DATA VISUALIZATION IN GRUTTY SHOES

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ABSTRACT

Grutty Shoes, Bags & Fashion is a company engaged in shoe retailing. Based on interviews conducted by representatives of the purchasing division and marketing division at Grutty Shoes, said that they have difficulty understanding information from the company's current operational reports, the information is in the form of inventory, purchase, marketing and information about sales partners. Difficulties occur because to get information there needs to be an extra effort to combine several reports and calculations manually. From this problem there needs to be a visualization to facilitate understanding of information. The study was arranged based on 7 steps of data visualization that were adjusted to the research to build good visualization and according to needs. Each step explains starting from extracting information using statistics or other types of methods and how visualization is built up to visualize it into a form that can be utilized. The results of this study are a form of precise visualization of the information needs of the purchasing division and marketing division based on the work performed. With the form of data visualization makes it easy for the marketing division and purchasing division to understand information about inventory, purchase, marketing and information about sales partners in the company, namely tour leaders and resellers. From the information understood can be used to plan inventory management strategies and formulate the company's marketing strategies.

Keywords : data visualization, statistics, inventory management, marketing, retail.

1. INTRODUCTION

Retail companies everyday record lots of transactions. This results in a very rapid growth in the amount of data and creates a large amount of data in the database. From the available data there is a lot of information that can be used to find out and plan business prospects for the company so that the investment made by the company does not become in vain[1]. Grutty Shoes, Bags & Fashion is a company engaged in shoe retailing.

Based on interviews conducted by representatives of the purchasing division and the marketing division, said that they had difficulties in understanding information from the company's current operational reports. Information that is difficult to understand is information about the turnover value of goods from each group of goods, information about the availability and quality of the vendor, information about marketing contributions made by the tour leader and resellers as well as information about the current market segment owned by the company. As a result of the difficulty in understanding the information regarding inventory, marketing, and sales, this causes operational disruption in the company with the accumulation of goods, the unavailability of the availability and quality of the goods sold, to the loss due to reduced sales turnover.

Based on existing problems, a visualization is needed to display data extraction into information that is easy to accept[2]. Data visualization not only converts data into graphical forms but is based on an in-depth analysis of data and an appropriate plan. Data visualization aims to make it easier to extract information quickly and understand large amounts of information[3].

The aim to be achieved from this research is to produce the right data visualization that can be used in understanding information by purchasing division and marketing division.

2. CONTENTS OF RESEARCH

2.1 Literature Review

A. Data Visualization

Visualisasi Data visualization is a study that explains how to present data using an approach that emphasizes more visual than traditional presentation[4]. Data visualization is a combination of various disciplines such as statistics, data mining, graphic design, and information visualization[5]. Two popular types of visualization are the dashboard and infographics. The choice of the diagram displayed must be in accordance with the type of data consisting of distribution or composition data that can explain the content in the data. In general, data visualization has 3 forms, namely simple text, tables, and graphics[6]. To determine the choice of visual form there are 4 categories that must be considered according to Chart Suggestions - A Thought-Starter by A. Abela, namely relationship, comparison, distribution or distribution as well as composition[7].

B. Descriptive Statistics

Statistik Descriptive statistics is the study of how to treat a data by planning, collecting, analyzing, interpreting and representing data[8]. Descriptive statistics also learn how to easily understand a data. Descriptive statistics only relate to things that provide information about a data or time or condition. This descriptive statistics serve to explain problems, circumstances and symptoms. Descriptive statistics include frequency distribution, mean, median, mode.

C. Visual Form

There are several types of visualization commonly used to present information. Here are some forms of visualization of data [6]:

a. Table

Tables interact verbally, meaning that reading is needed to see the information available. A good table is used to communicate with audiences consisting of several types that each type will look for special lines according to their interests or needs.

b. Line Chart

The line diagram is basically used to describe the time series relationship with continuous data. Line diagrams are usually used to see trends and things that change. The line diagram has an x-axis and y-axis, where the x-axis represents time and the y-axis represents quantum data.

c. Bar Chart

A bar chart can be used to describe changes in values over time and easily compare several different categories. Making variations of the bar diagram can be changed according to the case at hand. Variations of bar charts such as vertical, horizontal and stack-shaped. The bar diagram is easier to read because the eye is more accustomed to comparing which parts are smaller and which parts are larger.

