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Implementation of Sales Executive Dashboard for A Multistore Company in Yogyakarta

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***Abstract*— Information Technology is a part of strategic part for enterprise strategic planning. Information Technology can help the enterprise to determine its strategic planning. Through data from the past, the company can learn something and help to decide some strategic issue. A Multistore Company in Yogyakarta has more than five stores. The problem raises to generate real-time sales reporting. Sales manager and owner do not have access to real-time sales condition.**

To ease management analyzing and reporting sales condition, dimension model of the sales data needs to be built. This dimension model will help to make executive report from some dimensions mentioned in data warehouse. Sales data will pass through some processes: Extract, Transform, and Load (ETL) in order to prepare the data warehouse. This process is pre-processing data before dimensional model is built. In this research multi-dimensional modelling by taking data from 3 stores ranging from 1 February 2014 to 31 January 2015.

By implementing sales executive dashboard, it helps to monitor and analyze sales condition. Dashboard shows graphic which ease user, especially sales manager and owner to learn current and updated sales condition based on dimensions: time, outlet / store, and product. Report gives detail information and multidimensional helps to analyze data from different perspective.

***Index Terms*—Dashboard, Multi Dimentional Model, ETL, Executive Reporting**

I. INTRODUCTION

Development of Information Technology has been switched from operational to strategical issue. Information Technology helps company to make better decision by providing data analysis. Management takes benefits from this strategic information technology. One of the issues of strategic information technology is Business Intelligence. Business Intelligence brings a new horizon for company and bring real-time processing and analyzing data. Business Intelligence brings data processing into one step ahead. Business Intelligence providing information from the enterprise data.

Processing data from database needs three processes: extract, transform, and load (ETL). These three processes combine data from different and many data sources. It pull these data and store it into another database, which is called a data warehouse. Data Warehouse is built by using multidimensional model. Multidimensional model contains fact as a subject analysis and dimensions as perspectives to analyze the fact. This multidimensional model will be a baseline to build dashboard reporting.

Report visualization is a process to bring enterprise data into a meaningful information fast and easy to understand [1]. This visualization is called dashboard. Dashboard is a visualization result for data processing and has a purpose to be used for company's executive or manager (stakeholder) to measure company performance real time [1]. A system in the dashboard can handle and process big data and show it into short pages, show trends and information needed by company's manager or executive. Dashboard also gives manager a responsive user interface comparing with traditional reporting. Dashboard also give more information comparing with traditional reporting [1]. Designing the dashboard will help management and executive to identify trend, pattern, and / or data anomaly. Dashboard also can be used to help data analysis.

A retail company in Yogyakarta with more than one store has obstacles for management to manage and monitor sales condition. Sales data from outlet only save in local computer. It raises a problem if management want to monitor real time sales reporting. It takes much time to analyze the sales condition and needs to take strategic decision.

Management also has difficulties to produce real time sales report. Generating sales report spend more time. It needs to collect reports from stores and summarize it manually. Thus, management is unable to generate real-time reports. It needs much time to analyze some sales and managerial issues, such as stock level in every store / branches. From those situations, there are two research questions: (1) How to formulate multidimensional model for this

multistore retail company; (2) How to implement dashboard to visualize transaction data and bring information to management. In order to solve the research questions, researchers took data from 3 outlets as samples ranging from 1 February 2014 to 31 January 2015.

II. LITERATURE REVIEW

A. *Data Warehouse and Dimensional Model*

Data warehouse system were conceived to support decision making within organizations. These systems homogenize and integrate data of organizations in a huge repository of data in order to exploit this single and detailed representation of the organization's decision making [2]. Data warehouse is a system to extract, clean, transform, and send data source into a dimensional model and support to implement query and analysis to support decision making [3].

Therefore, considering that the very survival of the organizations frequently depends on the correct management, security and confidentiality of information [4], and the extreme importance of the information that users can discover by using these kinds of applications, it is crucial to specify confidentiality measures in the MD modeling process, and enforce them [4].

The data warehouse is a huge repository of data that does not tell us much by itself; like in the operational databases, we need auxiliary tools to query and analyze data stored [5]. Without the appropriate exploitation tools, we will not be able to extract valuable knowledge of the organization from the data warehouse, and the whole system will fail in its aim of providing information for giving support to decision making.

