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Visual Analysis of Marketplace Sales Data for Strategic Decision Making Using Tableau

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ABSTRACT

The weakness of the data or information generated is still in the form of tables that do not display more informative information in the form of graphs, making it difficult for companies to see sales developments and other information in a short time. Therefore, in this study, a sales data visualization using tableau was built to assist companies in processing table data into information in the form of graphs so that it does not take a long time to see the company's sales development. The research method used in this research is the nine steps kimball method. In this research through the stages of analyzing company data, designing a data warehouse, extract transform load process, implementing data visualization, and testing the system. This system was tested using the user acceptance test method and has obtained results with a percentage of 93% or strongly agree so that this sales data visualization is in accordance with the needs of the company. The results of this study are in the form of 3 pages that display company information in the form of graphs to assist in decision making.

1. Introduction

In a business, data information is an important thing for a company. The importance of data information in the company is as a consideration for making the right decision for the sustainability and development of the company's business (Diawati et al., 2019; Jabid et al., 2023; Ramli et al., 2022). However, there are several obstacles that must be handled by the company regarding the data owned by the company. One of them is the constraints of companies that have not been able to convert or utilize a set of existing data into interactive information for the company (Aripin & Paramarta, 2024; Paramarta et al., 2021; Sirat et al., 2023). Therefore, information technology is needed to help make it easier for companies to understand a set of data from the company (Fauzi et al., 2023; Permana et al., 2024; Sumesta & Satyawan, 2024).

PT. Akselerasi Sumber Berkah is one of the local companies engaged in trading beauty and health products in Indonesia, which is produces a total of 16 different product items. As one of the local companies engaged in the field of beauty and health that markets products on the marketplace, it cannot be denied, of course, there will be many business competitors owned by the company. Therefore, making a decision is important in a business, including the company PT. Akselerasi Sumber Berkah which also requires good and appropriate decision making for the sustainability and development of its business.

PT Akselerasi Sumber Berkah generates monthly product sales data reports that are both varied and unstructured. These reports are available on multiple marketplaces. Subsequently, the data will be employed as decision-making material to ascertain the target and facilitate future business growth.

Nevertheless, the data reports are still stored and presented in the form of tables, which is not satisfactory for the requirements of company stakeholders. As a result, the data report that resulted was unable to provide informative data visualization and in accordance with the information requirements of company decision-making (Dewi et al., 2021; Piantari et al., 2024; Suryadana & Sarasvananda, 2024), including the display of an overview of sales growth in each marketplace, the highest and lowest product sales in each marketplace, and sales comparisons in the marketplace. These are the limitations of the report. Therefore, in the present circumstances, it is imperative to reprocess the table data in other applications in order to generate more informative data information in the form of graphics (Fergina & Ozsut, 2022; Kwintiana et al., 2023; Lin, 2024; Sutrisno et al., 2023).

Based on the problems encountered in the company, PT Akselerasi Sumber Berkah needs a data visualization as a solution to these problems, by converting data into a graphic format can make data more informative, easy to understand and when making decisions for the development of a business to be more precise (Riyanti et al., 2024; Sudipa, Wardoyo, et al., 2023; Urva et al., 2023). Software or applications that assist in visualizing data that will be made at the company PT. Acceleration of Blessing Sources, namely using Tableau .The method used in this research is Kimball's Nine Steps method for building a data warehouse design, then for the Extract, Transform, and Load (ETL) process using the Pentaho Data Integration (PDI) Kettle application (Akhtar et al., 2020; Saputra et al., 2022; Septiani et al., 2024). The data visualization displayed is three display menus according to the needs of PT. Akselerasi Sumber Berkah , namely the Shopee sales menu, the Lazada sales menu and the sales comparison menu on the Shopee and Lazada marketplaces.This study suggests that data visualization be implemented to analyze sales data in order to facilitate the formulation of business continuity decisions.

2. Literature Review

To conduct a visual analysis of marketplace sales data for strategic decision-making using Tableau, it is essential to optimize the use of information technology on existing sales transaction data (Ismarmiaty & Rismayati, 2023; Radhitya et al., 2024) . By applying various visualization techniques such as bar graphs, line charts, and heat maps, insights can be extracted from sales data to identify patterns that can inform strategic decisions . Additionally, combining market and supply chain data is crucial for strategic and operational decision-making.Moreover, providing real-time, personalized insights to sales teams through email and text messages can enhance their performance by ensuring critical information is readily available for quick decision-making (Martha, 2024). Strategic consumer behavior analysis can aid in making informed pricing decisions by collecting consumer information in advance to adjust future arrangements and mitigate the impact of strategic behaviors (Cano et al., 2022; Zhang et al., 2023).Furthermore, considering factors like customer segmentation, targeting, relationship objectives, and sales channels can help in formulating an effective sales strategy (Panagopoulos & Avlonitis, 2010). Utilizing tools like Tableau for sales analysis and forecasting can support decision-making processes by visualizing data effectively (Jena, 2019; Rahayu et al., 2024). Additionally, understanding consumer behavior, competition dynamics, and pricing strategies is crucial for making informed pricing decisions (Kurniawan & Arvitrida, 2021; Maulidah et al., 2024). Leveraging data visualization tools like Tableau, along with insights from sales data analysis and strategic consumer behavior, can empower businesses to make informed decisions that drive sales growth and profitability.

