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Business Intelligence Design for the Purchasing and Selling Decision Making

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Abstract-- *The role of information technology in business enterprise processes is increasingly inseparable. The role of information technology as a tool for the performance of a company or organization in terms of providing the information needed in business operations, including management information, corporate critical data, the preparation of effective reports and Increasing the effectiveness of decision making. Business Intelligence (BI) is a tool that can support data processing to produce quality information and analyze information to produce knowledge that can support the decision-making process. BI Systems is a term generally used for applications and technologies that are used to help BI activities, such as collecting data, providing access and analyzing data, as well as information on company performance. Then, from the board, the executive can easily understand it and draw a conclusion from all the data for the decision-making process, especially in sales and purchases. From the application of the control panel, corporation can also make a conclusion of the forecast function, for example, which product is the most sold, which region ordered the most products, etc., which can help the executive to make a decision.*

Keywords— *design, business intelligence, decision making, star scheme, sales, purchase.*

I. INTRODUCTION

The growth of more advanced technologies increases competition between companies because they are no longer limited by time and space. Fast, accurate and up-to-date information needs are critical to improving company performance and making decisions that help companies compete. The quality of information is therefore becoming very important to society. The role of IT in business processes is increasingly intertwined. The role of information technology as a tool for the performance of a company or organization in providing business-critical information, including management information, critical data, effective reporting, and increased decision-making efficiency.

Through the use and application of information technology, the collection of related data can be transformed into appropriate and useful information for decision making. Business Intelligence (BI) is a tool that supports data processing to generate quality information and analyze information to create knowledge that can support decision making. BI systems are terms commonly used for applications and technologies that support BI activities, such as: These include data collection, access, data analysis, and business performance information. BI applications in a company can be used to improve company performance by selecting appropriate business strategies and to increase work efficiency for the benefit of the company. BI can also help companies analyze trend changes and identify strategies that anticipate them.

PT.XYZ recognizes the impotence of business intelligence and is interested in its development and implementation for decision making. In this study, we will create a Business Intelligence panel for PT.XYZ to help the company manage data and present it in a simple way, such as in charts and graphs. The manager can then easily understand this from the board of directors and draw conclusions for the decision-making process from all the data, especially in terms of sales and purchases. PT.XYZ can also draw conclusions for the prediction function from the use of a control panel. Which product sells the most, in which region it has ordered the most products, etc., which can help the manager make decisions.

II. SCOPE

The scope of this research is limited to the analysis and design of the business intelligence dashboard for PT.XYZ. The Business Intelligence dashboard provides the necessary information in the form of graphs and charts to help the manager make sales and purchasing decisions. The limits are as follows:

1. Analyze sales and purchasing services in PT XYZ.
2. Track sales and purchases in PT XYZ.

III. OBJECTIVES AND BENEFITS

The purpose of this research are :

1. Analyzing the sales and purchasing system in PT.XYZ
2. Analyzing the problem that occur in PT.XYZ
3. Create a business intelligence dashboard application as a troubleshooting tool for reporting and forecasting.

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4. Make the business intelligence dashboard easier to understand. Design a Business Intelligence dashboard view that displays information based on predictions of previous period data, past data groupings by region, and workforce information

The benefits gained from the application are:

1. This application processes all information and displays accurate data and real-time information that supports the administrator in the decision making process when buying and selling in PT XYZ.
2. The application can increase time efficiency in the reporting and decision making process.
3. The manager can easily understand the information and evaluate it for further development.
4. The administrator can use dashboard information for future predictive analysis.
5. The design creates business intelligence applications to integrate all aspects of existing data and display them in the application to simplify the search for details about the data required.
6. Make estimates of a potential customer. XYZ.

IV. RESEARCH METHODOLOGY

To correctly analyze the existing problems in PT XYZ and to design appropriate solutions, we use various research methods, including:

1. Method of data collection

a. Interview

The data collected by companies is interested in IT staff and IT managers to request information about business information needed to support decision making.

b. Direct observation

The collected data can be obtained by observing existing business processes and by direct observation of PT.XYZ.

c. Literature and philosophy

The data was collected through bibliographic research on books, the Internet, and other media related to the reference object. This data can help provide more knowledge and information for research.

