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OLAP Approach in Searching Manufacturing Industries in West Sumatera

E P W Mandala¹, D E Putri², D W T Putra³, D P Mulya⁴

^{1,2}Computer Science Universitas Putra Indonesia YPTK Padang, Indonesia

³Computer Science Institut Teknologi Padang, Indonesia

⁴Computer Science Universitas Darma Andalas Padang, Indonesia

*ekaprajawm@upiypk.ac.id

Abstract. The manufacturing industry is a business that uses machines, tools and workers in the process of converting raw materials into finished goods that can be sold. The manufacturing industry has an important role in the Indonesian economy. The industry contributed a large income to the country. In West Sumatera, there are many manufacturing industries that are growing and developing both on a medium scale and large scale which are spread throughout the cities and districts. So that it makes it difficult for the Department of Industry of West Sumatera Province to collect data on the existence of manufacturing industries. To solve this problem, approach of Online Analytical Processing (OLAP) is used to search data in a hierarchical manner. OLAP is designed using fact tables and several dimension tables. OLAP will provide the number of industries as a measure . This research can help the people of West Sumatera to find out about the local manufacturing industry and what products the industry produces. In the end, local industrial products will be favored by many local people and increase the income of the province of West Sumatera.

1. Introduction

Information technology that is developing rapidly creates a new problem in daily activities. Computers are currently used by companies to process data in business activities. Decisions made by leaders will influence the development and growth of the company. So, the decision obtained must be in good judgment [1].

One of the technologies used as decision making is the data warehouse. Data warehouse is a system used to report and analyze data which contains historical information [2]. To develop a data warehouse can use the OLAP (Online Analytical Processing) approach. OLAP can provide real-time information access so that the data needed can be found quickly and precisely [3]. OLAP displays data from a database based on the time dimension and then makes a relation with another dimension table. The goal is to execute queries related to data aggregation rather than individual transactions. OLAP cubes are created using a star scheme that contains fact tables and several dimension tables [4].

The OLAP approach can be used to display historical information from the manufacturing industry. In Indonesia, there are many manufacturing industries from medium to large scale. The manufacturing



industry is needed to be able to meet the level of production according to market needs. The manufacturing industry includes the food industry, beverage industry, textile industry, clothing industry, leather industry, wood industry, paper industry, printing industry, chemical industry, pharmaceutical industry, rubber industry, metal industry and furniture industry.

West Sumatra is one of the provinces in Indonesia that has many manufacturing industries. This is the background of this research, namely the number of manufacturing industries so that the Ministry of Industry of West Sumatra Province finds it difficult to regulate and accommodate each of these industries.

In the first section of this paper, we will explain some related works that have been done before. Next we will determine business requirements, determine the fact tables and dimension tables used. Then design a star scheme as the basis of OLAP. The last section is the system produced using the OLAP approach that is made web-based.

2. Related works

Research with the OLAP approach has been carried out before, several research studies will be explained in this section. In 2005, research on business intelligence which included data warehouses, data mining and OLAP had been carried out. This research builds data warehouse and data mining applications in the retail industry. OLAP can help in determining the best vendors and can differentiate with other vendors. OLAP can also help with good category management and can support financial management and human resource management [5].

In 2008, research on data warehouses and OLAP was also conducted on the electronics industry in Mexico. This research explains how to build IT infrastructure based on data warehouse and OLAP to help quality management systems so that data recovery can be done quickly. And finally this infrastructure can help to make decisions for continuous improvement in the future [6].

In 2011, research was conducted on building a virtual data warehouse in the manufacturing industry to limit the scope and duration. This research discusses the development of a virtual data warehouse for supply chain management with a scale of multinational companies and consulting companies with large semiconductor manufacturing industries. Building a data warehouse starts from determining business requirements, identifying internal and external data sources, determining dimension tables, then designing star schemes and finally applying multidimensional models [7].

3. Business Requirement

Online Analytical Processing (OLAP) is a technology used to organize a large database of businesses and support business intelligence. OLAP databases are divided into one or several cubes, and each cube is organized and designed by administrator cubes to fit the way you take and analyze data so that it is easier to create and use PivotTable reports and PivotChart reports that you need.

There are several questions that can be answered by using OLAP, for example

1. How the growth of the manufacturing industry in 2018 is more than 2017 in West Sumatra?
2. How many manufacturing industries are recorded in West Sumatra?
3. How to classify manufacturing industries based on the type of industry in West Sumatra?

These questions can be answered by using data analysis from OLAP so that actions can be determined because OLAP focuses on queries and reporting.

