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DESIGNING DATA WAREHOUSE MODEL USING BENEFIT COST RATIO ANALYSIS METHOD (CASE STUDY IN PT. ADVANCE)

Data warehouse has function to make the spreaded company's data to be integrated and concise, thereby it helps the executives in analyzing the existing data to obtain a quick and accurate strategic decision. This research has objective to design a data warehouse within the scope of application of the benefit-cost ratio. As a solution to the feasibility of the company's business, the unity of different data enables it to be combined with the results of the company's in-depth analysis. In designing the model, this research succeeded in designing data warehouse with the application of benefit-cost-ratio method which is used to carry out in-depth analysis of financial sector by providing the feasibility and percentage results of the current business. To summarize, the source data that is processed into the process of extracting, transforming, and loading which built by the star schema will affect the quality of generated data for the process of queries. In addition, the results of the data warehouse used for the decision-making process and feasible business strategy.

Keywords: data warehouse, ETL, BCR, OLAP, decision making.

Introduction

Nowadays, the development of data warehouse has become a familiar aspect for users in multiple departments of the organization, which proved by abundance data. Its development is one of the way to extract important information from scattered data in some information systems to a centralized integrated storage and meet the needs of data history records. This integrated data used for information transmission activities, reviewed from

various dimensions, and the level of detail can be set [1]. However, in order to obtain a fast and accurate analysis, it still requires further observations from various sources [2].

Problem Setting

The data warehouse has been successfully used in various needs in academia, the private sector, hospitals, government and other fields, for example

in PT. Advance which is a retail company engaged in sales and has a lot of data.

This large amount of data not only helps the upper-level supervisors and managers to carry out business operation activities or selected policy strategies, but also makes it difficult for the manager to conduct further analyses on the next selected strategy to determine the feasibility of the business. Therefore, it needs a system that can combine data from various sources to produce path-focused analysis results [3]. As for the data from the company, it can be determined through in-depth benefit-cost ratio analysis to determine the feasibility of the business being explored, thereby providing information that can be used in the decision-making process [4].

The data stored in the database used in the data warehouse is data in a unified format. This format is more meaningful and can generate high-quality data to support the decision-making process [5].

The benefit-cost ratio (BCR) is the ratio used in cost-benefit analysis to summarize the overall relationship between the relative costs and benefits of a proposed project. BCR can be expressed in currency or qualitative terms. If the BCR of the project is greater than 1.0, the project expected to bring positive net present value to the company and its investors [6].

Hence, this research has an aim to design the data warehouse within the application of benefit cost ratio as solution to the feasibility of the company's business, the unity of different data makes it integrated with the results of in-depth analysis of company.

Methods

The material and methodology of this research explained below.

A. Data Warehouse

Data warehouse defined as the data, which comes from various OLTP applications that need to be centralized for the purposes of analysis. The data should be processed into subject oriented, integrated, non volatile and time variant [2]. Since, data warehouse ensures a single-door

access mechanism for management; it allows the integration of various types of data from various applications or systems. Hence, it can obtain information and make decision analysis.

Data warehouse can help knowledge workers – executive, managers, and analysts make faster and more informed decision [1]. The [7] stated that data warehouse is not a product but an environment in which users can find strategic information. The data warehouses often been used to benefit various kinds of organizations, besides being able to make it easier for the system users, it is also known to be reliable for carrying out historical data analysis because the implementation can be done within the fast and accurate queries for analysis and decision making [8]. The data warehouse architectures layer showed in Figure 1 below.

B. Extract, Transform, Load

The ETL (extract, transform, and load) process is the stage that passed to develop the data warehouse. The process includes three phases, (1) the extraction process is to convert the data in the source into the required format, (2) the transformation process is completed to process the data into format as needed within the data warehouse; and (3) the loading process is the phase of loading data which the transformed data is ready to be loaded into the data warehouse [10]. This ETL process greatly affect the quality of the produced data. At this stage, the used data sources will be cleaned and unified to produce a good data and saved it to the storage. Therefore, it will be able to provide the expected analysis. ETL can also be called as the process of entering and sending data from data sources to data warehouse [11]. The figure 2 below showed the process of ETL.