2.2 Research Methodology

The type of research in this study is applied qualitative research. Applied research aims to find solutions to problems faced by society or business organizations.

The steps to be taken during the study refer to the book "Visualizing Data" which consists of seven steps, namely acquire, parse, filter, mine, represent, refine and interact[9]. Then adjusted to this research so as to produce the following steps:

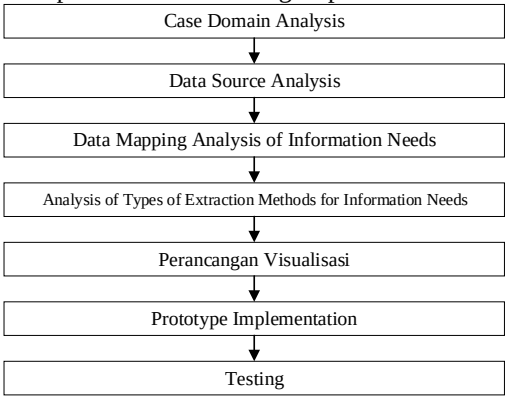


Figure 1. Research methodology

The following is an explanation of the steps to be taken in this study:

a. Case Domain Analysis

Case domain analysis is done to find out cases faced by purchasing division and marketing division. It is important to examine users who will read visualizations[10]. The case domains analyzed in this study consist of job analysis and information needs based on division, difficulties in understanding information which is then mapped into information needs to be solved by data visualization.

b. Data Source Analysis

Data source analysis is a stage to analyze existing data sources in the company, the data is obtained through a database of transactions owned by companies that are locked everyday.

c. Data Mapping Analysis of Information Needs

In the data mapping analysis phase, mapping of data relating to the problems to be solved and information needs from purchasing and marketing divisions is done.

d. Analysis of Types of Extraction Methods for Information Needs

The analysis phase of the type of extraction method for information needs is done to apply an algorithm or the most appropriate statistics to get information from the data. But if the data is in accordance with the information needs, there is no need to do this process.

e. Visualization Design

The visualization design stage is carried out to design the most appropriate form of visualization for information needs to be conveyed such as charts, bar charts, pie charts and others. The choice of color, shape and size will affect the results of the visualization performed. After that testing is done with acceptance.

f. Prototype Implementation

The implementation phase is the implementation stage of visualization design. Visualization will be implemented into website-based software.

g. Testing

The testing phase was carried out to test the accuracy of visualization with the information needed by the user and also to test the prototype that was built to function properly. The testing technique that will be used is usability testing.

2.3 Results and Discussion

The type of research in this study is applied qualitative research. Applied research aims to find solutions to problems faced by society or business organizations.

A. Case Domain Analysis

Case domain analysis is done to find out more details about the research domain. Case domain analysis is carried out based on the work of the purchasing division and marketing division obtained from interviews with representatives from each

division. From the analysis results obtained information needs that require a form of visualization. Information needs can be seen in Table 1.

Table 1. Information Needs

No	Division	Information Needs
1	Purchasing Division	Summary of inventory information (total number of SKUs, total number of items, total value of inventory, total moving quantity)
		Information on the highest turnover value in 3 months
		Information on each PO status every month
		Information comparison of good and reject goods every month
		The best vendor information for each item group
2	Marketing Division	Best Seller Item Information in 3 months
		TL arrival rate information every month
		Information on 10 Tour Leaders with the best profit
		Information 10 Resellers with the best profit
		Percentage Information of Each Sales Segment

B. Data Source Analysis

The data that will be analyzed in this study comes from Grutty Shoes. The data format obtained is in the form of a .sql database file. The database comes from daily transactions carried out by the company. The data that will be used in this study can be seen in Table 2.

Table 2. Data Source Analysis

Data	Table
Data 1	infinite_attendance
Data 2	infinite_fees
Data 3	infinite_good_receipt
Data 4	infinite_material_master
Data 5	infinite_material_productions
Data 6	infinite_material_sub_groups
Data 7	infinite_purchase_orders
Data 8	infinite_purchase_order_details
Data 9	infinite_resellers
Data 10	infinite_return_of_goods_details
Data 11	infinite_return_of_vendor_details
Data 12	infinite_tourleaders
Data 13	infinite_transaction
Data 14	infinite_transaction_details
Data 15	infinite_vendor_master

C. Data Mapping Analysis of Information Needs

Data mapping analysis is carried out by listing data relating to the problem to be solved and also the information needs. Data mapping on information needs can be seen in Table 3.