The usage of data warehouse will bring a good analysis of data. It will bring a good information to the business user. This information will support to make decision. Although as a decision support, information security is also a serious requirement which must be carefully considered as a element in the development lifecycle, from requirement analysis to implementation and maintenance [6].

Building data warehouse, the data should follow these three steps: extract, transform, and Load [7]. Extract is the first step. In this step, data is extracted. In this step, what information will be retrieved is also defined. The purpose of this step is to take data from its source. The next step is transform. In data transformation, some processes can be done: (1) data filtering; (2) data modification; (3) calculate measure and other new values; (4) Generate surrogate key value; (5) Creating summary from data. The last step is load. In this phase, data is loaded into data warehouse. In this phase, loading time interval is also be released.

The multidimensional conceptual view of data is distinguished by the fact / dimension. Multidimensional modelling is the process of the data modelling in the universe of discourse with the modelling structure to provide a multidimensional data model [8]. Multidimensional models categorize data, either as facts associated with numerical measure or as dimensions that characterize the facts and generally in plain text.

All multidimensional model contains fact and dimension tables with the variant of star schema or snowflake models. Fact is a term of the subject of analysis [2]. While, dimension shows different perspective or point of views where a subject can be analyzed from [2].

Multidimensional model is stored in a data structure called cube [2]. Cube can be generalized interpreted as a basic logical structure to describe multidimensional database. Cube operation is based on the most straight forward way to model multidimensional data. Each cube has a quantitative data that can be analyzed. This kind of data is called measures [2]

Building multidimensional model follows some phases / steps [5]: (1) Identify business process requirements; (2) Identify the grain; (3) Identify the dimensions; (4) Identify the facts; (5) Verify model; (6) Physical design considerations.

B. *Business Intelligence*

Business Intelligence is a term that covers data warehousing, data integration technology, query, report, and analysis tools [3]. Business intelligence gives business user independent access to information. One of the Business Intelligence implementation examples is implementation of Business Intelligence in multi-channel service delivery capability [9].

Business intelligence as IT application that helps organizations make decisions by using technology for reporting, data access, and also analytical applications [10]. Business Intelligence application also help to retrieve information that is hiding in database [10]. This hiding information are able to help worker formulate decisions by analyzing data [11]. A thorough formulation of business objectives and information technology must be established for an enterprise to obtain value from a BI implementation [12].

Performance Dashboard is a new model for Business Intelligence, building innovation to give suitable user interface for every user to retrieve information [1]. Imelda [13] tells that business intelligence is a process to extract company operational data and collect it into data warehouse. During data extraction, transformation and cleaning are done to implement formula, aggregation, and validation. This will bring a good for business issue.

III. RESEARCH METHODOLOGY

A. Building Data Warehouse

This research takes data from 3 stores ranging from 1 February 2014 to 31 January 2015. This data is used as a sample data. Researchers takes 3 stores as example. Those are: (1) Store at Jalan Magelang; (2) Store at Jl. KS Tubun (Kuncen); (3) Store at Jl. KS Tubun (MInang). To build the data warehouse, researchers adopt Johnson and Jones [7] methodology: (1) Data Extraction; (2) Data Transformation; (3) Data Loading.

1) Data Extraction (Extract)

Data from 3 stores are generated from different database. Those 3 stores use Access Database. These data are exported into SQL Server Database. From 3 stores, the number of data gained by researchers as follows:

1. Outlet in Jamal :

   There are 9649 transaction data and 30993 transaction detail data from this outlet.

2. Outlet in Kuncen

   There are 6825 transaction data and 19019 transaction detail data from this outlet.

3. Outlet in Minang

   There are 9521 transaction data and 31751 transaction detail data from this outlet.

Researchers drop some unnecessary columns. Those columns are in the some tables:

1. Table M_Data_Harga_Jual

   This table contains master data for product. In this table, columns for product code `[Kode Barang]`, product name `[Nama Barang]`, selling price `[Harga Jual]`, and net selling price `[Harga Net]` is used. Other columns will be dropped since it is not needed in dashboard reporting. After the cleaning process, the table structure as shown in table 1 below:

TABLE I. TABLE STRUCTURE M_DATA_HARGA_JUAL AFTER DELETE SOME COLUMNS

Fields / Column	Data Type	Size	Allow Null?
[Kode Barang]	Nvarchar	50	No
[Nama Barang]	Nvarchar	50	Yes
[Harga Jual]	Float		Yes
[Harga Net]	Float		Yes

From the table I, it is shown that the data warehouse uses 4 columns. Those columns have important information: Product id, product name, selling price, and net price. The other columns are deleted since have null values or 0.

