Design of Business Intelligence System Using OLAP to Optimize Sales in A Coffee Shop

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Abstract. One of the coffee shops in Jakarta, Indonesia, always updates its menu as a strategic business to attract customers. However, business decisions taken by management did not base on data analysis. Business Intelligence (BI) is a collection of methodologies, processes, architectures, and technologies to transform data into meaningful and useful information. The information generated by BI used as a basis for decision-making in a company. This research aims to develop a business intelligence model design in a coffee shop using OLAP to make it easier for management to optimize sales and develop strategic business decisions. The data used is sales data from September 2020 to February 2021. Processing is carried out through the extract, transform, load (ETL) process. The design of a business intelligence system using OLAP and visualized by using Power BI sales performance from each department menu. Some suggestions given to the company include (a) data storage is carried out periodically and transferred to cloud storage; (b) managing data by transforming it into a digital sphere like Microsoft Power BI.
Keywords: Business Intelligence, OLAP, Data Visualization, Coffee Shop

1. Introduction

Until now, coffee shops in Indonesia keep growing into a promising new business. This can be seen from the mushrooming number of modern coffee shops in the last three years [1]. Until 2019, Until 2019, there were almost 3,000 coffee shop outlets, which increased nearly three times compared to 2016. This research was conducted at one of the coffee shops in Jakarta, the 8th bean cafe. The problems occur when they make decisions not based on data analysis. So, they experienced losses during September (19.84%), October (58.89%), and January (2.11%). Therefore, it is necessary to do a sales analysis using a business intelligence approach to help the management of 8th Bean Cafe obtain new knowledge which can be used as the basis for decision making.

Until now, many large companies have used Business Intelligence (BI). The main goal of BI is to enable easy interpretation of large volumes of data [2]. Many companies have made BI investments and shown progress in business analytics [3]. BI is "process and product". BI is a process which means it consists of the methods companies use to obtain useful information. Businesses with intelligence can help companies survive and thrive in a global economy. [4]. In general, BI uses a data warehouse as its data source. Generated information used as a basis for decision-making in a company.

ETL or Extract Transform and Load is a set of processes for retrieving and processing data from one or many sources into new sources. The purpose of ETL is the process of aggregating data from multiple sources into a large central repository called a data warehouse. Data sources from ETL can consist of text files, spreadsheets, databases, emails, websites, and so on.

Currently, research on the use of BI systems has increased significantly [5]. Many companies have recognized the ability of BI systems to generate information and knowledge [6]. BI has been applied to design marketing strategy for a restaurant. All information from BI expected to make the restaurant's executives easier to analyze marketing strategy [7]. BI implementation is also applied to the mobile application to provide efficient and accurate services to customers, by providing a unique menu for each customer [8].

Other BI systems used to food industry field is BI system for food industry at Pakistan. This system is used to help decision makers to forecast product category[9]. Business intelligence systems is important as a tool to provide accurate and useful information for marketing decision makers in a bakery [10]. Business Intelligence also used for development of food society information system at food safety agency, ministry agriculture in Indonesia [11]

The objectives of this paper include Designing a business intelligence system model using OLAP analysis; Generate data visualization using business intelligence tools; Provide advice to management to facilitate making more strategic and quality decisions.

2. Methods

BI concept can be decomposed into three parts: (i) Data Capture, (ii) Data Storage, and (iii) Data Access and Analysis [12]. For this research, data were collected from an internal source. Then the collected data is processed by Extract, Transform, and Load (ETL) before being stored in the data warehouse. Then, the stored data is analyzed for decision-making.

This study used case study in 8th Bean Café as one of Coffee Shop in Jakarta, Indonesia. The Data used from September 2020 to February 2021 from data historical at this cafe. Data processing is carried out using the OLAP Data Cleaning, Transforming, Aggregating, Loading method. OLAP is formed through the Extract, Transform, and Load (ETL) [13]. Figure 1 shown OLAP processing that used in this research.

ETL (Extract - Transform - Load) is the important step. It is the biggest task of the data warehousing process [14]. Extract means all processes needed to connect with various data sources and make the data available for next processes.