To get a valid report, data and information are needed to be processed with OLAP analysis. Manufacturing industry data is obtained from the West Sumatra Statistics Agency which has been recorded for 5 years, starting from 2014 to 2018.

The number of Large and Medium Industry companies in West Sumatra during the period 2006-2015 are fluctuated. From 2008-2011 there was a sharp decline, 182 industries (2008) became 135 industries (2011). In 2013-2015 there was an increase. The number of industries increased from 140 companies in 2013 to 162 companies in 2015. The fluctuation of the number of large and medium industries each year is due to the provisions of the number of workers, where the number of workers in large industries and the minimum of 20 [8].

There are 143 manufacturing industries in West Sumatra. An industry can be categorized as medium industry if it has a workforce of between 20 and 99 workers. And it is categorized as a large industry if it has a workforce of 100 workers or more [9].

There are 18 manufacturing industry sub-sectors in West Sumatra in 2017 seen in Table 1 from West Sumatra Statistics Agency [9]

Table 1. Manufacturing Industry Sub Sector in West Sumatra in 2017

No	Sub Sector Code	Sub Sector	Number of Industries
1	10	Food products	71
2	11	Beverage products	6
3	13	Textiles	15
4	14	Wearing apparel	9
5	15	Leather products and footwear	1
6	16	Wood, wood and cork products (other than furniture) and plaiting materials of bamboo, rattan and the like	4
7	17	Paper and paper products	2
8	18	Printing and reproduction of recording media	5
9	19	Coal products and refined petroleum products	1
10	20	Chemical and chemical products	3
11	21	Pharmacy and pharmaceutical products	1
12	22	Rubber, rubber and plastic products	10
13	23	Non metallic mineral products	5
14	25	Fabricated metal products, other than machinery and equipment	2
15	28	Machinery and equipment	1
16	29	Motor vehicles, trailer and semi trailer	7
17	31	Furniture	6
18	33	Repair services and assembling of machinery and apparatus	1

4. Determine Fact Table and Dimensional Tables

4.1 Fact Table

Fact table is a table that generally contains numbers and historical data where the resulting key is very unique, because the key consists of a foreign key which is the primary key of several dimension tables that are related. Fact tables contain numerical values. These numeric values are usually referred to as measures. The resulting fact table is Fact_Industries with a measure of the number of industries.

4.2 Dimensional Tables

Dimension table is a table that contains a category with a summary of detailed data that can be reported from measurements. Some dimension tables that can be defined are

- Dim_Time
The time dimension is a dimension table that is almost always present in every OLAP. The time dimension usually contains year, quarter, month, etc
- Dim_SubSector
SubSector dimension is a manufacturing industry sub-sector in West Sumatra. SubSector dimension contains the subsector code and subsector name
- Dim_MajorGroup
MajorGroup dimensions are the main industrial groups that are grouped from each subsector. MajorGroup dimension contains majorgroup code and majorgroup name

- **Dim_SubGroup**
SubGroup dimension is an industry principal subgroup grouped from each majorgroup. The SubGroup dimension contains the subgroup code and subgroup name
- **Dim_TypeIndustries**
TypeIndustries dimension is a type of industry that includes medium and large industrial industries. TypeIndustries dimension contains typeindustries code and typeindustries name
- **Dim_MainProduct**
MainProduct dimensions are the main products produced by the manufacturing industry. MainProduct dimensions contain the mainproduct code and mainproduct name
- **Dim_District**
District dimension is the location of the manufacturing industry. District dimension contains district name.

5. Design Star Scheme

After the fact table and all dimension tables have been determined, the next process is to design a star scheme that will be used to produce OLAP. Why is this scheme called a star scheme? Because this scheme looks like a star, with a dimension table that surrounds the fact table. The main characteristic of a star scheme is that the dimension table is not normalized. The star scheme designed is shown in Figure 1.

