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Business Intelligent in an E-Commerce Industry

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Abstract. According to a survey from statista.com about in 2017, retail e-commerce sales worldwide amounted to 2.3 trillion US dollars and e-retail revenues are projected to grow to 4.88 trillion US dollars in 2021. Each year, e-commerce business increasingly popular. Some retail companies finally decided to focus on internet-based sales to get more customers. Along with transactions that continue to be carried out from year to year, transaction data continues to be stored and stacked and of course space consuming. So after years, Business Intelligence is finally appeared and offer great data processing. Without a business intelligence, these stacked big data are useless and wait to be removed because of poor knowledge. Business intelligence turns on the poor knowledge data into rich knowledge data visualization. This paper proposed a data warehouse that can be used to build a business intelligent with utilize information obtained from the history of transactions. To build up this business intelligent, authors uses methodology steps by Kimball which consists 4 steps of dimensional design process. Furthermore, data analysis will be presented in a dashboard using Power BI.

1. Introduction

As internet usage grows, the use of online shopping or e-commerce is also growing. The better data security increases customer's trust in e-commerce transactions. Seeing this situation, various organizations are started to be interested in expanding their business through e-commerce. Even, accorning to Abdullah, Ramli, Bakodah and Othman opinion, e-commerce can be one of the modern business strategies that can be the answer of the organizations, merchants and customer needs to cut costs and time in searching of products and services and finding lower price without the limitation of locations [1].

To gain more customers, e-commerce certainly does some strategies, such as increasing the number of product categories, conducting promotions and holding campaigns. However, without careful observation and in-depth analysis, these strategies might be less effective in details. This is a challenge for e-commerce industry to think of effective strategies to increase sales by considering things like customer interest, product availability, product quality, payment method, shipping service, partners and so on [1]. To support this decision making of strategies with only using traditional database system may not help much because of the massive data to be analyzed have poor knowledge [2]. This problem drives researchers to build a business intelligent which can assist to process mass amount of collected data from the e-commerce application and represent it in a way to transform a poor knowledge data into rich knowledge data, and finally can help e-commerce industry making a better decision [3].

Business Intelligence bring a sets of powerful tools and approach to improve business decision making using data warehousing, OLAP and data mining [4]. There are reseaches conducted to present analysis using business intelligence and the result can determine trend, which can be used as reference to make any strategies. For example, what factors determine the success of e-commerce and the result are, in last 5 years (2011-2017) says that trust and loyalty, user experience, quality and benefits, service interaction and third parties opinion are the factors that can support a successful e-commerce [1]. That result is coming from some research which using business intelligence to see the trend.

So, in this paper, authors are focused on analysing customers satisfaction based on ratting, location, product and payment type with highest demand and delivery time tracking to show the delay. Finally, this paper delivers a data warehouse which used to build up a business intelligent dashboard that can help e-commerce industry in analysing their market circumstances based on their transactional history and finally can help them in making decision, chose which strategy is the most effective. This data is taken from one company in Indonesia.

2. Related Works

This section explains about researches which related to the implementation of business intelligent in e-commerce industries. According to paper [5], combination between business intelligent and e-commerce brings some adventages, such as get knowledge about the customers, allow analysis of behaviour, find purchasing patterns, develop a better relationship management with customer, better stock management, support for marketing actions, and better financial performance. In this paper, the researchers show the process to transform raw data into knowledge. The row data is generated by customer when done each transaction through e-commerce, then the data go through ETL process and become a data warehouse. This data warehouse has data marts. The data warehouse are processed in an OLAP Server and produce a business intelligents as output. This business intelligents shows report and graph which can used to analysis trends and pattern. The result of this paper explain the knowledge to improve client-company relationship and better management of the internal processes of the company.

Another previous research proposed an Enterprise E-Commerce Intelligence System. This paper explains that to achieve a better performance of intelligence e-commerce, there are 4 parts of e-commerce system: an enterprise network system, an enterprise management information system, the enterprise e-commerce website and the enterprise competitive intelligence system. Relating to this paper, the focus will be on enterprise competitive intelligence system part. In this part, the researches focus on business intelligence that can support intelligence decision making with the used of data mining, data warehouse, online analysis process, visualization, knowledge management and intelligent search (Dehui, 2016).

In the process of making a business intelligent system, the historycal data can be analyses and mining hidden valueble information, which is very important for the development of the e-commerce. In the paper of [7], the researchers explain the step by step of build a data warehouse platform on e-commerce system, they start from collecting data from any sources data, then process the data with ETL process until produce a data warehouse, then they use an OLAP Servers to process the output. This paper focus on analyzing customer and sales theme. The result are the statistical information of customer and the comodity sales in histograms and pie charts.