2. Table Dt_Nota_H

   This table is the header for transaction data. There are some columns which have null values. Three columns are remaining: `[No Faktur]`, `[Tgl Keluar]`, `[Tipe Pembayaran]`. The table structure can be shown in table II:

TABLE II. TABLE STRUCTURE DT_NOTA_H AFTER DELETE SOME COLUMNS

Fields / Column	Data Type	Size	Allow Null?
No Faktur	Nvarchar	20	Yes
Tgl Keluar	Datetime		Yes
Pembayaran	Float		Yes

From table II, it is shown that there are 3 columns that have data about transaction number, transaction date, and total transaction.

3. Table Dt_Nota_D

   This table contains detail transaction data. Columns which have null values or 0 will be deleted. The remaining columns can be seen in table III:

TABLE III. TABLE STRUCTURE DT_NOTA_D AFTER DELETE SOME COLUMNS

Fields / Column	Data Type	Size	Allow Null?
No Faktur	Nvarchar	20	Yes
Kode Barang	Nvarchar	50	Yes
Nama Barang	Nvarchar	100	Yes
Jumlah	Float		Yes
Harga Satuan	Float		Yes
Total Gross	Float		Yes
Harga Netto	Float		Yes

From the table III, it is shown that there are 7 columns are used in this table. These 7 columns have information of transaction number, product code, product name, quantity, price per item, gross total, net price.

2) Data Transformation

Transformation is a process where extracted raw data is filtered and coded. This transformation will change data into specific value or add new columns.

There are some transformation processes that are done:

1. Categorize the product into generic and specific code. Category is used to simplify the analysis process. It will ease the management and executive to read the analysis.

2. Checking the product name and determine the new name for its product. Raw data from 3 outlets have different kind of product naming. As an integrated database, it should have the same name. Researchers did some changes for product names.
3. Researchers also give a new code to bring the same code among 3 database from 3 outlets. Although it is from the same company, 3 outlets have different kind of product code. Researchers transform it into a single code for the same product.
4. Adding transaction date to detail transaction table (DT_NOTA_D). This transaction date is derived from transaction date in header table (DT_NOTA_H).
5. Give outlet code for every transaction. The development of data warehouse involves 3 database from 3 outlets. Thus, every single transaction should be added outlet code. The outlet code are: (1) jamal for outlet located on Jl. Magelang KM 4.5; (2) kuncenn for outlet located on JL. KS Tubun No 75; (3) minang for outlet located on Jl. KS Tubun No. 83
6. Cleaning the data which have null values for product id and product name
7. Update the data which has different values for selling price [Harga Jual] and Net price [Harga Net]. The selling price and net price should have the same value.
8. Deleting row data in transaction detail for sales data which have quantity <= 0.
9. Copy the product data which have no sales record into a new table.
10. Add outlet code into a new table that contains product data from step 9.

3) Data Loading

Cleaning data cause reduce the number of rows. Table IV shows the number of rows before and after cleaning

TABLE IV. NUMBER OF ROWS BEFORE AND AFTER CLEANING DATA

Outlet ID	Number of Rows	
	Before Cleaning	After Cleaning
Jamal	30993	29419
Kuncenn	19019	18018
Minang	31751	30224

From the table IV, it is shown that there are some rows are deleting. Delete the rows that is not needed will bring a good analysis result.

B. Dimensional Model

To build dimensional model, researchers adopted processes from Ballard [5]. Dimensional model is a model based data to support high volume query access. Star schema is a tool to modelling multidimensional data in data warehouse. Star schema contains fact table with composite primary key and dimensional table with foreign key. Foreign key in dimensional table should respond exactly one component of primary key in fact table. There are some processes in order to design dimensional model [5]:

1) Identify Business Process Requirements

TABLE V. IDENTIFY BUSINESS PROCESS REQUIREMENTS

Business Process	Description	Functions
Sales Transaction	This business process record every transaction in each outlet. It needs to read reporting from different outlet as a dimension. Thus, it will help to define the suitable strategy for every outlet	Managerial Level

From table V, there is only 1 business process which involve in developing dimensional model. From the table V, it is needed outlet data as a dimension. It is needed to arrange the suitable plan and strategy for every outlet.