3. Research Methods

Framework

The framework used in the study is shown in Figure 1.

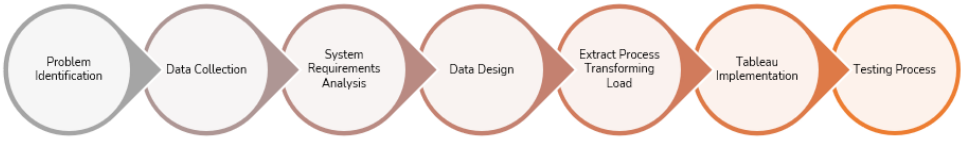

Figure 1. Framework

Figure 1 illustrates the process that commences with the identification of the problem. During this phase, the researcher establishes the research objectives, benefits, problem boundaries, and problems. The second stage involves the acquisition of data regarding data collection procedures through interviews and field methods and library methods (Ibrahim et al., 2023). Specifically, referencing numerous readings that pertain to the Nine Steps Kimball method and data visualization implementation. The third stage involves the examination of both functional and non-functional system requirements. Functional requirements are the desirable needs or results that stakeholders anticipate the system to provide. Hardware and software requirements are among the non-functional necessities. The subsequent phase is the data design process, during which the data warehouse will be constructed in accordance with the functional requirements analysis.

Application of Kimball's Nine Steps Method

Used to model data into a datawarehouse is Kimball's Nine Steps Method (Akhtar et al., 2020). Kimball's Nine Steps method includes 9 steps to build and develop a datawarehouse. The steps of Kimball's Nine Steps method are:

a. Choose the process, is a step to analyze the current process.
b. Choose the grain, in this part decide exactly what a fact table represents.
c. Identify and conform the dimension, at this stage the dimensions of the previously made grain are determined.
d. Choose the fact, after determining the grain and dimension, the fact table can be set.
e. Store precalculations in the fact table, in this process the calculations in the fact table are determined, so that the measure is obtained.
f. Rounding out the dimension table, at this stage is an addition to the dimension determination stage. At this stage, the dimension table is completed with attributes and descriptions.
g. Choosing the duration, determines the duration of the data used in the datawarehouse.
h. Track slowly the changing dimensions, at this stage taking into account the slowly changing dimensions can be traced.
i. Deciding the query priorities and the query modes, this stage uses physical design to produce a datawarehouse that will be used for the data analysis process.

After the data warehouse design process that uses the Kimball Nine Steps Method to build and develop this datawarehouse, then the next process is the Extract Transform Load (ETL) process. The ETL process is the process of transforming transactional data so that it can be stored in the datawarehouse that has been designed in the previous stage (Allaymoun et al., 2022). The ETL process also filters data that is really needed for the decision-making process and homogenizes the data contained in transactional data. After that, it is continued with the implementation of Tableau to visualize data into information (Atmaja et al., 2022). The last process is testing. The testing method used in this research is Black Box testing and User Acceptance Test testing (Sudipa, Udayana, et al., 2023). The focus of Black Box testing is the system requirements that have been determined at the functional requirements analysis stage (Melyawati et al., 2024).

Sales Information System Architecture

In this data warehouse, the data source comes from the Beaudelab product sales database at PT Akselerasi Sumber Berkah. In this data source database there is some data such as product sales on Shopee and product sales on Lazada. Furthermore, the database will go through the extract, transform, load (ETL) process before being stored in the data warehouse. After the ETL process, this data warehouse will be implemented in data visualization using the Tableau application. The following architecture of the proposed sales information system can be seen in figure 2.