Another survey is come from paper [8] which found that using business intelligence to make an product recommender system can make a better user experience. Significant market transformation has been accomplished by leading e-commerce vendors such as Amazon and eBay through their innovative and highly scalable e-commerce platforms and product reccomender system. As long as there are available data that can be processed using business intelligent, it still can be value add to increase business quality. Even as technology improves, recent research takes social media data to analyze customer opinion using text analysis and sentiment analysis to develop recommender system. These result of social media data is processed by bussiness intelligence to analyze trend.

3. Proposed Method

A data warehouse is a particular database to storing business oriented information for future analysis and decision making (Sapir, Shmilovici, & Rokach, 2008). To design the data warehouse until produce a business intelligence, authors are using Kimball Lifecycle as a reference. Kimball lifecycle consists of steps to build a technical architecture design, they are: 1. Program/Project Planning, 2. Business Requirements Definition, 3. Technical Architecture Design & Product Selection and Installation, 4. Dimensional Modeling, Physical Design, ETL Design & Development, 5. BI Application Design and BI Application Development, 6. Deployment, 7. Growth, 8. Maintenance.

Project planning, business requirements definition, architecture and installation are focusing on preparation before starts to develop a data warehouse or a business intelligence. It is very important so the project can be still on track. These requirements will be collecting business needs, data profiling, security requirements, data integration, data latency, achiving & lineage and end user delivery interface [10].
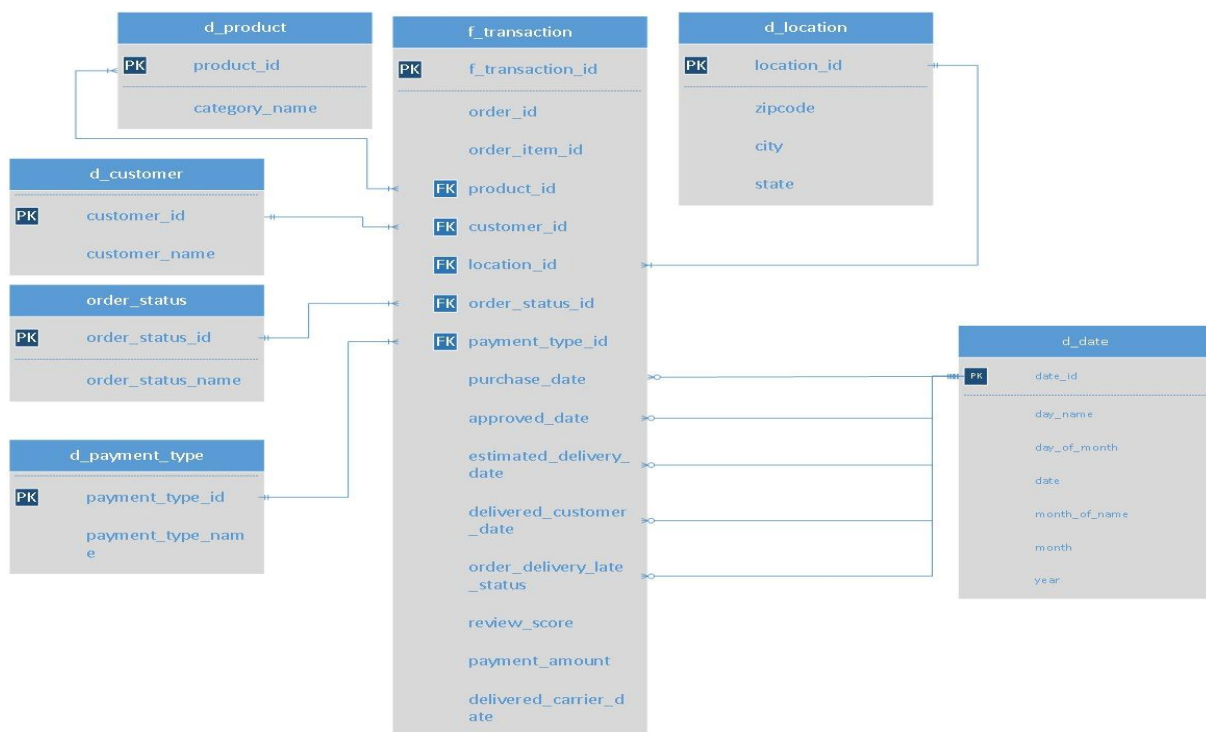
Figure 1. Star Schema for Data Warehouse

After plans all of the technology which involed in this project, the next step is make a dimensional design. There are 4 steps of dimensional design process.