2) Identify the grain

TABLE VI. IDENTIFY GRAIN

Grain / Fact	Description	Business Process
Transaction Detail	Analysis is needed to view from different perspective related with information value from every transaction detail: quantity, transaction date, product name, price per item, gross total, and outlet.	Sales Transaction

From the table VI, it is known that there is only one source. Transaction detail will be the fact table and its value will be information detail, such as product name, transaction date, quantity, price per item, gross total, and outlet.

3) Identify the dimensions

TABLE VII. IDENTIFY DIMENSION NEEDED

Dimension	Description	Grain
Time	Time is identified into transaction date, year, quarter, month, week, and day	Transaction Detail
Product	Product is classified into product code, generic category, specific category.	Transcation Detail
Outlet	Outlet is identified into outlet code.	Transaction Detail

From the table VII, it is shown that there are 3 dimensions are needed in dimensional model. Those are time, product, and outlet. Every dimension is categorized into subcategory.

4) Identify the Facts

TABLE VIII. IDENTIFY FACT TABLE

Fact	Description	Dimension
Transaction Detail	Fact table of Transaction Detail is a collection of information and analysis with dimensions. Fact table contains transaction code, product id, product name, quantity, price per unit, gross total, and net price	Time Dimension Product Dimension Outlet Dimension

From table VIII, it is shown that there is one fact tables and 3 dimensions: time, product, and outlet. Fact table (transaction detail) already contains data which is needed for analysis process.

5) Verify the model

In this process, model is verified and some columns are recalculated as a formula.

Fact table: Transaction Detail

Model:

- SalesTotal = sum(detail_nota.Jumlah)
- GrossRevenueTotal = sum(detail_nota.totalgross)

In this process, there are two columns as a model. SalesTotal is the sum of quantity of sold product. GrossRevenueTotal is the sum of total gross.

6) Physical Design Consideration

The last step is physical step, especially data sorting and searching through indexing. Data in data warehouse already sorted based on primary key.

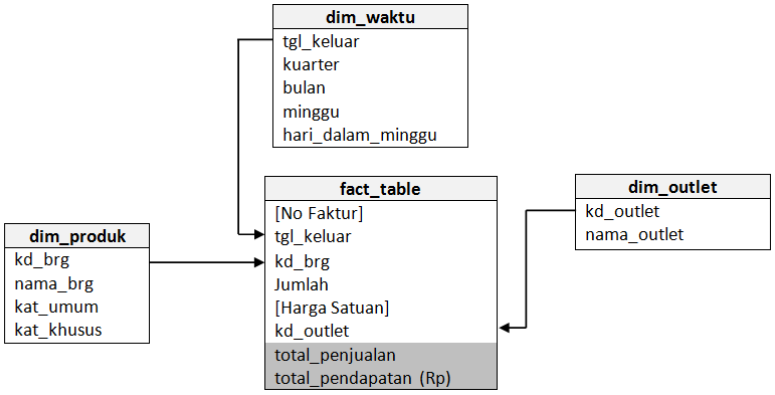

Fig. 1. Dimensional Model (Detail)

From figure 1, it is shown that there are 1 fact table with 3 dimensions. It is based on the design step. As a fact table is transaction detail with 2 added columns: sales total and total revenue. These 2 columns will be facts.

Facts:
Total Penjualan (Sales Total)
Total Pendapatan (Sales Revenue)

Table IX shows the dimensional model. Dimension time is divided into: Days in Week, Week, Month, and Quarter. While product is divided into: Generic Category, Spesific Category (Sub Category), and Product ID. Outlet dimension only has one dimension, which is outlet ID. As facts in this dimensional model are: Sales Total (Total penjualan produk) dan Revenue Total (Total pendapatan).

TABLE IX. DIMENSIONAL MODEL

Time	Product	Outlet
Quarter	Generic Category	Outlet ID
Month	Spesific Category	
Week	Product ID	
Days in Weeks		

C. Dashboard

Building dimensional model will lead to dashboard design. Information from the fact and dimension table will be presented using graphics.

1. Line Chart will be used to present sales transaction trend from specific period. Line chart will help user to read the trend of the data
2. Bar Chart will be used to compare between sales conditions among specific time.
3. Pie chart will be used to give information about percentage of product sales and comparing with dimension category, specific and generic category.