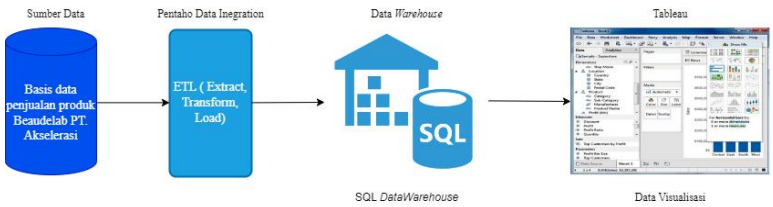

Figure 2. Sales Information System Architecture

4. Results and Discussions

Functional Requirement Analysis

In this research, the functional requirements desired by PT Akselerasi Sumber Berkah are as follows:

1. The system can display sales dashboard charts on Shopee and Lazada per month in 2022.
2. The system can display sales charts by product on Shopee and Lazada per month in 2022.
3. The system can display a graph of the 5 highest sales and 5 lowest sales of Beaudelab products on Shopee per month.
4. The system can display a graph of the 5 highest sales and 5 lowest sales of Beaudelab products on Lazada per month.
5. The system can display a comparison chart of Beaudelab product sales between Shopee and Lazada per month.
6. The system can display a graph of Beaudelab product sales transaction status on Shopee and Lazada per month.
7. The system can display a graph of the most favorite delivery providers on Shopee and Lazada.
8. The system can display a sales prediction graph of Beaudelab products on Shopee and Lazada for the next six months.

Datawarehouse Design

The design of the datawarehouse in this study uses Kimball's Nine Steps method which starts from choosing the process. Business processes related to the needs used in this study are shown in table 1.

Table 1. Choosing The Process

Business Process	Description
Sales Report on Shopee	The process to save all product sales transactions on Shopee
Sales Report on Lazada	Process to save all product sales transactions on Lazada

The next process is choose the grain which is the determination of what will be presented by the data warehouse fact table. In accordance with the functional requirements obtained, as follows:

1. The number of sales on Shopee can be seen by month and year.
2. The number of sales on Lazada can be viewed by month and year.
3. The number of sales on Shopee can be seen by product type.
4. The number of sales on Lazada can be viewed by product type.
5. The highest and lowest number of product sales on Shopee can be seen by month.
6. The highest and lowest number of product sales on Lazada can be seen by month.
7. A comparison of the number of product sales on Shopee and Lazada can be seen by month.
8. The number of product sales transaction statuses on Shopee can be seen by month.
9. The number of product sales transaction statuses on Lazada can be seen by month.
10. Number of favorite shipping providers on Shopee.
11. Number of favorite shipping providers on Lazada.
12. Prediction of the number of product sales on Shopee can be seen based on six months.
13. Prediction of the number of product sales on Lazada can be seen based on six months.

The next process in the datawarehouse is to define the dimension table. Based on the required data, the resulting dimension table is designated in table 2.

Table 2. Dimension Table

Dimensions	**Description**
Products	There is information about the product.

Delivery provider	There is information about delivery providers .
Transaction Status	There is information about the status of the transaction.
Time	There is information about the time.

Furthermore, determining the fact table, the following fact table is generated to meet the needs of the company can be seen in table 3.

Table 3. Fact Table

Facts	Description	Dimensions
Shopee Sales	There is information about the total sales on a product.	Product, shipping provider, transaction status, time, order
Lazada Sales	There is information about the total sales on a product	Product, shipping provider, transaction status, time, order

The next process is continued by completing the dimension table with attributes, types and their respective descriptions. The following details of the dimension table can be seen in table 4.

Table 4. Dimension Detail Table

Dimensions	Attributes	Type
Products	sk_itemName	integer
	itemName	varchar(100)
	last_update	date
Delivery provider	sk_shippingProvider	integer
	shipping_provider	varchar(40)
	last_update	date
Transaction status	sk_transactionStatus	integer
	transactionStatus	varchar(30)
	last_update	date
Time	sk_date	integer
	date	date
	year	integer
	quarter	character
	month	integer
	month_name	varchar
	day	integer

After that, complete the fact table with its respective attributes, types and descriptions. The following details of the fact table can be seen in table 5.

Table 5. Fact Table Details

Facts	Attributes	Type
Shopee Sales	orderItemId	character
	sk_date	date
	sk_itemName	integer
	sk_transactionStatus	integer
	sk_shippingProvider	integer
	quantity	integer
Lazada Sales	orderItemId	character
	sk_date	date
	sk_itemName	integer
	sk_transactionStatus	integer
	sk_shippingProvider	integer
	quantity	integer

From the results of the dimension tables and fact tables that have been made, a data warehouse schema can then be drawn to store the transaction data. There are four dimension tables, namely the time dimension table, product dimension table, shipping provider dimension table, and transaction status dimension table. In addition, there are two fact tables, namely the Shopee sales fact table and the Lazada sales fact table. Looking at the dimension table and fact table, the data warehouse schema that will be used is a star schema. For more details, the data warehouse scheme can be seen in Figure 3.