1. Select the business process [11]. In this step, authors are collecting a business process requirements from a retail industry. This retail has an e-commerce to sell their product. Their business flow are started from collecting products from seller, selling their product through e-commerce, taking orders, invoicing, receiving payments, packing order and process the shipping, and collecting ratting or feedback. So this business intelligence is expected to assist the decision makers to analyst their current condition and think about the future decision.

2. Declare the grain (Kimball & Ross, 2013). Grain determine the level of detail related to fact table measurements. In this case, grain declaration will be "One row per line item on a bill each purchasing transaction (order_item_id)".

3. Identify the Dimension (Kimball & Ross, 2013). After identifying grain, it is easier to determine dimension. Every fields in the dimension is already filtered based on what data that want to show in the business intelligence, so, not all data captured in e-commerce will be taken to fill the data warehouse. In this case, the dimensions will be date, customer, product, location, payment type and status.
    d_date contains of date data which will be used for e-commerce transaction date. This dimension consists of fields such as date_id, date, day_of_month, day_name, month, month_name, and year.
    d_customer contains of active or passive customers who has resigtered in e-commerce website. The fields in this dimension are customer_id, customer_code, and customer_name.
    d_location contains of customer's location who has registered in e-commerce website. The fields in this dimension are location_id, zipcode, city, and state.
    d_payment_type contains of payment type data which can be used in the e-commerce website. The fields in this dimension are payment_type_id and payment_type_name.
   **d_status** contains of order status data that starts from order creation until order sent to customer. The fields in this dimension are status_id and status_name.

4. Identify the Facts. Facts represent measurements. A measure means an indicator or a value of interest for the decision maker [12]. In this data warehouse, the fact table f_transaction has review score and payment amount as values to be measured. F_transaction contains transactions data which collected from e-commerce that describe product detail that bought by customer. This table consists of f_transaction_id, order_id, order_item_id, product_id, customer_id, location_id, status_id, payment_type_id, purchase_date, approved_date, delivered_carrier_date, delivered_customer_date, estimated_delivery_date, review_score, and payment_amount.

This steps produce a star scheme design. This scheme is seted as goal when doing extract, transformation and load (ETL). Later on, ETL will produce a data warehouse which will follow the star schema design (Figure 1). ETL play an important role in a data warehouse or business intelligence. ETL is also called as the backroom, it will process source transaction data and produce a presentation area/BI application [11]. One of process ETL is d_customer as shown Figure 2, and the fact ETL as shown Figure 3.


Figure 2. ETL for customer dimension
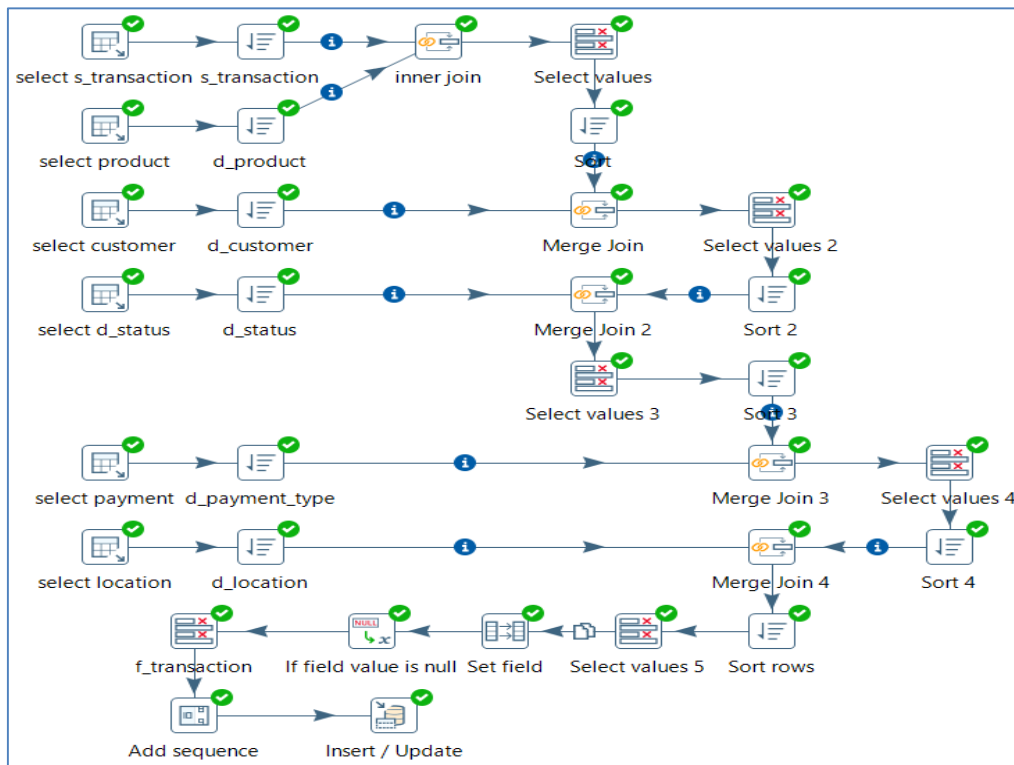
Figure 3. ETL for transaction dimension