Information processing in the OLAP database cannot be done automatically by Mondrian. It requires a document that defines the OLAP database, called a schema. Physically, the schema is an XML file. The tool provided by Pentaho for writing schemas is the Pentaho Schema Workbench. The Mondrian schema formed will be presented using JPivot. Before entering the presentation process, the Pentaho BI server is already installed. Pentaho BI Server is a web application, which is a framework for doing various jobs related to business intelligence issues. Pentaho BI Server has features such as backend security, User Access Control List (ACL), audit logs, scheduler, and others. Pentaho BI Server can be accessed via port 8080. JPivot is an OLAP Navigator application. There is no need to install JPivot because this application is included in the Pentaho BI Server package.

Transform means this section refers to any function to change the incoming data into the desired data. The functions performed can be data transfer, modification of data content or structure, calculations, integration of data from other sources, and so on. Load means all processes needed to enter data into the final target.

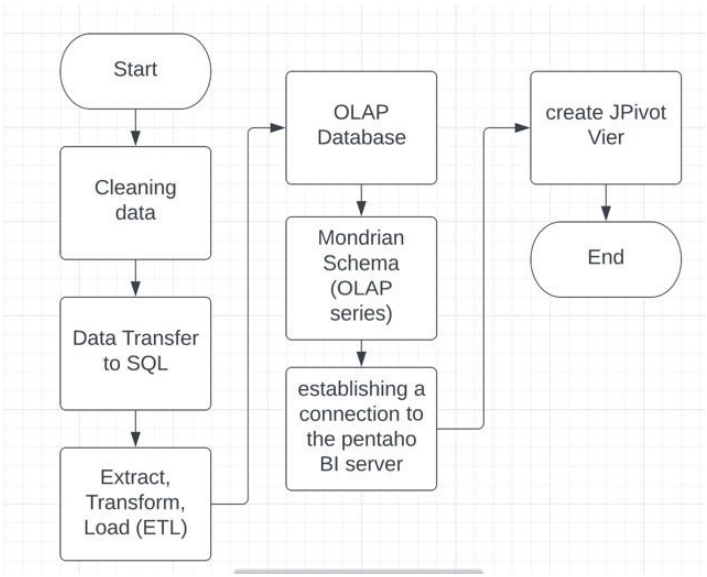


Figure 1 OLAP Processing

3. Results and Discussion

This coffee shop has many menu lists for customers. Overall, they have an 80 choices menu that is divided into Beverage and Food. All drinks, both coffee and tea, are included in the beverage group [15].

Data cleaning is carried out on data collected by removing unnecessary data. For example, words that are repeated and do not provide relevant information. In addition, there is a change in data names such as "PLU Name" to "Item_Name" and "Receipt No" to "Id_Transaction" to make it easier to understand. Figure 2 shown the data cleaning results.