2. Method of analysis

Analyze the current system and the problem currently occurring in PT.XYZ and find a solution to the problem. With methods of analysis, object-oriented analysis and a design book with a unified process Satzinger et al. (2010).

3. Design method

Using a design method based on Stage and Step Business Intelligence Development Steps with the concept of the book (Vercellis, 2009)

a. Business Justification
b. Business Planning
c. Business Analysis
d. Design
e. Construction
f. Deployment

V. LITERATURE REVIEW

A. Database

The Database is a shared collection of logically related data, and a description of this data, designed to meet the information needs of an organization. The database is a single, possibly large repository of data that can be used simultaneously by many departments and users (Connolly & Begg, 2015). The database system is arguably the most important development in the field of software engineering, and the database is now the underlying framework of the information system, fundamentally changing the way that many organizations operate. In short, the database is the foundation of the organization to carry out important activities to be developed in software engineering.

B. Data Warehouse

The data warehouse is a subject-oriented, integrated, nonvolatile, and time-variant collection of data in support of management's decisions. The data warehouse is the heart of the architected environment and is the foundation of all DSS processing (Vercellis, 2009).

A data warehouse is a foremost repository for the data available for developing business intelligence architectures and decision support systems (Vercellis, 2009).

Based on the definitions above, it can be concluded that the data warehouse is the primary repository where it is subject-oriented, integrated, nonvolatile, and time-variant for developing business intelligence architectures.

1) Main Categories of Data Feeding

It is possible to identify three main categories of data feeding into a data warehouse: internal data, external data and personal data.

a) Internal Data

Internal data are stored for the most part in the databases, referred to as transactional systems or operational systems that are the backbone of an enterprise information system. Internal data are gathered through transactional applications that routinely preside over the operations of a company, such as administration, accounting, production, and logistics (Vercellis, 2009).

These data usually come from different components of the information system:

1. Back-office systems that collect basic transactional records such as orders, invoices, inventories, production and logistics data.
2. Front-office systems, that contain data originating from call-center activities, customer assistance, and execution of marketing campaigns.
3. Web-based systems that gather sales transactions on e-commerce websites, visits to websites, data available on forms filled out by existing and prospective customers.

b) External Data

There are several sources of external data that may be used to extend the wealth of information stored in the internal databases (Vercellis, 2009).

To be concluded, the differences between internal data and external data is, if internal data is retrieving data from the database, then the external data is retrieved data that does not exist in the database.

c) Personal Data

In most cases, decision-makers performing a business intelligence analysis also rely on information and personal assessments stored inside worksheets or local databases located in their computers. The retrieval of such information and its integration with structured data from internal and external sources is one of the objectives of knowledge management systems (Vercellis, 2009).

2) Characteristics of Data Warehouse

There are four main characteristics of the data warehouse (Inmon, 2005), divided into:

a) Subject oriented

Subject oriented means a data warehouse is based on the main subject in the corporate environment and not process-oriented or application functions. Subject areas include the usual customer, product and transaction. Each subject area is physically implemented as a set of related tables in the data warehouse.

b) Integrated

Of all the aspects of a data warehouse, integration is the most important. Data is fed from multiple, disparate sources into the data warehouse. As the data is fed, it is converted, reformatted, resequenced, summarized, and so forth. The result is that data once it resides in the data warehouse has a single physical corporate image.

c) Non-volatile

Data warehouse's data is loaded (usually, but not always, en masse) and access, but it is not updated (in the general sense). Instead, when data in the data warehouse is loaded, it is loaded in a snapshot, static format. When subsequent changes occur, a new snapshot record is written. In doing so, a historical record of data is kept in the data warehouse.

d) Time-variant

The time-variant implies that every unit of data in the data warehouse is accurate as of some moment in time. In some cases, a record is time-stamped. In other cases, a record has a date of a transaction. But in every case, there is some form of time marking to show the moment in time during which the record is accurate.

Based on the descriptions above, characteristic the data warehouse is subject-oriented because the data is organized based on the main subject. The second characteristic of the data warehouse that it is integrated because once the data residing in a data warehouse, it has a single physical corporate image even though it came from different sources. Non-volatile because of data warehouse ability to keep a historical record of data and it can't be updated. The last salient characteristic is time-variant, which implies every unit of data in the data warehouse is accurate as of some moment in time.