C. Benefit Cost Ratio

Benefit and Cost Ratio is an analysis concept used to determine the feasibility of a project. Generally, B/C ratio has the function to determine the feasibility of a project related to the interests of public with formulation as below;

$$BCR = \frac{PV \text{ Benefit}}{PV \text{ Cost}}$$

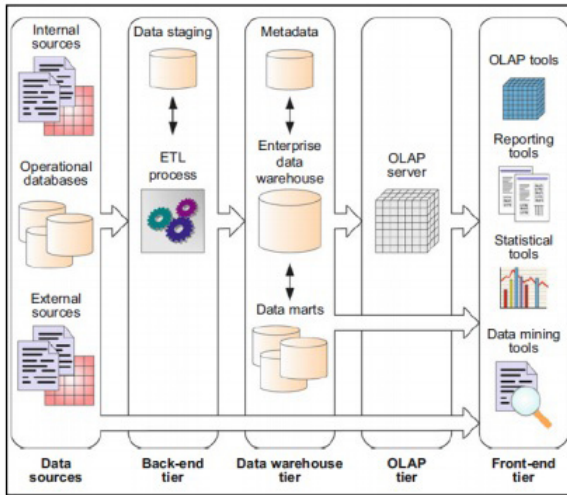


Fig. 1. The Data Warehouse Architecture layer. Sources: [9]

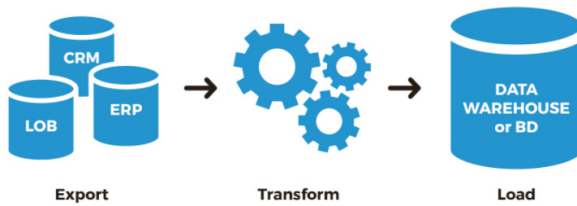


Fig. 2. ETL Process Flowchart

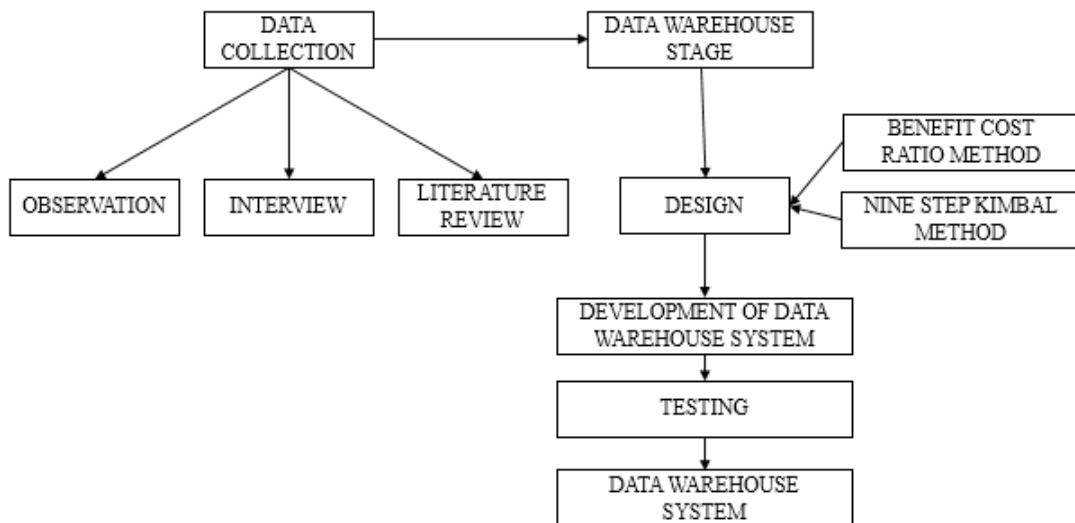


Fig. 3. Research Methodology

If the profit yields is bigger than one (> 1) then the business declared as feasible and vice versa, but if the profit is smaller than the cost ($< \text{cost}$) then the business is declared as not feasible.

D. Research Methodology

The research methodology is depicted in Figure 3 below by initiating and collecting sources obtained from various processes within the company such as data sales, locations, rental targets, marketing, customers, goods which are then built by nine steps of Kimball method and BCR analysis and testing the system, then finally ready for use. Those nine steps of Kimball are (a) choosing a process, (b) choosing a grain, (c) identifying and adjusting dimension, (d) choosing a fact, (e) saving the pre-calculation on fact table, (f) ensuring the dimension table, (g) choosing the duration based data, (h) observing the changing dimension, and (i) define the priority and query model. The steps on research methodology can be seen in the following figure below.