4. Analysis Results and Performance

After running all ETL process, the data warehouse is ready to be used to analyze. Authors are using Pentaho BI Server build an OLAP Cube and PowerBI to make a business intelligence application. BI helps consolidating, analysing and providing access to vast amounts of data for business decision making [13]. With BI dashboard, stakeholders of a company can instanly understand the condition of their company. Figure 4 shows some dashboard which is created by powerBI.
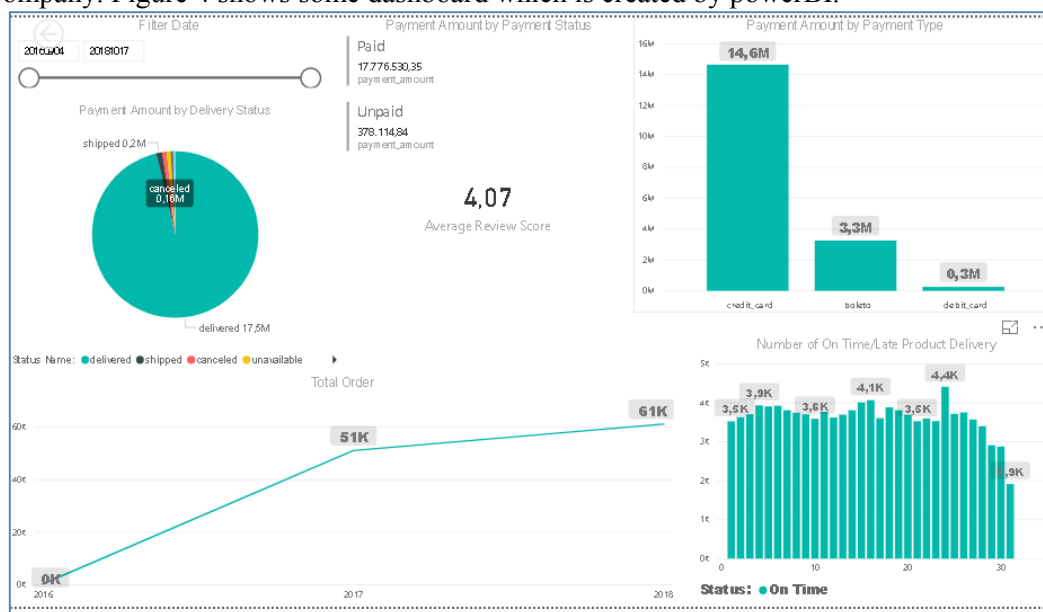

**Figure 4.** Business Intelligence Dashboard
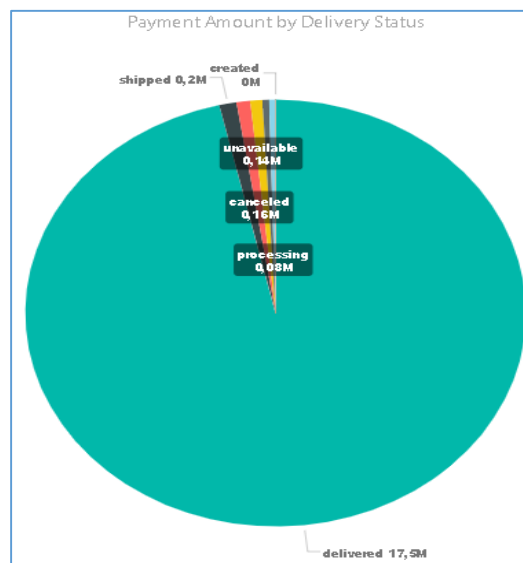
Figure 5. Payment amount by delivery status pie chart