Tahun	Bulan	Tanggal	Id_Transaksi	Id_item	Nama_item	Dep_kategori	Group_kategori	Qty_item
2020	9	1/9/2020 0:00	A20000016299	2	8TH BEAN CHCKN WIN	LIGHT BITES	FOOD	1
2020	9	1/9/2020 0:00	A20000016306	153	ICE AMERICANO	CLASSIC	BEVERAGE	1
2020	9	1/9/2020 0:00	A20000016313	37	ES KOPI JADOEL	SIGNATURE	BEVERAGE	1
2020	9	1/9/2020 0:00	A20000016313	60	ICE TARO LATTE	MILK-BASED LATTE	BEVERAGE	1
2020	9	1/9/2020 0:00	A20000016313	65	MILO	MACCHIATO / CHIZU	BEVERAGE	1
2020	9	1/9/2020 0:00	A20000016318	1	VIVA LA NACHOS	LIGHT BITES	FOOD	1
2020	9	1/9/2020 0:00	A20000016318	11	CHEESEBURGER	BURGERS	FOOD	1
2020	9	2/9/2020 0:00	A20000016375	1	VIVA LA NACHOS	LIGHT BITES	FOOD	2
2020	9	2/9/2020 0:00	A20000016375	2	8TH BEAN CHCKN WIN	LIGHT BITES	FOOD	3
2020	9	2/9/2020 0:00	A20000016375	56	ICE RED VELVET LATTE	MILK-BASED LATTE	BEVERAGE	3
2020	9	2/9/2020 0:00	A20000016375	207	POTATO WEDGES	SEASONAL FOOD	FOOD	2
2020	9	2/9/2020 0:00	A20000016375	128	MIX AND MATCH	MIX AND MATCH	FOOD	3
2020	9	2/9/2020 0:00	A20000016375	21	BUTTER FRIED RICE	MIX AND MATCH	FOOD	3
2020	9	2/9/2020 0:00	A20000016375	25	GRILL CHICKEN FILLET	MIX AND MATCH	FOOD	3
2020	9	2/9/2020 0:00	A20000016375	33	MOZZARELLA GRATIN	MIX AND MATCH	FOOD	3
2020	9	2/9/2020 0:00	A20000016376	213	GULAI BAKED RICE	SEASONAL FOOD	FOOD	3
2020	9	2/9/2020 0:00	A20000016388	14	SPAGHETTI BOLOGNE	FRIED RICE AND PASTA	FOOD	1
2020	9	2/9/2020 0:00	A20000016388	11	CHEESEBURGER	BURGERS	FOOD	1
2020	9	2/9/2020 0:00	A20000016388	153	ICE AMERICANO	CLASSIC	BEVERAGE	1
2020	9	2/9/2020 0:00	A20000016388	47	ICE CAFFE LATTE	CLASSIC	BEVERAGE	1
2020	9	2/9/2020 0:00	A20000016392	212	FISH AND CHIPS	SEASONAL FOOD	FOOD	1
2020	9	2/9/2020 0:00	A20000016401	218	SPAGHETTI LUMER	SEASONAL FOOD	FOOD	1
2020	9	2/9/2020 0:00	A20000016401	125	EXTRA MM. MOZZARE	MIX AND MATCH	FOOD	1
2020	9	2/9/2020 0:00	A20000016401	16	SPICY TUNA SPAGHET	FRIED RICE AND PASTA	FOOD	1

Figure 2. Data Cleaning Results

The results of data cleaning become the basis for designing Business Intelligence. Figure 3 is a step-by-step process for designing business intelligence system model for 8th Bean Café.

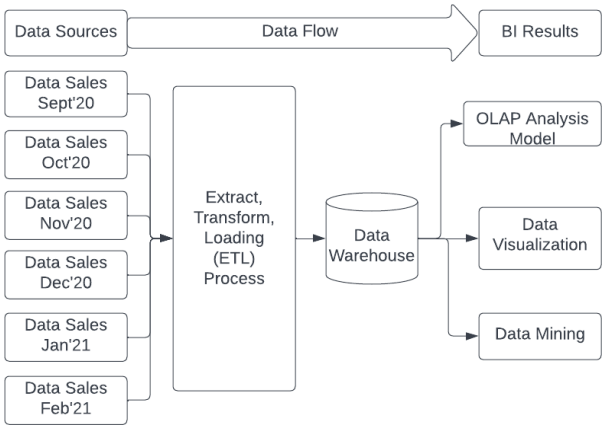


Figure 3 Business Intelligence Architecture

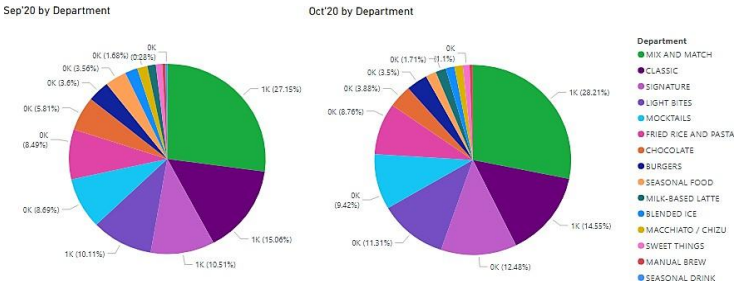
The components in Figure 3 relate to the basic functions of business intelligence [16]: extracting data from the operational system from 8th Bean Cafe, extracting data from data warehouse, and extracting data for business analysis.