3) ETL (Extract, Transform, Load) Tools

a) Extract

During the first phase, data are extracted from the available internal and external sources. A logical distinction can be made between the initial extraction, where the available data relative to all past periods are fed into the empty data warehouse and the subsequent incremental extractions that update the data warehouse using new data that become available over time. The selection of data to be imported is based upon the data warehouse design, which in turn depends on the information needed by business intelligence analyses and decision support systems operating in a specific application domain (Vercellis, 2009).

b) Transform

The goal of the cleaning and transformation phase is to improve the quality of the data extracted from the different sources, through the correction of inconsistencies, inaccuracies and missing values (Vercellis, 2009). Some of the major shortcomings that are removed during the data cleansing stage are:

a. inconsistencies between values recorded in different attributes having the same meaning;
b. data duplication;
c. missing data;
d. existence of inadmissible values

During the cleaning phase, preset automatic rules are applied to correct most recurrent mistakes. In many instances, dictionaries with valid terms are used to substitute the supposedly incorrect terms, based upon the level of similarity. Moreover, during the transformation phase, additional data conversions occur in order to guarantee homogeneity and integration with respect to the different data sources. Furthermore, data aggregation and consolidation are performed in order to obtain the summaries that will reduce the response time required by subsequent queries and analyses for which the data warehouse is intended (Vercellis, 2009).

c) Load

Finally, after being extracted and transformed, data are loaded into the tables of the data warehouse to make them available to analysts and decision support applications (Vercellis, 2009).

4) Dimensionality Modeling

Dimensionality modeling is a logical design technique that aims to present the data in a standard, the intuitive form that allows for high-performance access. Dimensionality modeling uses the concepts of Entity-Relationship (ER) modeling with some important restrictions. Every dimensional model (DM) is composed of one table with a composite primary key, called the fact table, and a set of smaller tables called dimension tables (Connolly & Begg, 2015).

There are three basic types of dimensional models, one of them is star schema. Star schemas have one fact table and several dimension tables (Ballard, Farrell, Gupta, Mazuela, & Vohnik, 2006).

Star schema is a logical structure that has a fact table containing factual data in the center, surrounded by dimension tables containing reference data (which can be denormalized). The representation of multidimensional star schema contains two types of data tables: dimension tables and fact tables (Vercellis, 2009).

Based on the statements above, it can be concluded that star schema is the logical structure of the data that enables two types of tables, they are dimension tables and fact tables. Dimension tables contain data that is compatible with the needs of business and the facts surrounding the table to obtain the information.

The multi-dimensional representation is based on a star schema that contains two types of data tables: dimension tables and fact tables. A fact table is a table that generally contains something that can be measured and historical, and a collection of a foreign key from the primary key contained in each dimension table (Vercellis, 2009) . Fact tables usually refer to transactions and contain two types of data:

a. Links to dimension tables, that are required to properly reference the information contained in each fact table.
b. Numerical values of the attributes that characterize the corresponding transactions and that represent the actual target of the subsequent OLAP analyses.

Therefore, the fact table contains derived data and connects one or more dimension tables. The dimension table is a table that contains categories with summary details of which can be in the form of reports. In general, dimensions are associated with the entities around which the processes of an organization revolve.

5) Metadata

In order to document the meaning of the data contained in a data warehouse, it is recommended to set up a specific information structure, known as metadata, i.e. data describing data. The metadata indicate for each attribute of a data warehouse the original source of the data, their meaning and the transformations to which they have been subjected. The documentation provided by metadata should be constantly kept up to date, in order to reflect any modification in the data warehouse structure. The documentation should be directly accessible to the data warehouse users, ideally through a web browser, according to the access rights pertaining to the roles of each analyst (Connolly & Begg, 2015).

6) Staging Area

The staging area is the place where the extracted and transformed data is placed in preparation for being loaded into the data warehouse. The purpose of the staging area is for handling data extracted from the source system. There can be data transformations at this point and/or as the data is loaded into the data warehouse. The structure of the staging area depends on the approach and tool used for the extract, transform, and load (ETL) processes (Ballard, Farrell, Gupta, Mazuela, & Vohnik, 2006).

Based on the statements above, it can be concluded that the staging area is the place where the ETL process runs for consumption by the business users.