Results and Discussion

A. General Description of System

The general description indicates the author's ideas for designing the system, which details are shown in the Figure 4 below;

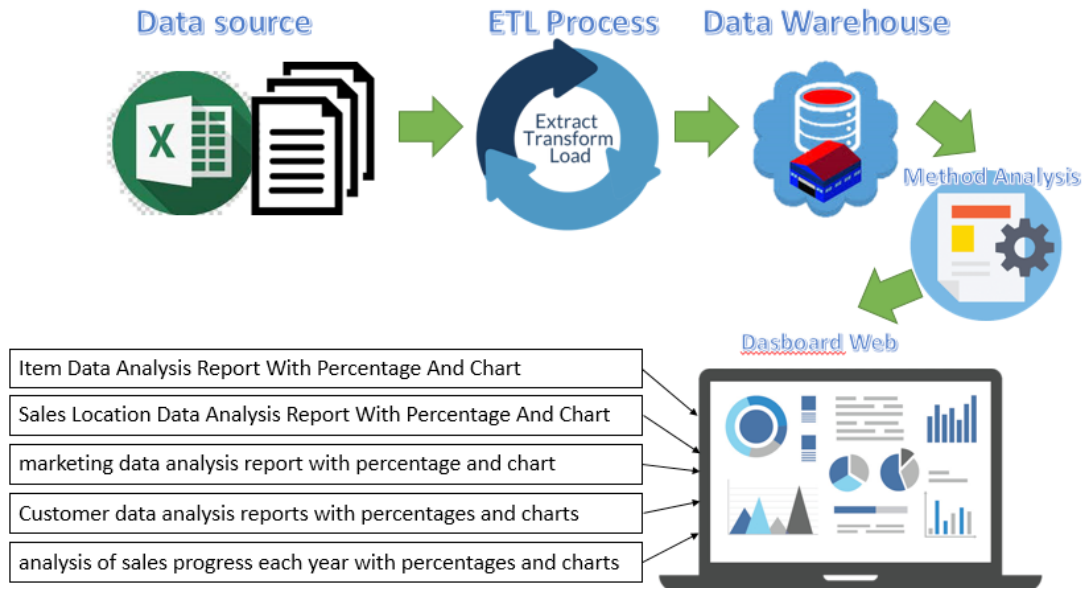


Fig. 4. Data Warehouse Overview of PT. Advance

Fig. 4 above described the initial process where the data obtained from source will be carried out by ETL stage, which aims to clean the data and perform unity that is integrated into the data warehouse. This ETL stage is greatly affects the quality of the owned data, regarding the owned source data is correctly related to the generated output data. After the data stored in data warehouse, then there is a process of applying BCR analysis method to determine the feasibility of business by calculating the ratio and percentage of a result. The last process that displayed on visual dashboard with an attractive appearance is combined with a chart that will make it easier for managers to perform an analysis.

B. Schema Dimensional Data Warehouse

Multidimensional data model design is intended for data modelling that will be used in the decision-making process for management. The following below is a modelling image of the multidimensional data model used in this design by Star Schema model.

This stage consists of six dimension tables that surround a fact table where the fact table itself is the sales table because in this table, there are values that can be calculated as an overview. There are six dimensions included, dim_customer,

dim_marketing, dim_showroom, dim_salesdetail (goods), dim_time, and dim_contract_detail. From the entire dimension table and related facts, the ETL process was carried out to produce data that is valid and stored in data warehouse. Several ways can be done by additional software, for instance, the software that familiar in the market for ETL process is kettle software (pentaho data integration). This kettle software can be used in ETL data warehouse process. The dimension table and its attributes in this study include, among others kettle Software can be used for ETL data warehouse process. The dimension tables and its attributes in this study are:

C. Discussion of Design Results

In this design, the data source taken from the year of 2018 to 2020. These data sources have been analysed at the ETL process stage and used calculation methods to determine the cost-benefit ratio method applied to determine the operation viability of the business, as seen in table 8 below:

From the results of design analysis, the source data can be integrated and utilized for the benefit of analysing the functionality of the sales location through the calculation of sales value compared to the target ratio, therefore, managers can quickly