The ETL process is done with the Pentaho Data Integration tool, known as "spoon". The ETL process begins by retrieving data from the sales database and entering it into the spoon worksheet as input. ETL takes advantage on this infrastructure is one of the primary information sources to get the data into the data warehouse [17]. Figure 4 shown OLAP database from ETL.

#	Tahun	Bulan	Nama_item	Department	Group	Qty_terjual	sk_kategori	sk_waktu
1	2020	9	8TH BEAN CHCKN WINGS	LIGHT BITES	FOOD	1	11	1
2	2020	9	ICE AMERICANO	CLASSIC	BEVERAGE	1	2	1
3	2020	9	ES KOPI JADOEL	SIGNATURE	BEVERAGE	1	1	1
4	2020	9	ICE TARO LATTE	MILK-BASED LATTE	BEVERAGE	1	3	1
5	2020	9	MILO	MACCHIATO / CHIZU	BEVERAGE	1	4	1
6	2020	9	VIVA LA NACHOS	LIGHT BITES	FOOD	1	11	1
7	2020	9	CHEESEBURGER	BURGERS	FOOD	1	12	1
8	2020	9	VIVA LA NACHOS	LIGHT BITES	FOOD	2	11	1
9	2020	9	8TH BEAN CHCKN WINGS	LIGHT BITES	FOOD	3	11	1
10	2020	9	ICE RED VELVET LATTE	MILK-BASED LATTE	BEVERAGE	3	3	1
11	2020	9	POTATO WEDGES	SEASONAL FOOD	FOOD	2	15	1
12	2020	9	MIX AND MATCH	MIX AND MATCH	FOOD	3	14	1
13	2020	9	BUTTER FRIED RICE	MIX AND MATCH	FOOD	3	14	1
14	2020	9	GRILL CHICKEN FILLET	MIX AND MATCH	FOOD	3	14	1
15	2020	9	MOZZARELLA GRATIN	MIX AND MATCH	FOOD	3	14	1
16	2020	9	GULAI BAKED RICE	SEASONAL FOOD	FOOD	3	15	1
17	2020	9	SPAGHETTI BOLOGNESE	FRIED RICE AND PASTA	FOOD	1	10	1
18	2020	9	CHEESEBURGER	BURGERS	FOOD	1	12	1
19	2020	9	ICE AMERICANO	CLASSIC	BEVERAGE	1	2	1
20	2020	9	ICE CAFFE LATTE	CLASSIC	BEVERAGE	1	2	1
21	2020	9	FISH AND CHIPS	SEASONAL FOOD	FOOD	1	15	1
22	2020	9	SPAGHETTI LUMER	SEASONAL FOOD	FOOD	1	15	1
23	2020	9	EXTRA MM. MOZZARELLA	MIX AND MATCH	FOOD	1	14	1
24	2020	9	SPICY TUNA SPAGHETTI	FRIED RICE AND PASTA	FOOD	1	10	1
25	2020	9	CHEESEBURGER	BURGERS	FOOD	5	12	1

Figure 4 Database for 8th Bean Cafe

The results of the data cleaning are then processed using Power BI software to display summary results with an easier-to-understand visualization [7]. The sales detail for each month is visualized with a pie chart in Figures 5. The pie chart provides information in the form of slices based on the sales proportion in all existing departments.