IV. IMPLEMENTATION AND ANALYSIS

A. *System Implementation*

Fact table and dimension table in Figure 1 and Table IX are initial steps to make cube and multidimensional database.

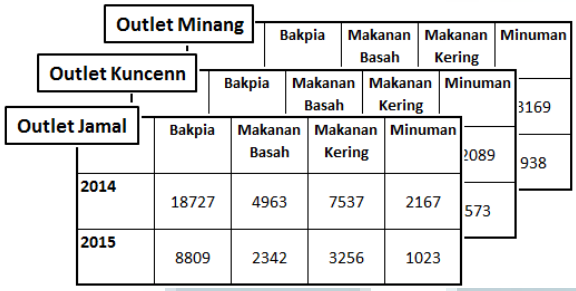

Fig. 2. Cube Multidimensional Model

Figure 2 shows cube multidimensional database that will be implemented to generate sales dashboard. Cube consists of fact table, dimensional table which has some descriptive columns, and measure. Descriptive columns in dimensional table will help to filter data based on dimension attribute. Measure is quantitative value to be analyzed. Measure value is gained from fact table and will be counted based on dimension on cube.

Data warehouse is ready after ETL process and cube multidimensional model design. Data warehouse can be used to analyze sales report. The next step is report implementation which has important role in managerial level and help in analysis process. It will bring to decision making based on this report.

		Measures TotalBrgTerjual dim-produk				
dim-waktu	dim-outlet	Minuman	Makanan Kering	Makanan Basah	Lain-lain	Bakpia
2014	minang	3,169	9,424	7,645	2,274	23,584
M12	minang	807	2,984	2,388	721	7,526
M11	minang	615	2,057	2,002	449	6,205
M10	minang	85	277	232	78	701
M9	minang	145	250	174	63	601
M8	minang	102	222	154	58	617
M7	minang	859	2,580	1,708	655	4,720
M6	minang	91	255	189	57	724
M5	minang	113	216	304	72	705
M4	minang	111	160	164	26	601
M3	minang	109	237	164	52	608
M2	minang	132	186	166	43	576

Fig. 3. Total Product Sold per Month (Item)

		Measures TotalPenjualan dim-produk				
dim-waktu	dim-outlet	Minuman	Makanan Kering	Makanan Basah	Lain-lain	Bakpia
2014	jamal	14,466,900	171,879,000	118,559,500	39,903,500	653,249,000
	kuncenn	12,744,500	85,478,500	102,816,000	11,502,000	420,712,500
	minang	17,587,800	218,472,300	176,818,000	28,263,500	822,085,000
2015	jamal	6,629,000	79,397,000	58,613,000	17,605,000	308,815,000
	kuncenn	3,720,500	26,607,000	34,267,000	3,839,000	141,581,500
	minang	4,847,500	59,002,500	45,158,500	8,075,500	236,240,000

Fig. 4. Total Gross Revenue (Rupiah)

Figure 3 and 4 show the total product sold per month and total gross revenue. This report is generated based on dimensional model. Management is able to make and analyze sales report and gross revenue from 3 dimensions: time, outlet, and product based on measure: total product sold and total gross revenue (in rupiah).

