan, no_sj, id_jasa_angkutan, nopol, nama_sopir, KG, harga_angkutan, amount_tagihan, kas_jalan, sisa_tagihan, dan id_tanggal_angkutan . The results from the data in the table extract coal types can be seen in Table 7.

Table 7. *Extract* table angkutan

Nama Tabel	Field
Tabel angkutan	id_angkutan
	tanggal_angkutan
	no_si
	id_jasa_angkutan
	nopol
	nama_sopir
	KG
	harga_angkutan
	amount_tagihan
	kas_jalan
	sisa_tagihan

8. Process extract the table jasa angkutan
   Process extract the coal type table, conducted the retrieval of data from OLTP database. Column in the extract is id_jasa_angkutan column, nama_jasa_angkutan, alamat, dan no_telepon. The results from the data in the table extract coal types can be seen in Table 8.

Table 8. *Extract* table jasa angkutan

Nama Tabel	Field
Tabel jasa_angkutan	id_jasa_angkutan
	nama_jasa_angkutan
	alamat
	no_telepon

2. Process Transformation

The process of transformation is conducted cleaning and conditioning.

a) Cleaning

Cleaning process to clean the data that does not need from the table that have been filed extract namely removes unused. Here is a field name is omitted in the process of cleaning:

1. In the table jenis_batubara does not require field keterangan because The field contains data that does not match the needs of the information required.
2. In the table konsumen does not require field alamat and no_telepon because the field that contains data that does not match the needs of the information required and there are some records no_telepon field empty.
3. In the table suplier does not require field alamat_suplier and no_telepon because the field that contains data that does not match the needs of the information required and there are some records no_telepon field empty.
4. In the table jenis_pengiriman does not require field keterangan because The field contains data that does not match the needs of the information required.
5. In the table jasa_angkutan does not require field alamat_jasa_angkutan and no_telepon because the field that contains data that does not match the needs of the information required and there are some records no_telepon field empty.

Table 9. Cleaning table jenis batubara

jenis_batubara	
No	Field
1	id_jbatubara
2	nama_batubara
3	Keterangan

→

jenis_batubara	
No	Field
1	id_jbatubara
2	nama_material

b) Conditioning

Conditioning process is done by selecting the attribute from the data source to the target (data warehouse). Explanation from conditioning in the transformation process that is changing the date field split into several fields (day, month, year) because when the process of analysis, the required data can be analyzed in a range based on the desired time. For more details, see the table below below

Table 10. Table Conditioning

Tanggal_pembelian
5/02/2013
13 /02/ 2013
27/02/2013
21/03/2013
30/03/2013

→

dim_tanggal_pembelian		
tanggal	bulan	tahun
5	02	2013
13	02	2013
27	02	2013
21	03	2013

3. Proses Load

In this process, the data that have been read, cleaned, and changed its format, will be stored in the data warehouse. The technique used is the update. Existing data will not be deleted or changed because the data will be updated periodically. Later all the data that passes through the extraction and transformation will be directly inserted into the data warehouse without changing existing data.

3.6 Data *WareHouse Layer*

In this layer, the data that have been through the ETL process will be stored in a centralized storage logic is the data warehouse. Will be needed three tables of facts namely the fact table pembelian, fact penjualan and the fact angkutan. In addition there will be a dimension table that will be used together in some fact tables. Viewed from the requirement, then the schema data warehouse that will be used Fact constellations. For more details, relation schema data warehouse can be seen in the image below:

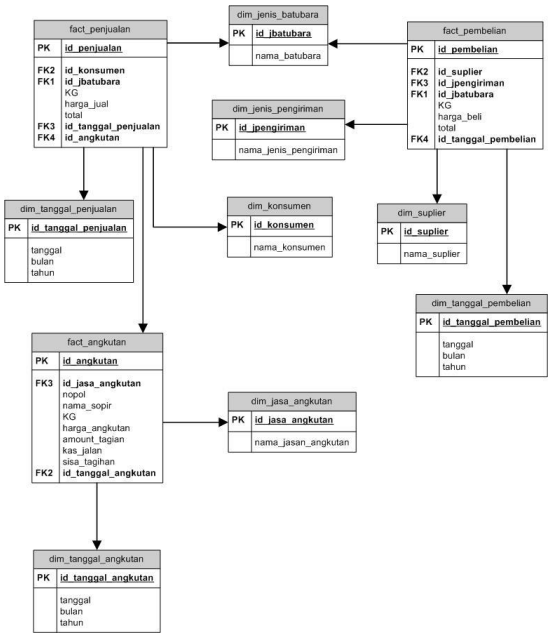


Image 10 Schema Data Warehouse

3.7 Functional Requirements Analysis

Functional needs analysis conducted to provide an overview of systems running on Software Datawarehouse. The analysis will be made to describe the functional model and information flows namely use case diagram.

1. Use case diagram

Use Case diagram illustrates the process from each procedure runs located in the Software Datawarehouse built. The following diagram Usecase Software Datawarehouse.

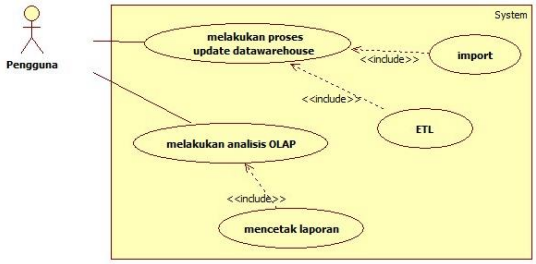


Image 11 *Usecase Diagram* software *Datawarehouse* Karya Anugerah Tritunggal

2. Definition Actor

Definition of the actors describe the role of actors in the system. The definition of an actor in the software Datawarehouse Karya Anugerah Tritunggal (KAT) can be seen in Table 11.