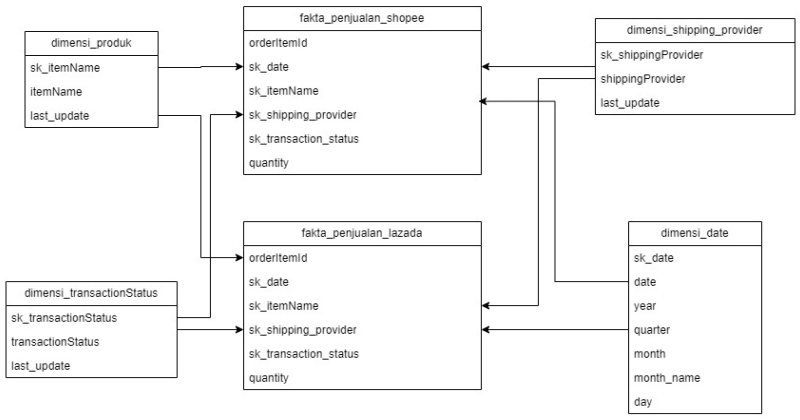

Figure 3. Datawarehouse Schematic

Extract Transform Load (ETL) Process

This research goes through several ETL processes, including the product dimension ETL process, time dimension ETL, transaction status dimension ETL, shipping provider ETL, Shopee sales facts

ETL, and Lazada sales facts ETL. The ETL process carried out uses sales data from the company PT Akselerasi Sumber Berkah which is still in excel form, then it will be converted into a CSV file.[16]. The tool used to perform ETL is Pentaho Data Integration Kettle where the ETL process can be stored in the form of a .ktr file. The ETL results will be stored in the sqlyog database.

ETL Time Dimension (Date)

The time dimension ETL process has several processes shown in Figure 4.

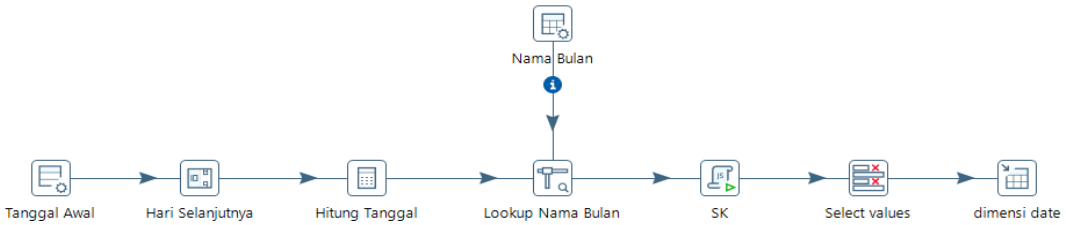

Figure 4. ETL Time Dimension

ETL Dimensions, Transaction Status, Delivery Provider

The ETL process for the product dimension, transaction status dimension, and shipping provider dimension have the same ETL process. However, the difference is in the columns used for the dimension creation process, namely the itemName column for the product dimension, the transactionStatus column for the transaction status dimension, and the shippingProvider column for the shipping provider dimension. Figure 5 shows the ETL process for one of the dimensions, the shipping provider dimension.

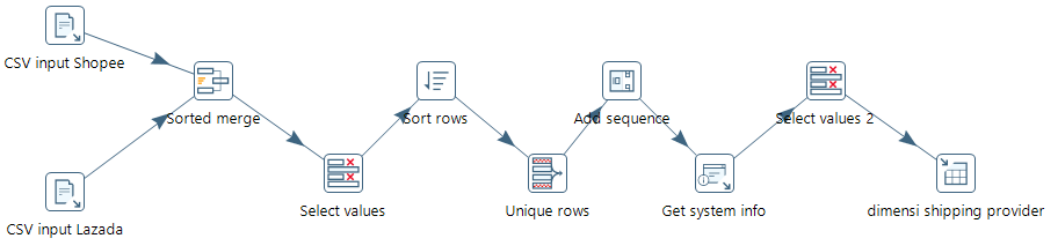

Figure 5. ETL Service Provider Dimensions

Shopee and Lazada Sales Facts ETL

As with creating the three dimensions, such as transaction status, product, and shipping provider, the ETL for Shopee and Lazada sales facts has the same process. However, the thing that differentiates is the input file, while the rest of the process is the same. Figure 6 shows the sales fact ETL process.

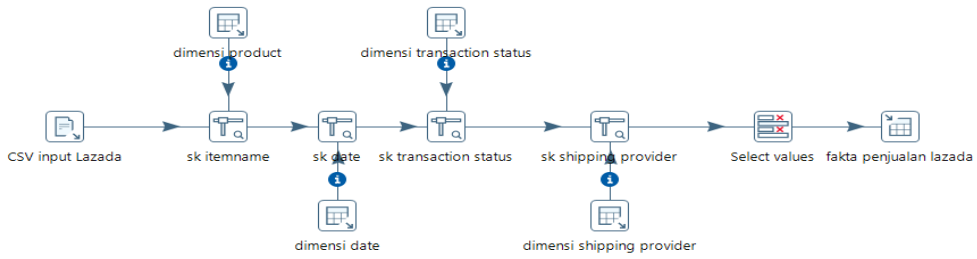

Figure 6. Sales Facts ETL

Tableau User Interface Implementation

The user interface implementation discusses the data visualization display that has been built based on the design in the previous chapter. Making data visualization into a dashboard is made using Tableau tools. Data visualization in the form of dashboards in this study consists of three dashboards, which consist of three buttons (menus) that can direct them to related dashboards. The three buttons are dashboards, sales, and transactions. The following is the implementation of the dashboard user interface

Dashboard Page

On the dashboard page, there are several data visualizations displayed, namely bar charts of Lazada and Shopee sales per product, sales predictions for the next six months by Tableau tools, and total sales of both Lazada and Shopee in 2022.