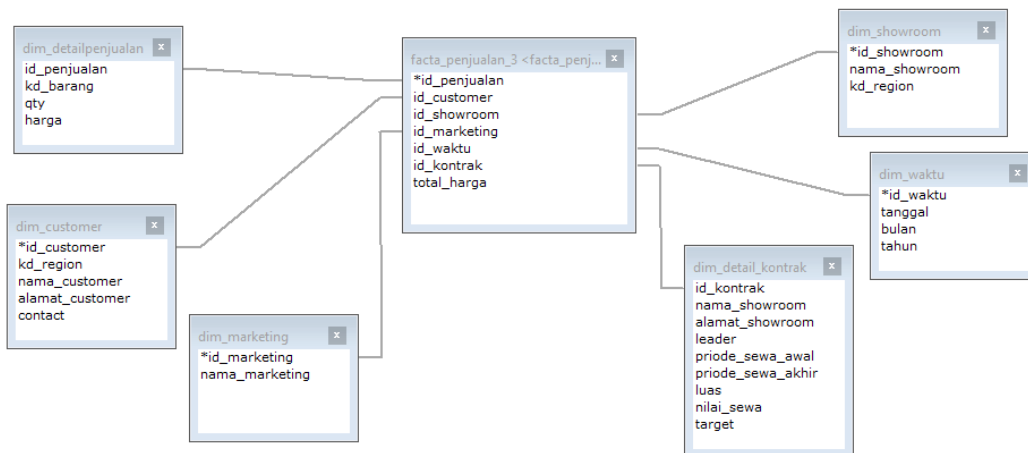


Fig. 5. Star Schema Dimensional

Table 1. Sales Fact

Field	Type (Length)	Description
Id_sales	Varchar (20)	Sales id
Id_customer	Varchar (20)	Customer id
Id_showroom	Varchar (20)	Showroom id
Id_marketing	Varchar (20)	Marketing id
Id_time	Varchar (20)	Sales id
Id_contract	Varchar (20)	Sales id
Total_sales	Int	Total sales

Table 2. Sales Detail Dimensions

Field	Type (Length)	Description
Id_sales	Varchar (20)	Sales id that connected to sales fact
Kd_item	Varchar (20)	Item code
Qty	Int	Total item
price	Int	The unit price of goods

Table 3. Customer Dimension

Field	Type (Length)	Description
Id_customer	Varchar (20)	Customer id that connected to sales fact
Kd_region	Varchar (20)	Regional code
Name_customer	Varchar (50)	Customer name
Address_customer	Varchar (100)	Customer address
Contact	Varchar (20)	Customer phone number

Table 4. Marketing Dimension

Field	Type (Length)	Description
Id_marketing	Varchar (20)	Marketing id that connected to sales fact
Name_marketing	Varchar (50)	Marketing name

Table 5. Showroom Dimension

Field	Type (Length)	Description
Id_showroom	Varchar (50)	Showroom id that connected to sales fact
Name_showroom	Varchar (20)	Showroom location
Kd_region	Varchar (20)	Sales regional code

Table 6. Time Dimension

Field	Type (Length)	Description
Id_time	Varchar (20)	Time id that connected to sales fact
Day	Varchar (20)	The day that links to the event
Month	Varchar (20)	The month that links to the event
Year	Varchar (20)	The year that links to the event

Table 7. Contract Detail Dimension

Field	Type (Length)	Dimension
Id_contract	Varchar (20)	Contract id that connected to the fact
Name_showroom	Varchar (50)	Showroom name
Address_showroom	Varchar (100)	Sales address
Leader	Varchar (50)	Leaders of the area
Intial_lease_period	Date	Initial lease period
End_lease_period	Date	End of lease period
Total area	Varchar (20)	Total area
Rental_value	Int	Sales location rental value
Target	Int	Sales target ratio

carry out analysis in decision-making process. Based on the data sources processing with the benefit of cost ratio method, the showroom G (Gramedia) MBG (K) on the date January 1-31, 2020 can reach the top of result feasible 1743.4% with the omset 871.702.240.