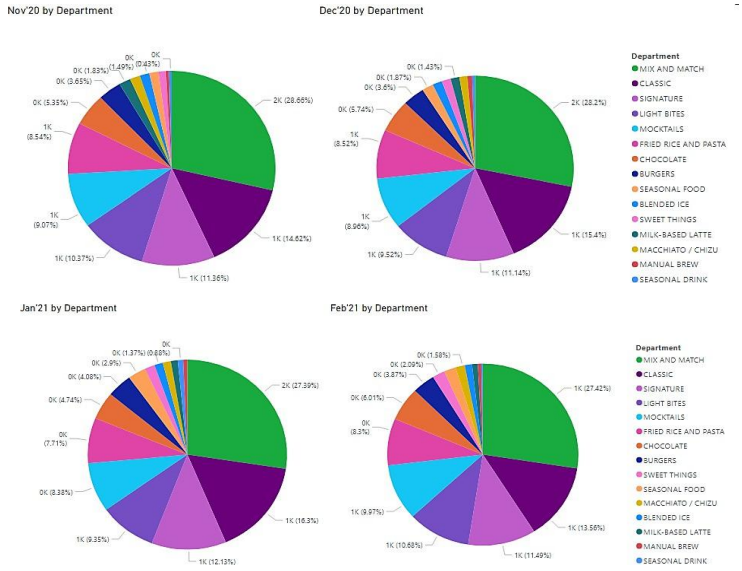


Figure 5 Pie Chart the Sale September 2020 to February 2021

The resulting pie chart provides information on the highest sales were for food in the mix and match category. Sales of mix and match each month respectively have a proportion of 27.15%, 28.21%, 28.66%, 28.2%, 27.39%, and 27.42%. The classic category is the second highest sales right after mix and match. classic in each month has a proportion of 15.06%, 14.55%, 14.46%, 15.4%, 16.3%, and 13.56%, respectively.

The overall sales visualization of each department is shown in Figure 6 by a stacked column chart. From this chart, Mix and match is the menu with the highest sales in this department. Likewise, seasonal drinks, indicate that the lowest sales are in that department.

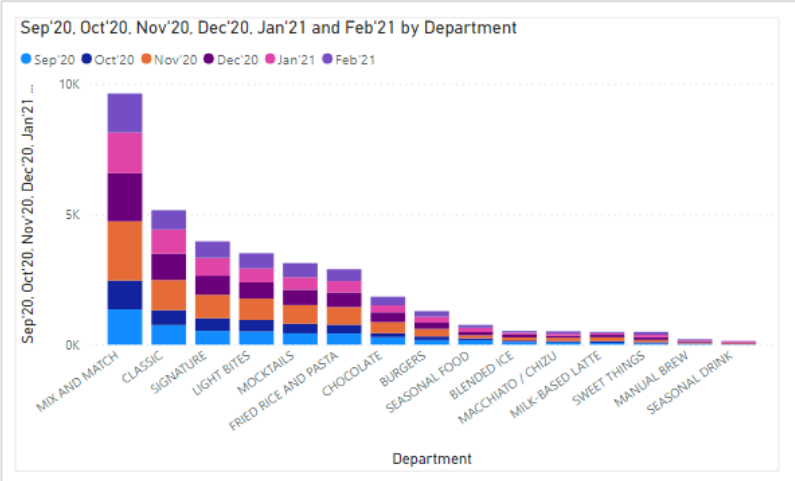


Figure 6 *Stacked Column Chart* for Sales

The results of the Business Intelligence design of 8th Bean Cafe provide benefits in the form of new knowledge as a basis for decision making. Data mining analysis with association rules [15] that have been done can be used as a sales strategy at the cafe. It is also supported based on data visualization results, where the classic and signature menus occupy the top 2 and 3 positions from total sales in 6 months.

The suggestion to this cafe is to make improvements related to data storage and management by transforming it into a digital scope. Data sales every month can be uploaded to the cloud. Then

transforming the data into the digital environment is not only related to the storage of raw data with large capacities, but how the data can provide information in a short, precise, and easily accessible place anywhere. The start of the transformation to the digital sphere prepares the company to enter the wider digital business ecosystem, making the company more structured, and resulting in more strategic business decisions. One of the tools that can be used is Microsoft Power BI. Power BI software is designed as a business intelligence tool with a very simple user interface. Data properly can be instantly converted into new information or knowledge for the company. In addition, real-time data control can be carried out anywhere, and at the same time by multiple users.

The limitation of this research is the results have not been implemented. Because management requires training to apply BI. The system environment must also be prepared to use BI, so the suggests can be used.

4. Conclusion

The design of the business intelligence system model provides benefits in the form of multidimensional sales report information. Results of sales data visualization using Power BI sales performance from each department menu. Based on analysis, the highest sales were for food in the mix and match department. Some suggestions that can be given to the company include are: (a) so that data storage is carried out periodically and transferred to cloud storage; (b) to manage data by transforming it into a digital sphere such as the use of Microsoft Power BI

5. References

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