7) Dimension Table

Dimension tables contain attributes that describe fact records in the fact table. Some of these attributes provide descriptive information; others are used to specify how fact table data should be summarized to provide useful information to the business analyst. Dimension tables contain hierarchies of attributes that aid in summarization (Ballard, Farrell, Gupta, Mazuela, & Vohnik, 2006).

The dimension table contains relevant, yet separate, information (such as the corporate calendar, the corporate pricing tables, the locations of stores, the means of shipment for an order, and so forth). The dimension table defines important, yet ancillary, information that relates to the fact table (Inmon, 2005).

8) Fact Table

The fact table is a structure that contains many occurrences of data. The fact table and the dimension table are related to the existence of a common unit of data (Inmon, 2005).

Fact tables usually refer to transactions and contain two types of data:

a. Links to dimension tables, that are required to properly reference the information contained in each fact table.
b. Numerical values of the attributes that characterize the corresponding transactions and that represent the actual target of the subsequent OLAP analyses.

Based on the statements above, it can be concluded that a fact table is the primary table in a dimensional model and related to the dimension table by the existence of a common unit of data.

C. Dashboard

Today's dashboards are direct descendants of the old EIS and DSS systems with greatly improved functionality and appearance. That's because they are linked to today's powerful data systems and utilize a tightly focused Key Performance Indicator.

Three types of the dashboard (Scheps, 2018) are:

1) Tactical Dashboards

Measure short-term productivity and effectiveness. Their output is often used by an individual contributor. As an example, a network engineer might have a tactical dashboard that actively monitors real-time IT infrastructure statistics and trends. And it can help to tip-off when something is wrong immediately.

2) Operational Dashboards

Quantity the short and medium-term effectiveness of a specific business function (or family of business functions) at the team of the business-unit level. This level of the dashboard could potentially be deployed for an individual knowledge worker or a local team manager. The trends and metrics displayed will have an impact on short-term decisions.

3) Strategic Dashboards

Built for the policy-setting levels of the organization (such as the chief-level executives or business-unit directors). These dashboards display metrics that represent corporate strategy and direction.

D. Business Intelligence

1) Definition of Business Intelligence

Business information and business analyses within the context of key business processes that lead to decisions and actions and that result in improved business performance (Williams & Williams, 2006).

Business intelligence can be defined as the processes, technologies, and tools needed to turn data into information, information into knowledge, and knowledge into plans that drive profitable business action. Business intelligence encompasses data warehousing, business analytical tools, and content/knowledge management.

Business intelligence may be defined as a set of mathematical models and analysis methodologies that exploit the available data to generate information and knowledge useful for complex decision-making processes (Vercellis, 2009).

2) Purpose of Business Intelligence

The main purpose of business intelligence systems is to provide knowledge workers with tools and methodologies that allow them to make effective and timely decisions (Vercellis, 2009).

a) Effective decisions

The application of rigorous analytical methods allows decision-makers to rely on information and knowledge that are more dependable. As a result, they are able to make better decisions and devise action plans that allow their objectives to be reached in a more effective way.

b) Timely decision

Enterprises operate in economic environments characterized by growing levels of competition and high dynamism. As a consequence, the ability to rapidly react to the actions of competitors and to new market conditions is a critical factor in the success or even the survival of a company.

3) Business Intelligence Architecture

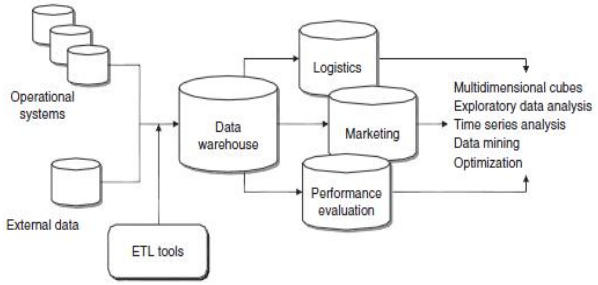

Fig. 1. Typically Business Intelligence Architecture

Business intelligence architectures contain three major components (Vercellis, 2009), they are:

a) Data sources

In the first stage, it is necessary to gather and integrate the data stored in the various primary and secondary sources, which are heterogeneous in origin and type. The sources consist for the most part of data belonging to operational systems but may also include unstructured documents, such as emails and data received from external providers.