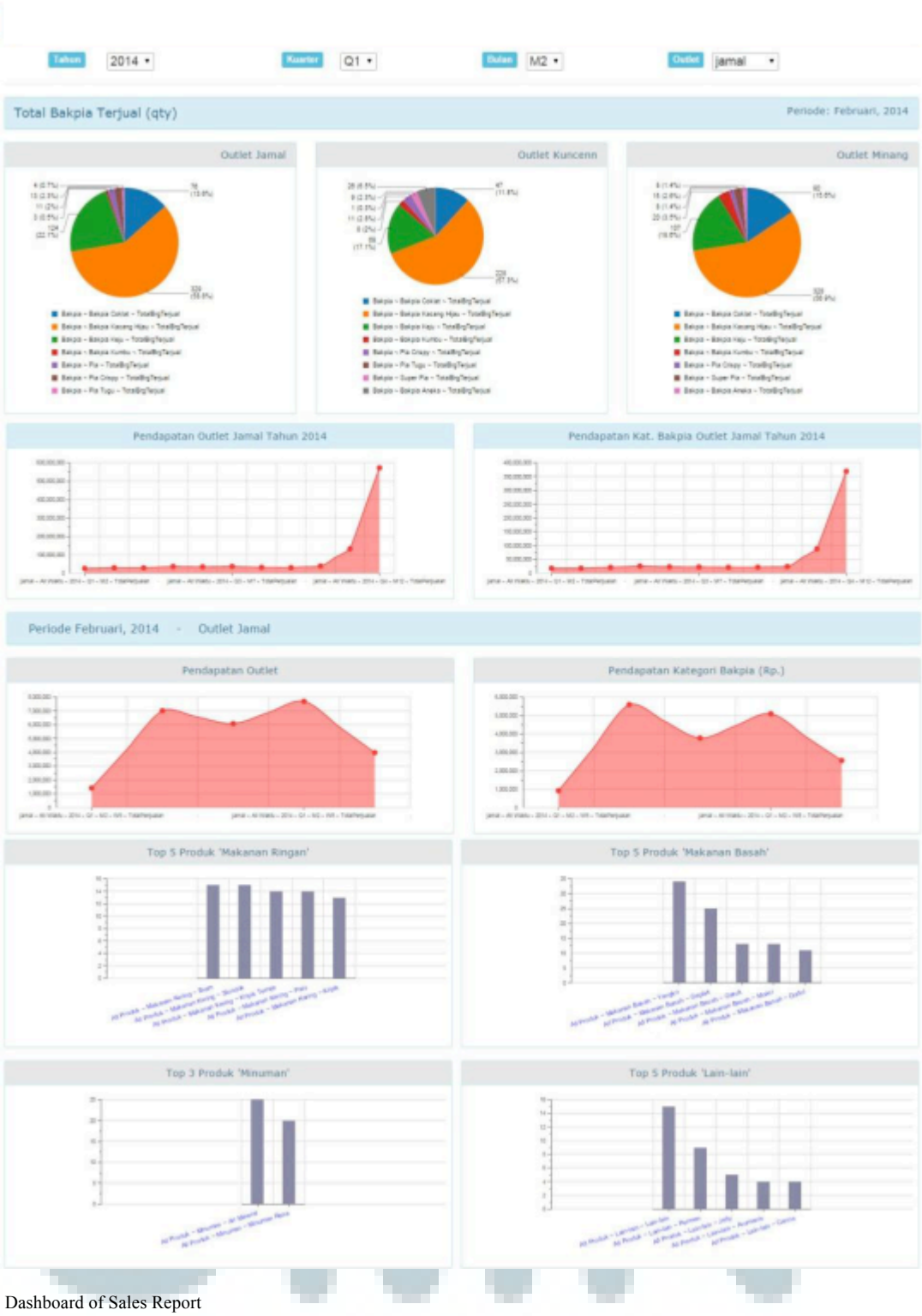

Fig. 5. Dashboard of Sales Report

Figure 5 shows sales report dashboard. Dashboard has feature to show graphics interactive based on chosen dimension value. Dashboard is also designed to capture information based on filter parameter. Filter parameter is defined based on dimension in cube.

B. System Analysis

Dashboard is designed to monitor and support management analysis for sales condition in company. Using dashboard, management is able to capture and monitor current sales record and condition. Dashboard also help management to explore data in many dimension and support performance review between

management and operational [1]. Sales transaction data will be visualized into 3 dimensions: time, outlet, and product. Using these 3 dimensions will help user to generate report based on its need.