This dashboard shows some analysis charts that are interconnected with each other. It contains information of: Payment amount based on delivery status. Figure 5 shows the amount of obtained income based on delivering products process status. So stakeholders instantly the profit in certain time. Figure 6 as bar chart shows the counts of late product delivery and on time product delivery. It is so important to analysing the punctality.
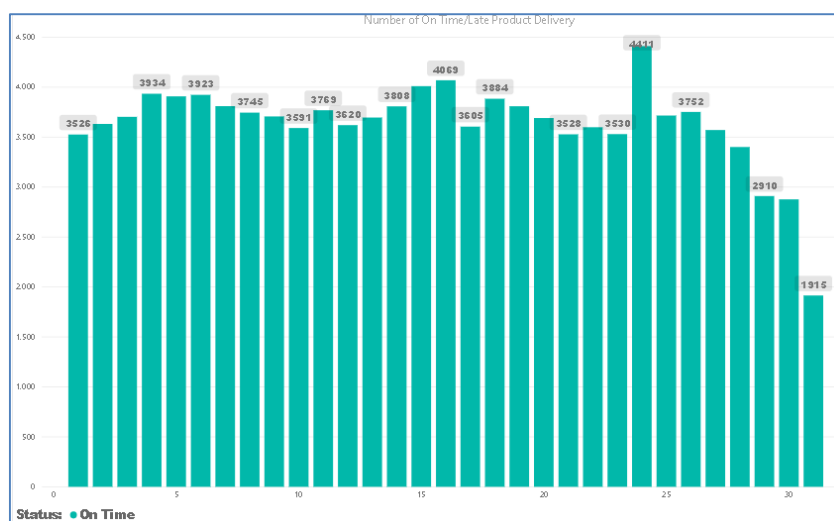
Figure 6. On Time/Late Product Delivery Bar Chart

Average review score. This number shows overall average of customers ratting. Every given score by customer will affect this average, so stakeholders know their overall performance quality by customers' ratting.Time filter will affect all the charts based on date as shown Figure 7.
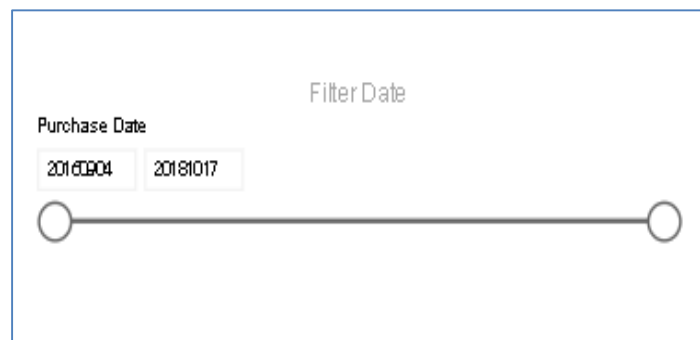
Figure 7. Time Filter

Number of order chart shows amount of orders each date. So stakeholders can analyze product selling every day whether increase or decrease with the exact number. It can be shown in Figure 8.

5. Conclusion
This paper have   explained the details of build a business intelligence, started from business requirements, design a star scheme, ETL implementation, build a data warehouse, OLAP cube and finally produce a business intelligence dashboard. Authors have used Kimball's method and the result is the data warehouse / business intelligence is successfully builded and meet the business expectation. Business user got a better sight of their rigid data with the assist of the BI dashboard.
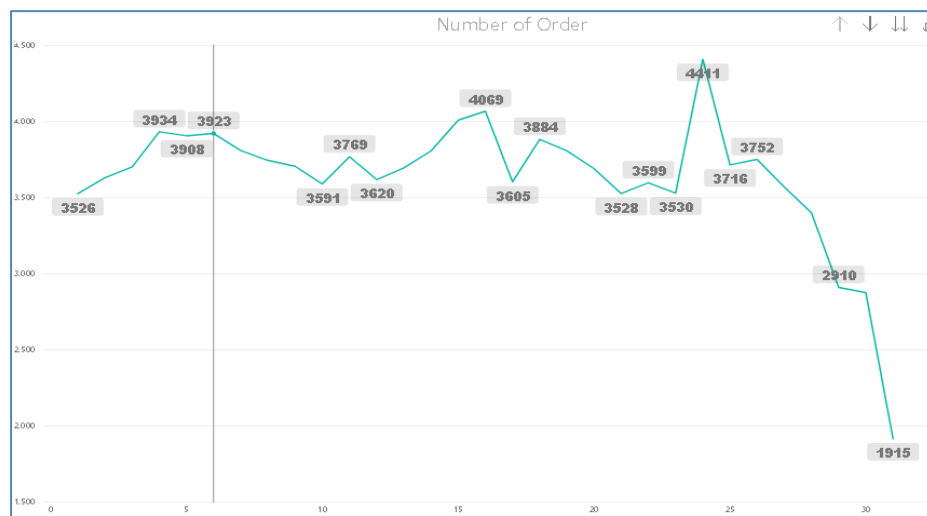
Figure 8. Number of Order Chart

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