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Implementation of Business Intelligence for Sales Analysis and Customer Segmentation at XYZ Store

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ABSTRACT

XYZ Retail Store has a large amount of transaction data, but it has not been optimally utilized for strategic decision making. The research aims to implement a Business Intelligence. Business Intelligence helps analyze sales data and segment key business entities, namely customers, suppliers, and products. The research methodology includes designing a datawarehouse using Kimball's Nine Step method with MySql as the database platform. Extract, Transform, Load (ETL) process is performed to prepare the data before processing with Online Analytical Processing (OLAP) approach for multidimensional sales analysis, and Data Mining with K-Means clustering algorithm to perform segmentation. The results obtained from the entire analysis, visualized using the tools of tableau.

Keyword: *Business Intelligence, Data Warehouse, OLAP, Data Mining, K-Means, Segmentation, Tableau.*

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1. INTRODUCTION

The rapid advancement of technology in line with the times plays a role in the transformation of information systems and business technology, especially in the field of Business Intelligence (BI). Business Intelligence is a category that is generally used in technology to collect, store, analyze and provide access to data that can help users from the company[1] . The use of BI can contribute to turning data into useful information for decision making. In today's technological era, BI has provided significant support for many companies so that companies are able to improve operational performance, increase competitiveness, understand consumer habits, refine business flows, and respond more quickly and effectively to market changes. Therefore, BI serves as a crucial instrument in formulating data-related policies.

In its implementation, several analysis methods are applied in BI, including OLAP (Online Analytical Processing) which is used for multidimensional data exploration and Data Mining which serves to identify hidden patterns in data. As a result, the implementation of BI at XYZ store is expected to provide additional benefits to the company, especially in improving

the way data is processed and improving the quality of decision-making processes and business planning in the future.

2. METHODS

This research uses a qualitative method that allows getting an in-depth understanding and in accordance with the implementation of business intelligence with OLAP and data mining methods that can optimize needs and decision making through BI dashboards. [1]

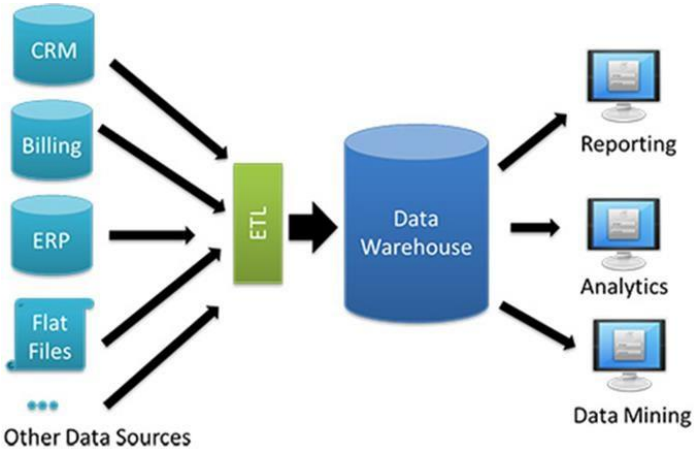

Figure 1 Business Intelligence

2.1 Data Sources

The data sources that will be used in this research are obtained from dummy data with a database structure with the name posci4[3] with MySql with the database platform. The data is designed to represent the main business processes at the XYZ store. The business process is simulated through modules (Enterprise Resource Planning) and CRM (Customer Relationship Management.

2.2 ETL

Data acquisition used in BI architecture is to implement the Extract, Transfrom, and Load (ETL) process. ETL is also a category of technology that moves data between systems ISSN: 2774-3993 3 by accessing data from various sources, then applying rules to transform and clean the data so that it is ready to be analyzed [2]. The Extract stage is the process of collecting data from various sources and locations to one central location [1]. In the transform stage, data is modified or transformed to conform to the desired structure and format. This includes merging columns, changing data types, and additional calculations [2]. The data is transformed to fit the desired structure and format. This includes column merging, data type changes and additional calculations [1]. After the data has been extracted and transformed as needed, it is then loaded into the target data store. This can be a data warehouse, relational database, data lake, or other storage system [1].

2.3 Data Warehouse

Information storage that is united in a centralized repository using MySQL as a data warehouse. Data that will be used for analysis is stored in the data warehouse. Data warehouse storage is separate from the transactional database because the data warehouse is read-only and there is no updating process [3]. To design a data warehouse, a nine-step kimbal method is applied, which is one of the methodologies that can be used to build a good data warehouse [4]. Nine Step was introduced by Ralph Kimball, a data warehouse and Business Intelligence

expert [5]. The following are the stages of the nine step kimball method: Choosing the Process, Choosing the Grain, Identifying and Conform the Dimensions, Choosing the Fact, Storing Pre Calculation In the Fact Table, Rounding Out the Dimension Tables, Choosing the Duration of Database, Tracking Slowly Changing Dimensions.