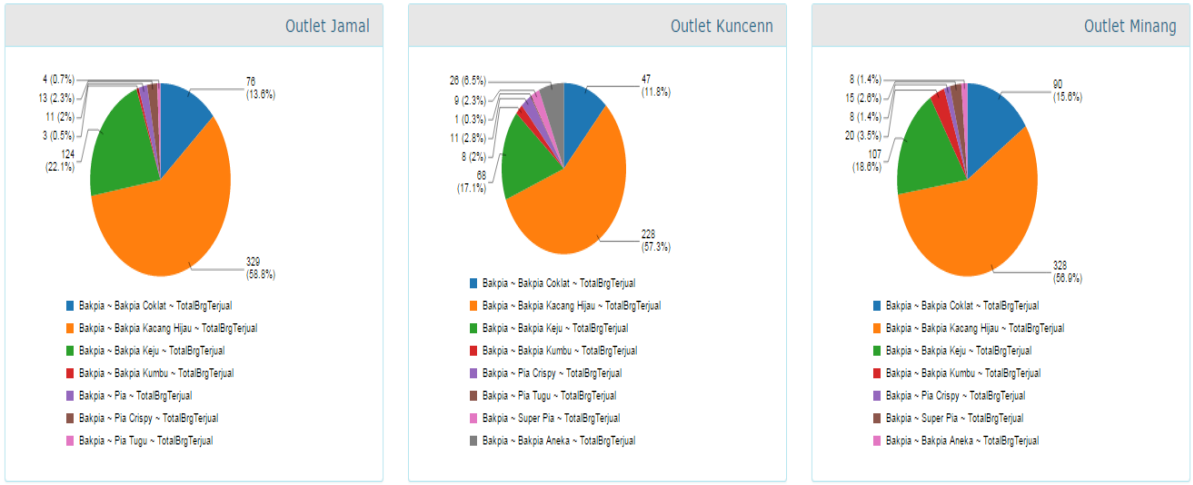

Fig. 6. Graphic of Item Product sold based on outlet dimension

Figure 6 shows total item product sold in every outlet. This graphic also indicates outlet dimension is used in this report. With this graphic, user is able to gain percentage of product sold based on product category. Color domination in pie chart shows best seller product.