In the form of bar chart data visualization, it can display sales between Shopee and Lazada for each product easily and more effectively to compare them. In addition, this form of visualization has been sorted from the product that has the highest sales to the lowest. This visualization can be scrolled to see other sales on the bar chart using the scroll pane next to the visualization. The bar chart shows that the highest product sales are on Shopee until it reaches 7,747 sales, while Lazada is 5,738 sales. As for the total sales of all products can be seen above the bar chart, where Shopee sales outperform Lazada sales. Then, in the visualization of sales predictions, it is predicted that sales will increase every month for Lazada, while Shopee's will decrease in the early months of 2023 but increase again every month. In addition to predictions, the line chart data visualization also shows how the sales each month are either decreasing or increasing. Because the product name has a longer name, this can be overcome by hovering over the product name or on the barchart. This can bring up a tooltip that displays the product name more fully. This can also be directed to other parts of the chart.

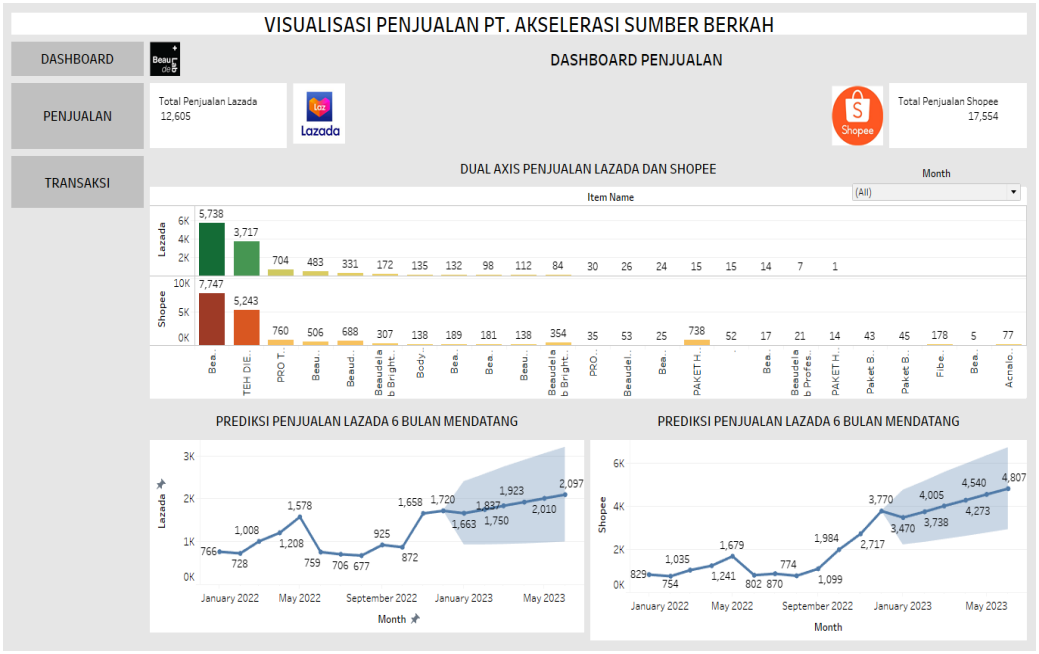

Figure 7. Dashboard Page

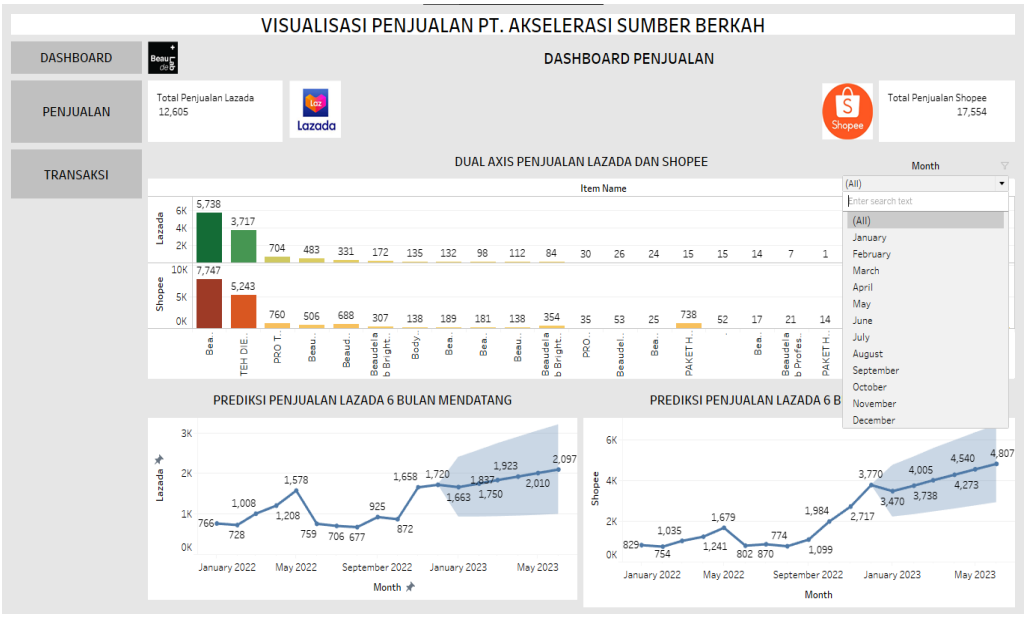

Figure 8. Month Filter Feature

Sales Page

The sales page consists of two dashboards, one that consists of a line chart that shows sales in 2022 based on products on Lazada and Shopee. Then, the second page consists of a barchart that displays the 5 highest and lowest products each month. To go from page one sales to page two sales, you can press the next button and press the back button to return. The first page of sales displayed has two filters, namely month filters and product filters, so that it can focus and facilitate product analysis.