Therefore, this showroom gets the highest omset from those dates rather than other showrooms. This result can help managers in the decision-making process and policy. The database also become more structured and simple which make it easy to be read. Compared to the other data warehouse, this benefit cost ratio data warehouse has strength in quick decision-making process with simple and compact display. The analysis shows that data warehouse technology has been adopted in company as well as in government organizations for managing their huge data and for decision making.

Table 8. Data Sources Processing with the Benefit of Cost Ratio Method

No	Showroom	Period	Contract lease	Target Ratio	Omset	Result,%, Feasible
1.	G GRAMEDIA MBG (K)	01-31 Jan. 2020	5.000.000	50.000.000	871.702.240	1743,4
2.	G GRAMEDIA MBG (K)	01-28 Feb. 2020	5.000.000	50.000.000	408.202.000	816,4
3.	G GRAMEDIA MBG (K)	01-31 Mar. 2020	5.000.000	50.000.000	148.900.000	297,8
4.	G GRAMEDIA MBG (K)	01-30 Apr. 2020	5.000.000	50.000.000	119.821.200	239,64
5.	G GRAMEDIA MBG (K)	01-31 May 2020	5.000.000	50.000.000	166.936.000	333,87
6.	M MITRA 10 GATSU	01-31 Jan. 2020	6.750.000	67.500.000	257.274.000	381,15
7.	M MITRA 10 GATSU	01-28 Feb. 2020	6.750.000	67.500.000	301.292.000	446,36
8.	M MITRA 10 GATSU	01-31 Mar. 2020	6.750.000	67.500.000	284.015.000	420,76
9.	M MITRA 10 GATSU	01-30 Apr. 2020	6.750.000	67.500.000	79.959.060	118,46
10.	M MITRA 10 GATSU	01-31 May 2020	6.750.000	67.500.000	85.807.000	127,12
11.	G HYPERMART MATARAM (K)	01-31 Jan. 2020	4.500.000	45.000.000	52.073.000	115,72
12.	G HYPERMART MATARAM (K)	01-28 Feb. 2020	4.500.000	45.000.000	83.198.000	184,88
13.	G HYPERMART MATARAM (K)	01-31 Mar. 2020	4.500.000	45.000.000	39.758.000	Not Feasible
14.	G HYPERMART MATARAM (K)	01-30 Apr. 2020	4.500.000	45.000.000	13.098.000	Not Feasible
15.	G HYPERMART MATARAM (K)	01-31 May 2020	4.500.000	45.000.000	24.192.000	Not Feasible

Conclusion

Therefore, based on the discussion above, it can be concluded that, this research had designed the process of extraction, conversion, loading and use of the star schema, which has a fact table and six interrelated dimensions, thus the result of the data can be used for the required analysis. This research

also successfully in designed the data warehouse by applying the benefit-cost ratio method to analyse the business functions that performed using data (processed historical data) obtained from the year of 2018–2020. Therefore, it has benefits to help managers in the decision-making process and policy, especially for the selected policy.

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ПРОЕКТУВАННЯ МОДЕЛІ СКЛАДУ ДАНИХ З ВИКОРИСТАННЯМ МЕТОДУ АНАЛІЗУ СТВОРЕННЯ ПЕРЕВАГИ

Вступ. Склад даних має функцію зробити дані розповсюдженої компанії інтегрованими та стислими, у такий спосіб допомагаючи керівникам в аналізі наявних даних для отримання швидкого та точного стратегічного рішення.

Мета. Це дослідження має на меті створити сховище даних у межах сфери застосування співвідношення вигоди та витрат.

Методи. Для вирішення доцільності бізнесу компанії, єдність різних даних дає змогу поєднувати їх із результатами поглибленого аналізу компанії. Розробивши модель, вдалося спроектувати сховище даних із застосуванням методу співвідношення вигоди та витрат, який використовується для здійснення поглибленого аналізу фінансового сектору завдяки визначенню доцільності та надання процентних результатів поточного бізнесу.

Результати. Таким чином, вихідні дані, які обробляються в процесі вилучення, перетворення та завантаження, які побудовані за допомогою зіркової схеми, впливатимуть на якість генерованих даних для процесу запитів. Крім того, результати сховища даних використовуються для процесу ухвалення рішень та реалізації бізнес-стратегії.

Ключові слова: сховище даних, ETL, BCR, OLAP, ухвалення рішень.