Table 3. Data Mapping Analysis

No	Information Needs	Data
1	Summary of inventory information (total number of SKUs, total number of items, total value of inventory, total moving quantity)	5
2	Information on the highest turnover value in 3 months	4, 14
3	Information on each PO status every month	7, 8
4	Information comparison of good and reject goods every month	10
5	The best vendor information for each item group	7, 8, 11, 15
6	Best Seller Item Information in 3 months	14
7	TL arrival rate information every month	1
8	Information on 10 Tour Leaders with the best profit	1, 2
9	Information 10 Resellers with the best profit	13
10	Percentage Information of Each Sales Segment	13, 14

D. Analysis of Types of Extraction Methods for Information needs

Analysis of the type of extraction method is done to meet the information needs that have been determined. To extract information from existing data it is necessary to do statistical calculations or use data mining methods. This type of method can be seen in Table 4.

Table 4. Analysis of the Type of Extraction Method

No	Information Needs	Type of method
1	Informasi nilai turnover barang tertinggi dalam 3 bulan	Perhitungan Turnover
2	Informasi masing-masing status purchase order setiap bulan	Statistika
3	Informasi Persentase Masing Masing Segmen Penjualan	Statistika

Selection of methods is done to find information in a data. The following are the methods applied to meet information needs:

1) The method used in finding information needs of per-group turnover value is using the inventory turnover formula[11]. Where the higher the turnover value, the better. From the available data, the total

cost of goods sold (COGS) per group of goods is taken and the total inventory value per group of goods. The formula for calculating inventory turnover is as follows:

$$Turnover = \frac{Cost\ Of\ Goods\ Sold}{Average\ Inventory}$$

The results of the calculation of the turnover value of each item group can be seen in Table 5.

Table 5. Turnover Value Result

Item Group	Turnover Value
Aksesoris	69%
Alas Kaki	73%
Boneka	350%
Dompet	81%
Fashion	90%
Gesper	81%
Tas	64%

2) The method used in finding information needs on the percentage of purchase order status is statistics, namely with the relative frequency distribution. The following is the calculation result of the purchase order percentage.

Table 6. Percentage Purchase Order Results

Value	Absolute Frequency	Relative Frequency
0	295	10,42402827 %
1	35	1,236749117 %
2	2335	82,50883392 %
3	53	1,872791519 %
4	112	3,957597173 %
Jumlah	2830	100 %

3) The method used in finding information needs of the percentage of each sales segment is statistics, namely with the relative frequency distribution. The following are the results of the calculation of the percentage of the sales segment.

Table 7. Percentage of Sales Segment Results

Nilai	Frekuensi	Frekuensi Relatif
RETAIL	83027	94,03576727 %
RESELLER	5068	5,739979387 %
KARYAWAN	138	0,156297781 %
VENDOR	58	0,065690372 %
Jumlah	88293	100 %

E. Visualization Design

At this stage the visualization of the selected data will be presented in several forms. The design is done by choosing the right visual form, eliminating clutter and focusing attention[6]. The following is an explanation of the presentation of the visualization of each information need:

a. Summary of inventory information

The form of visualization chosen is simple text. Simple text is chosen because it is easy to display one or two information simultaneously. With the explanation of being free of clutter, the alignment uses left-align and the white space as a separator between components.



Figure 2. Final Results of Information Needs 1

b. The highest turnover of goods in 3 months

The form of visualization chosen is horizontal bar chart. Horizontal bar chart is chosen because it is easy to understand comparisons from several categories. With the explanation of being free of clutter, the alignment uses left-align, the white space is a separator between components and does not contain a border.

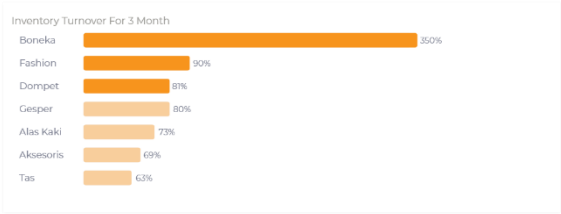


Figure 3. Final Results of Information Needs 2

c. Number of purchase orders waiting for approval

The form of visualization chosen is simple text. Simple text is chosen because it is easy to display one or two information simultaneously. With the explanation of being free of clutter, the alignment uses left-align and the white space as a separator between components.