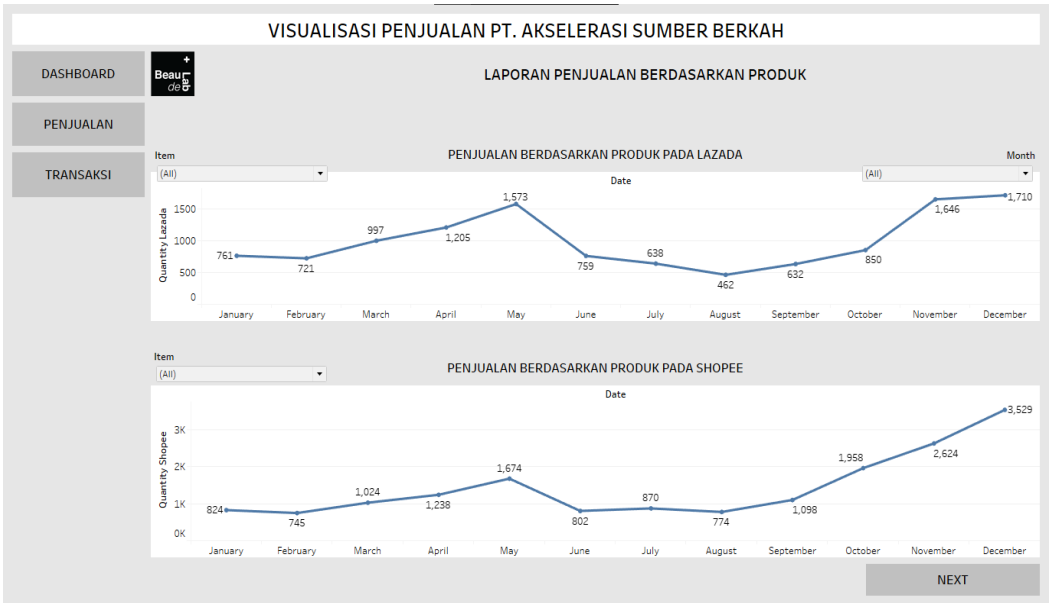

Figure 9. First Sale Page

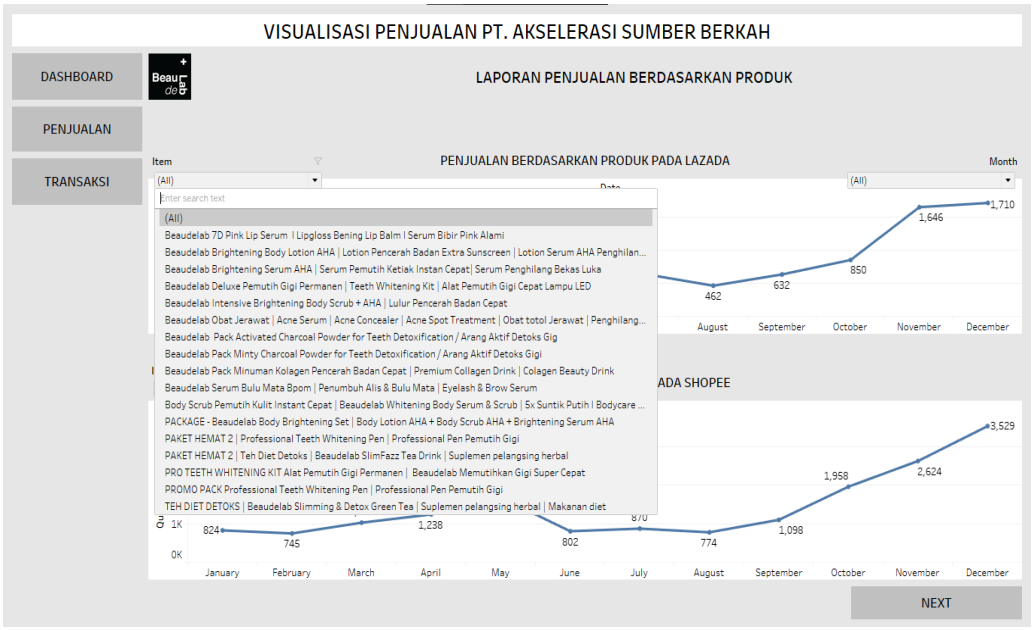

Figure 10. Product Filter

On the second page, sales can provide information on products that have the potential to support sales, and products that need to be improved in terms of marketing or promotion.

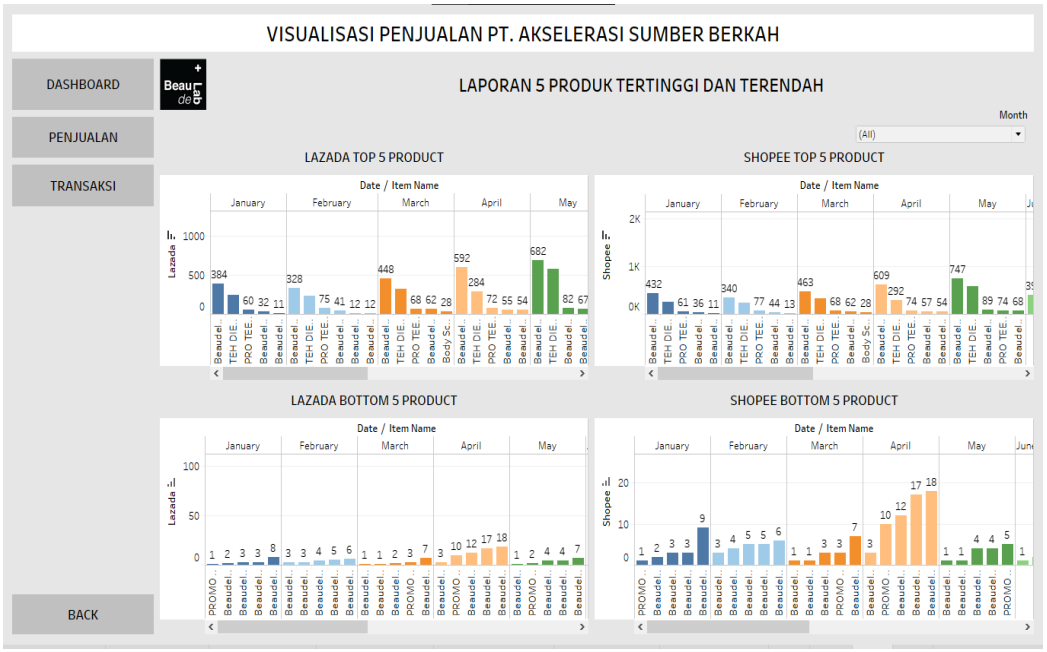

Figure 11. Second Sales Page

Transaction Page

The transaction page consists of a barchart data visualization that displays the status of sales transactions for one year. Then, there is a pie chart data visualization that displays the most favorite shipping providers. Figure 12 shows that the most favorite shipping provider from Lazada is LEX ID, while the most favorite shipping provider from Shopee is SPX. In addition, from the barchart displayed, stakeholders get information every month on the status of their sales transactions. From this information, the canceled status can be taken into consideration to create a strategy on how to reduce canceled sales and increase the confirmed status.