b) Data warehouses and data marts

Using extraction and transformation tools known as extract, transform, load (ETL), the data originating from the different sources are stored in databases intended to support business intelligence analyses.

c) Business intelligence methodologies

Data are finally extracted and used to feed mathematical models and analysis methodologies intended to support decision-makers. In a business intelligence system, several decision support applications may be implemented. And that is included decision support application:

1. Multidimensional cube analysis
2. Exploratory data analysis
3. Time series analysis
4. Inductive learning models for data mining
5. Optimization models

4) Business Intelligence Opportunity Analysis Overview

The principal methods of BI opportunity analysis are to identify and prioritize opportunities to use business information, business analyses, and structured decisions. The principal objectives are to increase revenue and/or reduce costs, thereby increasing profits and creating business value (Williams & Williams, 2006) . To accomplish those objectives, a structured approach that aligns two key factors with each other is needed:

a. Business drivers, business strategies, goals and objectives, and the core business processes that drive provided.
b. BI applications that will improve the effectiveness of those core business processes.

5) Development of a Business Intelligence

There are 4 main steps in the development of business intelligence (Vercellis, 2009), there are:

a. Analysis

During this phase, the needs of the organization relative to the development of a business intelligence system should be carefully identified. This preliminary phase is generally conducted through a series of interviews of knowledge workers performing different roles and activities within the organization. It is necessary to clearly describe the general objectives and priorities of the project, as well as to set out the costs and benefits deriving from the development of the business intelligence system.

b. Design

The second phase includes two sub-phases and is aimed at deriving a provisional plan of the overall architecture, taking into account any development in the near future and the evolution of the system in the mid-term. First, it is necessary to make an assessment of the existing information infrastructures. Moreover, the main decision-making processes that are to be supported by the business intelligence system should be examined, in order to adequately determine the information requirements. Later on, using classical project management methodologies, the project plan will be laid down, identifying development phases, priorities, expected execution times and costs, together with the required roles and resources.

c. Planning

The planning stage includes a sub-phase where the functions of the business intelligence system are defined and described in greater detail. Subsequently, existing data, as well as other data that might be retrieved externally, are assessed. This allows the information structures of the business intelligence architecture, which consists of a central data warehouse and possibly some satellite data marts, to be designed. Simultaneously with the recognition of the available data, the mathematical models to be adopted should be defined, ensuring the availability of the data required to feed each model and verifying that the efficiency of the algorithms to be utilized will be adequate for the magnitude of the resulting problems. Finally, it is appropriate to create a system prototype, at low cost and with limited capabilities, in order to uncover beforehand any discrepancy between actual needs and project specifications.

d. Implementation and control

Implementation and control are the last phases and consist of five main sub-phases. First, the data warehouse and each specific data mart are developed. These represent the information infrastructures that will feed the business intelligence system. In order to explain the meaning of the data contained in the data warehouse and the transformations applied in advance to the primary data, a metadata archive should be created. ETL procedures are set out to extract and transform the data existing in the primary sources, loading them into the data warehouse and the data marts. The next step is aimed at developing the core business intelligence applications that allow the planned analyses to be carried out. Finally, the system is released for test and usage.

VI. PROPOSE DESIGN

E. Business Data Model

This model is the data on the logical model of the company, where the data show what is part of the activities of business organizations.

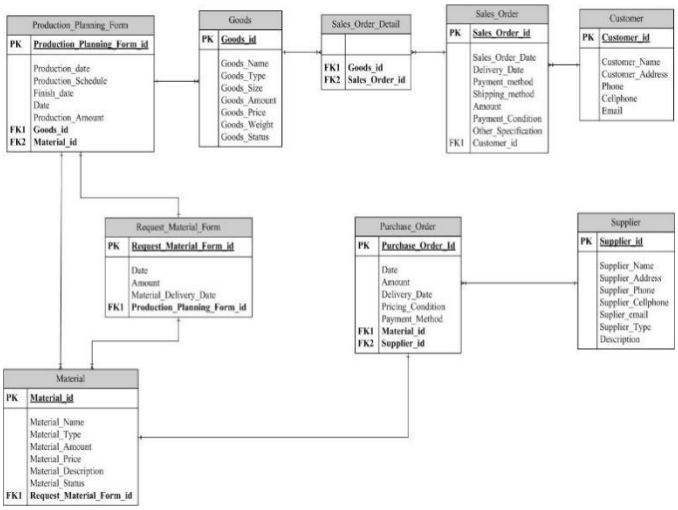

Fig. 1. Proposed Reational Model

F. Logical Database Design

1) Star Schema

There are two Star Schema we create in the PT XYZ, the first one is Sales Star Schema and the second one is the Purchase Star Schema.