2.4 Reporting

Data analysis is a method of converting data into information. Data analysis is needed to get solutions to problems that are being worked on [6]. Data analysis in Business Intelligence is the process of collecting, processing, and interpreting data [1]. Based on BI Architecture, the data analysis used is OLAP (Online Analytical Processing) analysis and data mining with K-Means clustering technique. OLAP is a technology to answer analytic needs. OLAP is made for ad hoc data existence and analysis by displaying multidimensional databases. OLAP has the ability to combine classic drilldata into various forms of tables to be presented as an OLAP cube [7]. Cube in OLAP is a multidimensional data structure that allows fast data analysis, OLAP consists of 2 basic types [8] There are Measure, which is the part of the cube that contains the data set to be summarized, for example, quantity data, price, average value, amount, and so on. Dimension, which is the part of the cube that describes a category of data that will be used as a basis for summarizing the data. Data is usually grouped into several levels. The dimension that is generally always present is the time dimension. Data Mining is the process of analyzing big data to find patterns, trends, and useful information that can support decision making in a business. Data mining can understand customer behavior, improve operational efficiency and identify opportunities by utilizing statistical techniques, machine learning and analysis algorithms [9].

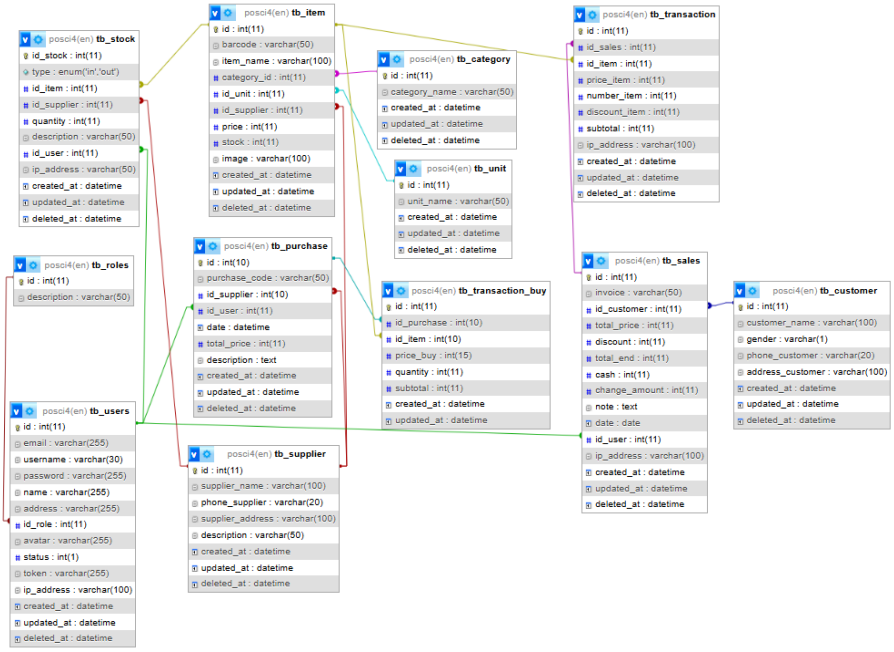

Figure 2 ERD

2.5 Presentation

The last stage of BI design is designing data visualization in the form of a dashboard. The goal is to provide a strategic overview that is easy to understand for decision makers. To create a reliable data visualization that allows users to explore, analyze and understand data in an intuitive and attractive way, an application called Tableau is used [10].

3. RESULTS AND DISCUSSION

The data source that will be used in this research is obtained from dummy data with a database structure with the name posci4 from [11] with MySql with the database platform.

The data is designed to represent the main business processes at the XYZ store. Based on the ERD [3] displayed there are 12 tables, namely item tables containing product data that includes category id, unit id, selling price, and product stock in the XYZ store. This table contains 206 data with the structure as shown in table 1.

Table 1 tb_item

No	Column name	Data type	Character length
1	id	integer	11
2	barcode	varchar	50
3	item_name	varchar	100
4	category_id	integer	11
5	id_unit	integer	11
6	id_supplier	integer	11
7	price	integer	11
8	stok	integer	11
9	image	varchar	100
10	created_at	datetime	-
11	update_at	datetime	-
12	delete_at	datetime	-

The category table contains product category data. This table contains 10 data with the structure as shown in table 2.

Table 2 tb_category

No	Column name	Data type	Character length
1	id	integer	11
2	category_name	varchar	50

No	Column name	Data type	Character length
3	created_at	datetime	-
4	update_at	datetime	-
5	delete_at	datetime	-

The customer table contains customer data from the XYZ store. This table stores information such as customer name, gender, customer phone number, and address. This table contains 4000 data with the structure as shown in table 3.