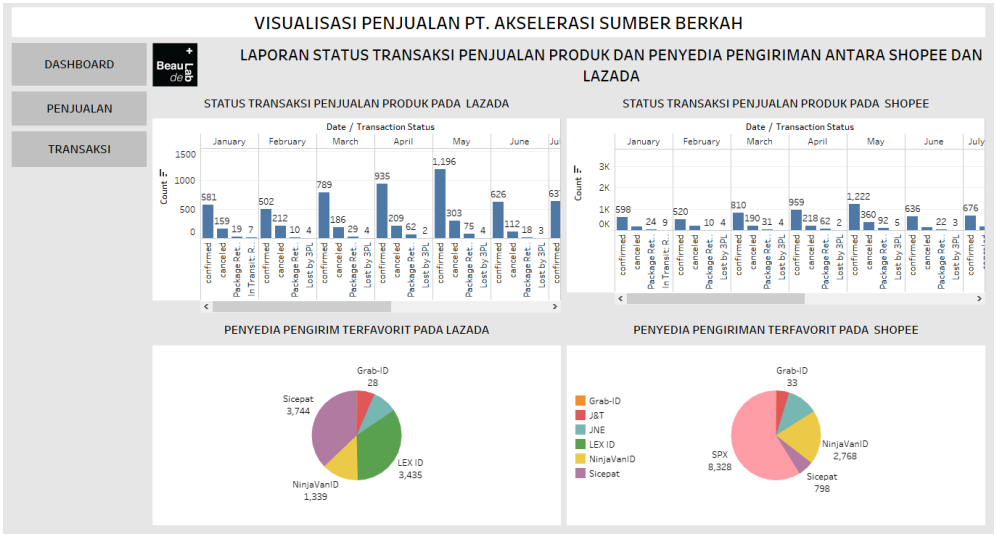

Figure 12. Transaction Page

System Testing

User Acceptance testing is carried out to find out the data used in the system is valid, to observe the implementation results through test data and check the function of the system test results. This test is carried out by giving the right to the CEO of the company and the management team, which totals 8 people from the company PT. Akselerasi Sumber Berkah to directly provide an assessment of the data used in the form of a questionnaire. The assessment categories used for the questionnaire are; Strongly Agree (SA), Agree (A), Fair (F), Disagree (D), and Strongly Disagree (SD). The questionnaire that will be made can be seen in table 6.

Table 6. UAT Questionnaire Results

No.	Questionnaire	SA	A	F	D	SD
1	Is the data visualization system built in accordance with the needs? Company	6	2			
2	Data used in the process charting is valid and no data errors	8				
3	Graphics displayed can provide clear and informative information	5	3			
4	Graphics displayed can provide information that is easy to understand	4	3	1		
5	Information graphics displayed according to needs Company	5	2	1		
	Total	**28**	**10**	**2**		

Table 7. UAT Testing Results

UAT Highest Score	Number of questionnaires*number respondents*highest score of the questionnaire (5*8*5 = 200)
Strongly Agree (SA)	5*28 = 140
Agree (A)	4*10 = 40
Fair (F)	3*2 = 6
Disagree (D)	2*0 = 0

Strongly Disagree (SD)	1*0 = 0
Total	140 + 40 + 6 + 0+0= 186 **186/ 200*100% = 93%**

Table 4. UAT Testing Presentation

Percentage	Description
0% - 19.99%	Strongly Disagree (SD)
20% - 39.99%	Disagree (D)
40% - 59.99%	Fair (F)
60% - 79.99%	Agree (A)
80% - 100%	Strongly Agree (SA)

Based on the results of the user acceptance test (UAT) conducted at the company PT. Acceleration of Blessing Sources, it can be seen from the percentage table of UAT test results that the system built at the company PT. Akselerasi Sumber Berkah, received a very agreeable assessment with a percentage of 93%, which means that this sales data visualization is in accordance with the needs of the company PT. Acceleration of Blessing Sources.

5. Conclusion

The conclusions that can be drawn in the research entitled visualization of sales data at PT. Akselerasi Sumber Berkah using Tableau are: Visualization of sales data at PT. Acceleration of Blessing Sources was successfully built based on the problems found at the research site. The author designs data visualization using the nine steps kimball method to design a data warehouse, uses Pentaho Data Integration tools to process data and store data in the data warehouse database, then uses Tableau tools to visualize data in the form of graphs, butterfly charts contained in the main dashboard display which has dual axis sales of Shopee and Lazada. then the form of line charts on the prediction display of Shopee and Lazada, then the line chart form on the Shopee and Lazada sales prediction display for the next six months, and the sales dashboard which has sales by product per month Shopee and Lazada, the bar chart form is on the display of the five highest and lowest products Shopee and Lazada, and the transaction dashboard which has the status of transactions per month Shopee and Lazada, and the pie chart form on the display of Shopee and Lazada's favorite shipping providers. Sales data visualization at PT Akselerasi Sumber Berkah was successfully built by having three display menus, namely the main dashboard which has dual axis sales of Shopee and Lazada, predictions of Shopee and Lazada sales for the next six months. Sales dashboard which has sales by product per month Shopee and Lazada, the five highest and lowest products Shopee and Lazada. Transaction dashboard which contains Shopee and Lazada's monthly transaction status, and Shopee and Lazada's favorite shipping providers. The three menus have been tested with a user acceptance test and provide results with a percentage of 93% or strongly agree, which means that this sales data visualization is in accordance with the needs of the company PT. Akselerasi Sumber Berkah.

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