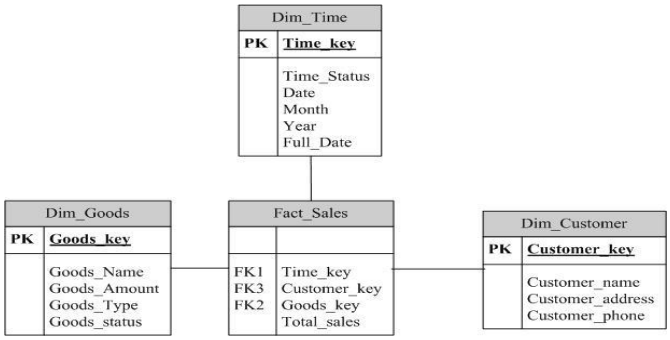

Fig. 2. Sales Star Schema

Sales star schema is base build on the dimension that the fact sales needed. In the image 4.5 the Fact Sales get the dimension from the Dim_Time, Dim_Goods, Dim_Customer. Fact Sales need the Time_key,Customer_key,Goods_key,Total_sales.

So each attribute can be process and with the star schema we can take the total sales which is taken from many dimension. The Sales Star Schema is needed for the Fact Table.

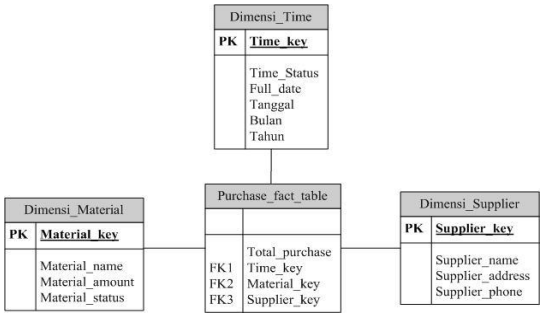

Fig. 3. Purchase Star Schema

Purchase star schema is base build on the dimension that the fact purchase needed. The Purchase Star schema need 3 dimension, which are Dimensi_Supplier, Dimensi_Material, Dimensi_Time. The Purchase Star Schema takes the

Time_key,Material_key, Supplier_key for the Total_Purchase process. From all the dimension that the purchase fact takes it can be show the total purchase by getting the data from all the dimension.

2) Fact Table

Fact table is a combination of several foreign key contained in the dimension table. Fact table is made to determine the relationship of the facts relating to inter-dimensional. Usefulness of the fact table is to define the relationship between many dimensions. Such relations are based on the primary key contained in the dimension table.

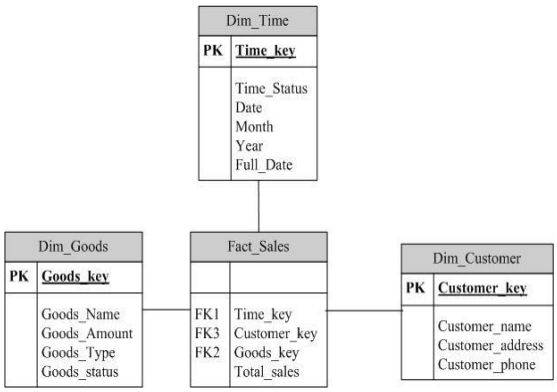

Fig. 4. Fact Table Sales

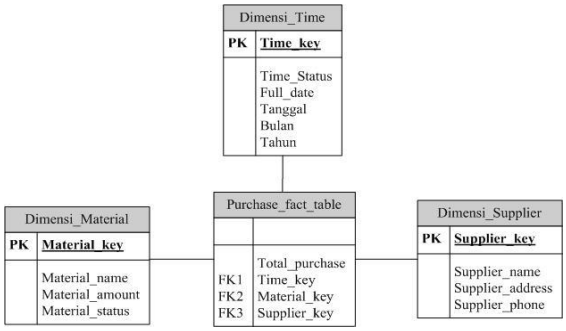

Fig. 5. Fact Table Purchase

3) Data Dictionary

TABLE I
SALES FACT TABLE

Entity	Attributes	Data Type and Length	Process	Source
Sales Fact Table	GoodsID	Varchar (255)	Copy	Goods
	Amount	Float	Copy	Salesorder
	Date	Datetime	Copy	Date
	CustID	Varchar (255)	Copy	Customer
	TotalPrice	Float	Copy	Salesorder
	Type	Varchar (255)	Copy	Goods