Table 3 tb_customer

No	Column name	Data type	Character length
1	id	integer	11
2	customer_name	varchar	100
3	gender	varchar	1
4	customer phone	varchar	20
5	category_name	varchar	100
6	created_at	datetime	-
7	update_at	datetime	-
8	delete_at	datetime	-

The Suppliers table contains information about suppliers or suppliers from XYZ stores. This table contains 73 data with the structure as shown in table 4.

Table 4 tb_supplier

No	Column name	Data type	Character length
1	id	integer	11
2	supplier_name	varchar	100

No	Column name	Data type	Character length
3	phone_supplier	varchar	20
4	supplier_address	varchar	100
5	description	varchar	50
6	created_at	datetime	-
7	update_at	datetime	-
8	delete_at	datetime	-

The purchase table is a table that stores purchase information between XYZ stores and suppliers. This table contains 3,813 data with the structure as shown in table 5.

Table 5 tb_purchase

No	Column name	Data type	Character length
1	id	integer	10
2	purchase code	varchar	50
3	Supplier_id	integer	10
4	id_user	integer	11
5	date	datetime	-
6	total_price	integer	11
7	description	text	11
8	created_at	datetime	-
9	update_at	datetime	-
10	delete_at	datetime	-

Slightly different from the purchase table, the sales table stores information about sales transactions between XYZ stores and customers. This table contains 8,234 data with the structure as shown in table 6.

Table 6 tb_sales

No	Column name	Data type	Character length
1	id	integer	11
2	invoice	varchar	50
3	customer_id	integer	11
4	total_price	integer	11
5	discount	integer	11
6	total_end	integer	11
7	cash	integer	11
8	change	integer	11
9	note	text	11
10	date	date	-
11	id_user	integer	11
12	ip_address	varchar	100
13	created_at	datetime	-
14	update_at	datetime	-
15	delete_at	datetime	-

The roles table is a table that stores information about roles or access rights in the XYZ store system. In this table there are 3 roles, including superadmin, administrator and cashier, with the structure as shown in table 7.

Table 7 tb_roles

No	Column name	Data type	Character length
1	id	integer	11

2	description	varchar	50

This stock table contains information about incoming and outgoing stock from XYZ stores. This table contains 2338 data with the structure as shown in table 8.

Table 8 tb_stock

No	Column name	Data type	Character length
1	id_stock	integer	11
2	type	enum	‘masuk’,’keluar’
3	id_item	integer	11
4	supplier id	integer	11
5	quantity	integer	11
6	description	varchar	50
7	id_user	integer	11
8	ip_address	varchar	50
9	created_at	datetime	-
10	update_at	datetime	-
11	deleted_at	datetime	-

This transaction table contains details of sales between XYZ stores and customers. This table contains 10,238 data with the structure as shown in table 9.

Table 9 tb_transaction

No	Column name	Data type	Character length
1	id	integer	11
2	id_sales	integer	11
3	id_item	integer	11
4	price_item	integer	11

No	Column name	Data type	Character length
5	quantity_item	integer	11
6	discount_item	integer	11
7	subtotal	integer	11
8	ip_address	varchar	100
9	created_at	datetime	-
10	update_at	datetime	-
11	delete_at	datetime	-

Similar to tb_transaction, this table contains details of purchases between XYZ stores and suppliers. This table contains 7,626 data with the structure as shown in table 10.

Table 10 tb_transaction_buy

No	Column name	Data type	Character length
1	id	integer	11
2	id_purchase	integer	10
3	id_item	integer	10
4	price_buy	integer	15
5	quantity	integer	11
6	subtotal	integer	11
7	created_at	datetime	-
8	update_at	datetime	-

The unit table contains units of goods from the product table. This table has 6 units, including bottles, pcs, fruit, kg, grams and packs. with the structure as shown in table 11.

Table 11 tb_unit

No	Column name	Data type	Character length
1	id	integer	11
2	unit_name	varchar	50
3	created_at	datetime	-
4	update_at	datetime	-
5	delete_at	datetime	-

The users table is a table that stores information about user data from the XYZ store system. This table contains 25 data with the structure as shown in table 12.

Table 12 tb_users

No	Column name	Data type	Character length
1	id	integer	11
2	email	varchar	255
3	username	varchar	30
4	password	varchar	255
5	name	varchar	255
6	address	varchar	255
7	id_role	integer	11
8	avatar	varchar	255
9	status	interger	1
10	token	varchar	255
11	ip_address	varchar	100
12	created_at	datetime	-
13	update_at	datetime	-

No	Column name	Data type	Character length
14	deleted_at	datetime	-

CONCLUSION

The implementation of Business Intelligence (BI) at XYZ Store has successfully answered various business needs through OLAP analysis and data mining. All analysis and segmentation results are visualized in an interactive dashboard using Tableau, which can effectively improve analysis efficiency and support data-based decision making for XYZ Store.

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