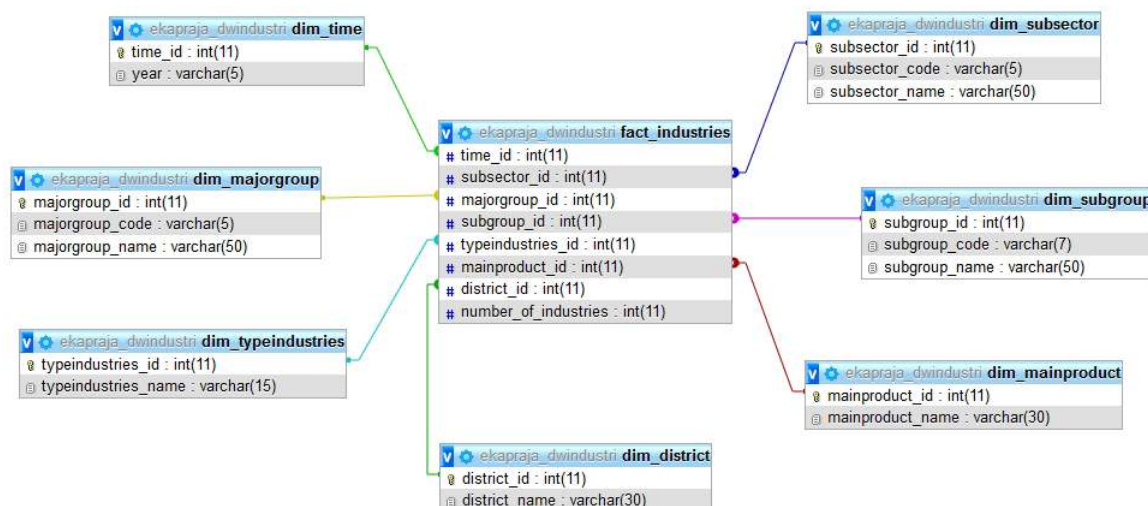


Figure 1. Star scheme for OLAP manufacturing industry

The star scheme in Figure 1 shows the relationship between one fact table with seven dimension tables. All primary keys in the dimension table will relate to the foreign key in the fact table. The fact table contains all the IDs of each dimension table and one measure, namely the number of industries.

6. Implementation OLAP using Web-based Application

After completing the design of the star scheme, the next step is implementing OLAP using a website-based application. Why is it website based? Website is a page of information that is presented online through the internet so that it can be accessed by anyone, anywhere and anytime as long as there is still an internet connection [10]. The reason is that the OLAP manufacturing industry can be accessed by the public to obtain information about the manufacturing industry in West Sumatra. OLAP will greatly assist the Department of Industry of West Sumatra Province and the West Sumatra Statistics Agency in managing the manufacturing industry.

OLAP manufacturing industry implemented in the website can be seen in Figure 2

OLAP MANUFACTURING INDUSTRY IN WEST SUMATRA

YEAR	TYPE INDUSTRIES
<input checked="" type="checkbox"/> 2017	<input checked="" type="checkbox"/> Medium Industries
SUB SECTOR	MAJOR GROUP
<input checked="" type="checkbox"/> 10 - Makanan	<input checked="" type="checkbox"/> 104 - Pengolahan Minyak Kelapa
SUB MAJOR GROUP	MAIN PRODUCT
<input checked="" type="checkbox"/> 10431 - Industri Minyak Mentah Kelapa Sawit	<input checked="" type="checkbox"/> 104315 - Crude Palm Oil (CPO)

DISTRICT	NUMBER OF INDUSTRIES	DISTRICT	NUMBER OF INDUSTRIES
Kota Bukittinggi	0	Kab. Lima Puluh Kota	0
Kota Padang	4	Kab. Padang Pariaman	1
Kota Pariaman	0	Kab. Pasaman	1
Kota Payakumbuh	0	Kab. Pasaman Barat	12
Kota Sawahlunto	0	Kab. Pesisir Selatan	1
Kota Solok	0	Kab. Sijunjung	0
Kab. Agam	3	Kab. Solok Selatan	3
Kab. Dharmasraya	6	Kab. Tanah Datar	0

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Figure 2. OLAP manufacturing industry

Figure 2 illustrates how seven-dimensional tables such as year, type industries, sub-sectors, major groups, sub-major groups, main products and districts can influence measure, namely the number of manufacturing industries in West Sumatra. Hopefully this OLAP can be an alternative media for searching the manufacturing industry in West Sumatra.

7. Conclusion

Data and information are collected from the statistics center of West Sumatra such as historical data and historical information about the manufacturing industry from 2014 - 2018, perceived need to analyze the data and information, so that data and information can be used to see the development of manufacturing industries in West Sumatra.

Our approach, in a first step, we determine and collect all business requirement in the form of data and information related to OLAP development. The second step, we determine the fact tables and dimension tables where we define one fact table and seven dimension tables. The third step, we design a star scheme. And the final step, implementing OLAP using web-based applications.

OLAP implemented will be very helpful in providing data and information regarding the number of manufacturing industries in West Sumatra.

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