TABLE II
GOODS DIMENSION

Entity	Attributes	Data Type	Process	Source

		and Length		
Dimensi Goods	GoodsID	Varchar(255)	Write	Goods
	Name	Varchar(255)	Write	Goods
	Type	Varchar(255)	Write	Goods
	Amount	Float	Write	Goods
	Price	Float	Write	Goods

TABLE III
CUSTOMER DIMENSION

Entity	Attributes	Data Type and Length	Process	Source
Dimensi Cust	CustID	Varchar(255)	Write	Cust
	CustName	Varchar(255)	Write	Cust
	City	Varchar(255)	Write	Cust
	CompanyName	Varchar(255)	Write	Cust

TABLE IV
TIME DIMENSION

Entity	Attributes	Data Type and Length	Process	Source
Dimensi Time	Date	Datetime	Write	Time
	Month	Datetime	Write	Time
	Year	Datetime	Write	Time
	FullYear	Datetime	Write	Time

TABLE V
PURCHASE FACT TABLE

Entity	Attributes	Data Type and Length	Process	Source
Purchase Fact Table	MaterialID	Varchar(255)	Write	Material
	Amount	Varchar(255)	Write	Purchase Order
	Date	Datetime	Write	Time
	SupplierID	Varchar(255)	Write	Supplier
	TotalPurchase	Varchar(255)	Write	Purchase Order

TABLE VI
SUPPLIER DIMENSION

Entity	Attributes	Data Type and Length	Process	Source
Dimensi Supplier	SupplierID	Varchar(255)	Write	Supplier
	SupplierName	Varchar(255)	Write	Supplier
	CompanyName	Varchar(255)	Write	Supplier

TABLE VII
MATERIAL DIMENSION

Entity	Attributes	Data Type and Length	Process	Source
Dimensi Material	MaterialID	Varchar(255)	Write	Material
	MaterialName	Varchar(255)	Write	Material

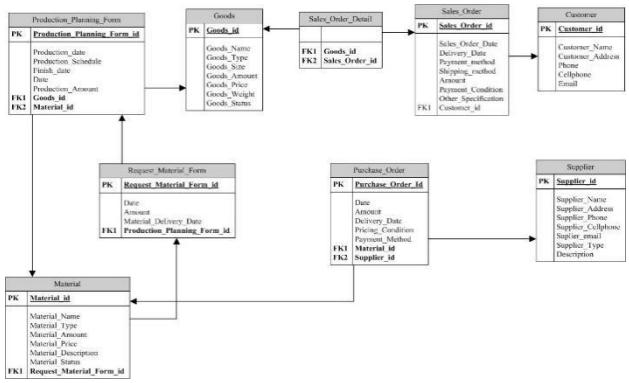

Fig. 5. Proposed Entity Relationship Diagram

The business processes that run in PT XYZ for production process is described below :

a. First the sales team will write all order from customer into sales order. The sales order will include the data of the customer and also all goods (cement) that the customer order. Everyday the production planning team will check the current stock of the goods. If the amount of the goods is under the minimum required, then the production planning team will create a production planning form that including the data of all goods that under minimum stock, the schedule of production and also all the materials required to make the goods. If there any mistakes or miscalculation the production planning team will revise production planning form and then will sent it to the production team.
b. After the production team collect the production planning form they will create a request material form and sent it to the warehouse department. Warehouse department will check and send all material needed to the production team based on the request material form. If the material stock is below minimum stock, the warehouse department will make a purchase order and send it to suppliers to restock the material. After receiving all the required material, the production team will start the production process based on the production planning form.

4) Internal Database Management System

The design to create a database diagram to determine the attributes of each table, then specify the Primary Key of each table to show the relationship attribute of every table.