Table 11. Definition Aktor Software *Datawarehouse* Karya Anugerah Tritunggal

No	Aktor	Deskripsi
1	Pengguna	Pengguna adalah orang yang dapat menjalankan sistem, seperti melakukan import data, melakukan proses ETL, dan menghasilkan laporan dari hasil OLAP

3. Definition Use Case

Use case definitions describe each use case contained in the software usecase diagram Datawarehouse Karya Anugerah Tritunggal. Use case definitions can be seen in Table 12.

Table 12. Table Definition *Use Case* Software *Datawarehouse* Karya Anugerah Tritunggal

No	*Usecase*	Deskripsi
1	Melakukan Update Datawarehouse	Melakukan proses import data dan ETL (*Extract,Transform,Load)*
2	Import	Merupakan proses import data ke database OLTP
3	ETL	Merupakan proses *Extract, Transform, Load* dari database OLTP ke database *Datawarehouse*
4	Melakukan Analisis OLAP	Melakukan proses pemilihan informasi strategis OLAP dan menampilkan informasi strategis yang dipilih
5	Mencetak Laporan	Melakukan proses pencetakan informasi strategis yang dipilih

4) IMPLEMENTATION AND TESTING

4.1 IMPLEMENTATION HARDWARE

Hardware used to implement the system built is as follows:

Table 13 hardware used

No	Perangkat keras	Spesifikasi
1	Processor	Intel Core I3 350M 2.26 Ghz
2	RAM	4 GB
3	VGA	512 GB
4	*Harddisk*	320 GB
5	*Monitor*	LCD 14"
6	*Keyboard*	Standard Port USB
7	*Mouse*	Standard Port USB

4.2 Implementasi Software

Software used to implement the system built is as follows:

Table 14 software used

No	Perangkat Lunak	Spesifikasi
1	Sistem Operasi	Windows 8.1
2	DBMS	SQL Server 2014
3	Bahasa Pemrograman	C#
4	*Code Editor*	Visual Studio 2013

4.3 implementation interface

Implementation of the interface is done by displaying each display and encoding system built in

the form of program files. As for the implementation of data warehouse software to see built can be seen in the table below:

Table 15 implementation Software

No. Process	Name Proses	Name File
1	Import	Import.cs
2	ETL	ETL.cs
3	OLAP	OLAP.cs
3.1	Informasi jumlah setiap jenis batubara paling laku dijual setiap bulan dan tahun.	OLAP1.cs
3.2	Informasi konsumen yang sering membeli batubara dalam setiap bulan dan tahun.	OLAP2.cs
3.3	Informasi jumlah batubara yang dipasok oleh suplier dalam setiap bulan dan tahun.	OLAP3.cs
3.4	Informasi jumlah sisa tagihan pada transaksi angkutan dalam setiap bulan dan tahun.	OLAP4.cs
3.5	Informasi jumlah amount tagihan setiap sopir pada transaksi angkutan dalam setiap bulan dan tahun.	OLAP5.cs
3.6	Informasi total transaksi penjualan setiap konsumen dalam setiap bulan dan tahun.	OLAP6.cs
3.7	Infromasi jumlah transaksi setiap jasa angkutan dalam setiap bulan dan tahun.	OLAP7.cs

4.4 Testing Systems

Testing data warehouse built using black box testing methods. The test plan can be seen in the table below:.

Table 16 Testing plan

Kelas Uji	Detil Pengujian	Jenis Uji
Import	Berhasil import atau gagal import	*Black Box*
ETL	Berhasil *Ekstrak, Transform, Load* atau gagal *Ekstrak, Transform, Load*	*Black Box*
OLAP	Berhasil melakukan analisis OLAP atau gagal melakukan analisis OLAP	*Black Box*

4.5 Alpha Testing Conclusion

Based on the results of Alpha testing has been done can be concluded that the application has been running quite well, in this test data integration can be said to be a success because from the stage of the import process, ETL and OLAP goes well.

4.6 Testing strategic information

Tests conducted strategic information to determine whether the strategic information generated by the data warehouse application CV.Karya Anugerah Tritunggal has been fulfilled or not fulfilled. For more details can be seen in the table below:

Table 17 Information Number Each type Coal Bestsellers Sale Every Month And Year

Data Masukan	Yang Diharapkan	Pengamatan	Kesimpulan
Nama data : data penjualan, data jenis batubara, data tahun dan bulan penjualan	Informasi Jumlah Setiap Jenis Batubara Paling Laku Dijual Setiap Bulan Dan Tahun sudah sesuai dengan informasi yang dibutuhkan perusahaan	Informasi yang dihasilkan dapat menampilkan jenis batubara paling laku dijual dsesuai dengan bulan dan tahun	[√] Terpenuhi [ ] Tidak Terpenuhi

5. CONCLUSIONS AND SUGGESTIONS

5.1 Conclusions

Based on the analysis and testing data warehouse, it can be concluded that:

1. Software's data warehouse can help the company to present information that is multidimensional and integrated.
2. Application of data warehouse on a CV. Trinity Grace also works to assist the operations manager in making the final report is multidimensional.

5.2 Suggestions

Here is the advice that can be given to further development of the system, is:

1. It is expected to develop a decision support system such as building data mining.
2. The need conducted maintenance and supervision of the process data warehouse ETL (Extract, Transform, Load) for the quality of the data in the data warehouse is assured accuracy.

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