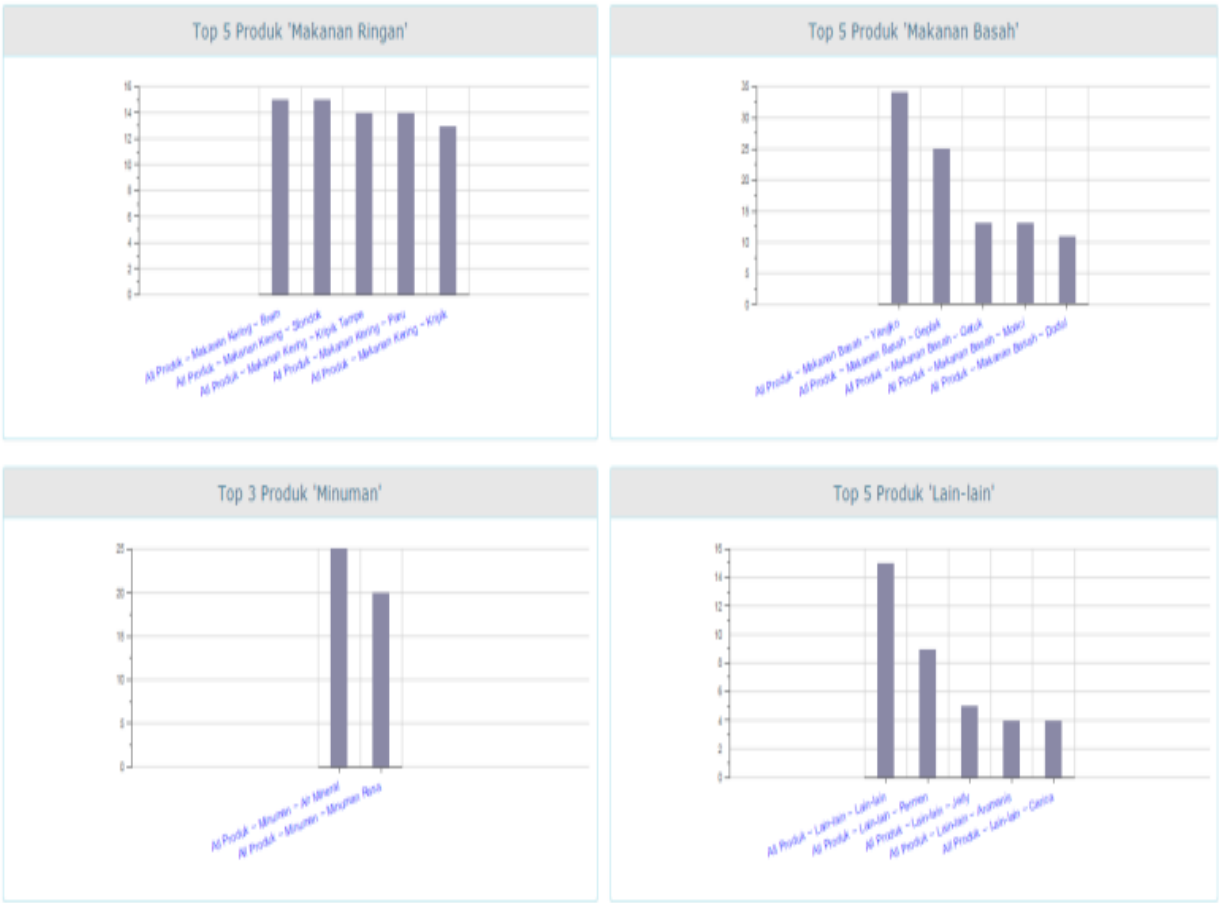

Fig. 7. Top 5 product for Generic Category

Figure 7 shows top 5 product. Bar chart shows top 5 product of generic category. Available generic category: Snacks, Food, Drinks / Beverages, and Others. Diagram in figure 7 shows information of item product sold for specific period and outlet.

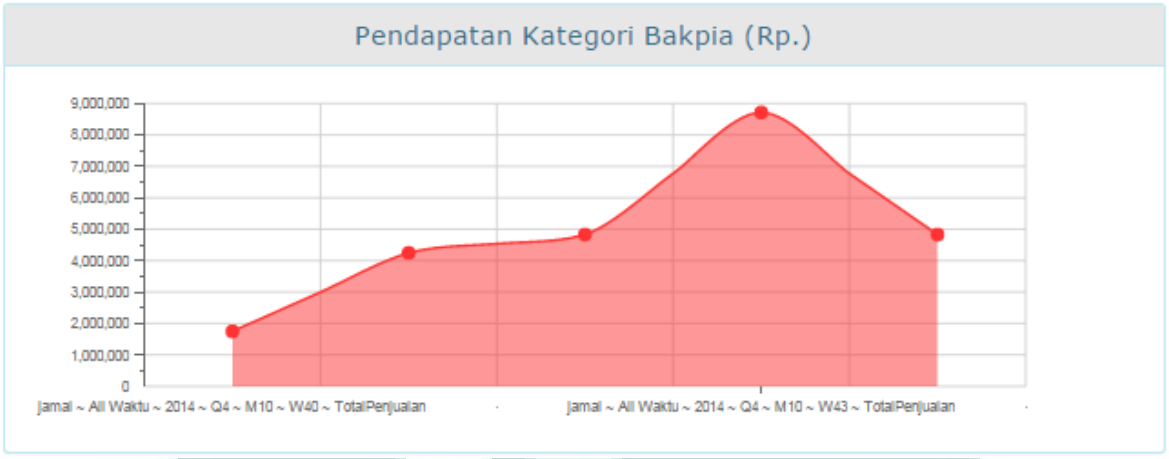

Fig. 8. Total Revenue Trend

Figure 8 shows trend for total revenue. Line chart indicates fluctuation of sales revenue during specific period of time. This line chart also bring an analysis to sales trend based on time dimension (day, week, month, and quarter). Management can read the data and analyze the sales position.

By developing dashboard business intelligence, sales manager and management has an independent access to the information [10]. The information generated in the dashboard are vary: (1) Top 10 product sold for every store; (2) Total revenue for each store and accumulative; (3) Revenue for each product category.

The system has some advantages for user, especially for sales manager and owner. Those advantages are: (1) Multidimensional model that are generated help owner to summarize the data into pivot table and can be monitored from some perspective through dimension; (2) Information are able to be drilled down into smaller dimension; (3) Sales data visualization and graphics are able to deliver sales information to sales manager and owner. But this system also has a disadvantage. System is unable to calculate company profit. To analyze company profit, it needs expenditure data.

V. CONCLUSION

Based on system implementation and analysis, there are some points as conclusion:

1. Sales transaction data dimensional model has been developed using 3 dimensions: time, outlet, and product category based on fact table which has information of sales transaction detail.
2. Dimensional model can be used to help making of executive reporting. The report is presented in table and converted into graphic.
3. Dashboard can be used based on dimensional model using multidimensional expression. Sales data can be derived and seen from many dimensions.
4. Business intelligence system and dimensional modelling can bring information and present it into dashboard visualization. This will help management to understand and analyze sales condition fast. This analysis will bring good and quick business decision.

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