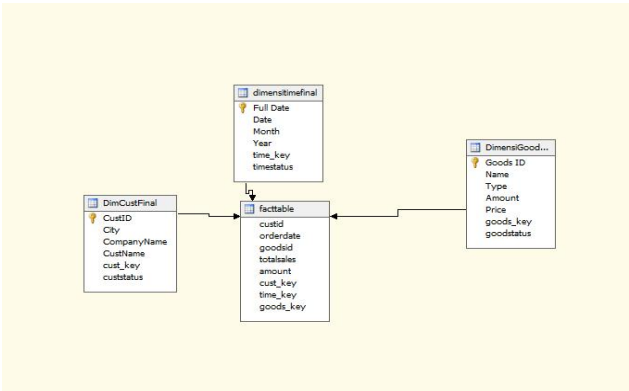

Fig. 6. Database Sales Diagram

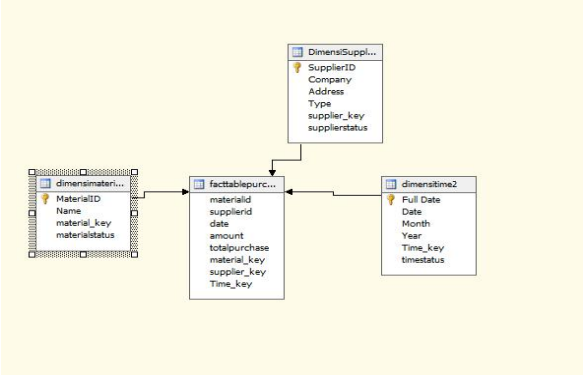

Fig. 7. Database Purchase Diagram

5) Source Data Selection Process

The data used to create the BI should be considered and analyzed properly so that the results obtained in accordance with what is to be achieved.

a. Identification of data: data cleaning is done to remove data that is not needed in making BI as null data or record data that is not used will be deleted.
b. Data analysis: after data is cleaned, and then analyzed the data to be used for entities, attributes that need to be used, and the importance of data that is how big the data needed to support BI.
c. Selecting data: after the analysis process, the researcher determines what data can be used in building this BI. Data record sales, goods, permit, and returns the data is important to build BI, while customer data is supporting data.
d. Tools: to perform data cleansing or ETL process researchers use the software Microsoft SQL Server.

6) Meta Data Repository Design

Meta data is created using the centralized meta data repository where data will be entered on the database while using SQL Server to enter the process of cleansing and ETL then be processed into a tool of information using Business Intelligence Development Studio (BIDS).

TABLE VIII
METADATA DESIGN

Cube Name	Fact Name	Dimension Name	Attribute
OLAP	FactSales	DimensiCust	CustID
			CustName
			City
			CompanyName
		DimensiTime	TotalSales
			Date
			Month
			FullYear
		DimensiGoods	GoodsID
			Name
			Type
			Amount
			Price
	FactPurchase	DimensiSupplier	SupplierID
			SupplierName
			CompanyName
		DimensiMaterial	MaterialID
			MaterialName
		DimensiTime	TotalSales
			Date
			Month
			FullYear

VII. CONCLUSIONS

In this research, a star schema model for data warehouse design that includes four dimensions, such as customer, position, item, and time, with a sales fact table that measures total sales. This schema creates various dashboards, such as customer segmentation, item positioning panel, sales performance tracking panel, and sales forecasting panel to help managers make decisions. Of all the processes that have been carried out in the development of business intelligence, we can conclude the following:

1. Business Intelligence supports in-depth analysis because reports of different sizes can be displayed and are more suitable for analysis than for operational reports. An example of an in-depth analysis report is used to track sales performance, customer segmentation, and item placement.
2. Business Intelligence provides a sales performance indicator that can help offset losses from bad sales.
3. Business Intelligence provides a report that breaks down metrics by item position and size so that managers know which article is most required at each position and can perform more accurate article placement.
4. Business Intelligence helps determine customer segmentation by analyzing customer data, time dimension, and article size based on the frequency of business relationships with the company.
5. Business Intelligence provides a graph to compare sales with statistical graphs to see if the graph is zoomed in or out.
6. With Business Intelligence, you can view sales forecasts based on data stored in the previous year and view sales forecasts as a graph.

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