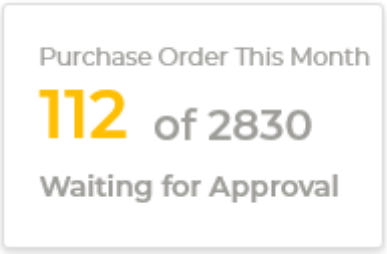


Figure 4. Final Results of Information Needs 3

d. Comparison of items returned in one month

The form of visualization chosen is simple text. Simple text is chosen because it is easy to display one or two information simultaneously. With the explanation of being free of clutter, the alignment uses left-align and the white space as a separator between components.

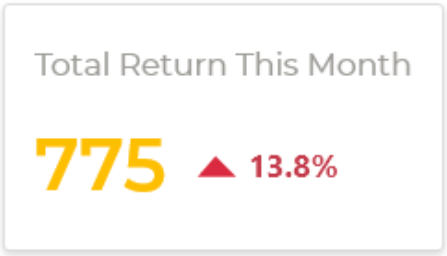


Figure 5. Final Results of Information Needs 4

e. The best vendor of each item group

The form of visualization selected is the table. The table is chosen because it is easy to understand information as a whole. With the explanation of being free of clutter, the alignment uses left-align, the white space is a separator between components and does not contain a border.



KELOMPOK	VENDOR	GRADE
Aksesoris	ANWAR	A
Alas Kaki	PT. WIJAYA ARTHA	A
Boneka	MELVI ANUGRAH COLLECTION	A
Dompet	SUSI VIVO	A
Fashion	PAPA DIRA	A
Gesper	GOLD CORAL SUMBER JAYA	A
Tas	BENGKEL MODE	A

Figure 6. Final Results of Information Needs 5

f. Best seller item

The form of visualization chosen is a symbol and simple text. Symbols and simple text are chosen because it is easy to display one or two information simultaneously. With the explanation of being free of clutter, the alignment uses left-align and the white space as a separator between components.



Figure 7. Final Results of Information Needs 6

g. Tour leader arrival rate

The form of visualization chosen is line chart. Line chart charts are chosen because it's easy to understand time series comparisons easily. With the explanation of being free of clutter, the alignment uses left-align, the white space is a separator between components and does not contain a border.

Figure 8. Final Results of Information Needs 7

h. The best tour leader in 3 months

The form of visualization chosen is horizontal bar chart. Horizontal bar chart is chosen because it is easy to understand comparisons from several categories. With the explanation of being free of clutter, the alignment uses left-align, the white space is a separator between components and does not contain a border.



Figure 9. Final Results of Information Needs 8

i. Best reseller in 3 months

The form of visualization chosen is vertical bar chart. Vertical bar chart is chosen because it is easy to understand comparisons from several categories. With the explanation of being free of clutter, the alignment uses left-align, the white space is a separator between components and does not contain a border.

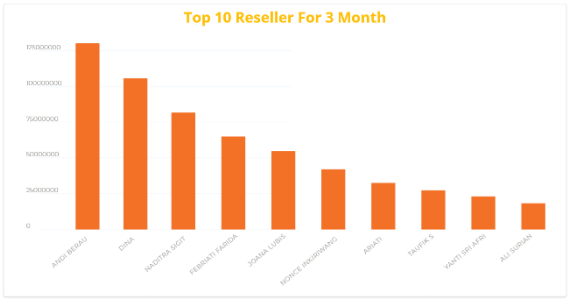


Figure 10. Final Results of Information Needs 9

j. Percentage of retail segments

The form of visualization chosen is simple text. Simple text is chosen because it is easy to display one or two information simultaneously. With the explanation of being free of clutter, the alignment uses left-align and the white space as a separator between components.

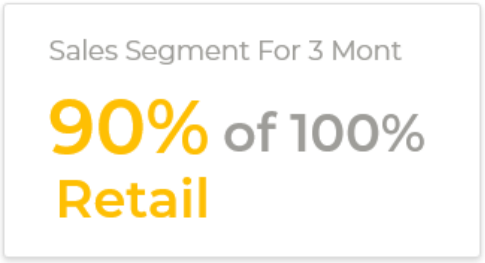


Figure 11. Final Results of Information Needs 10

To test how effective the design has been made, testing of one representative from the purchasing division and one representative from the marketing

division is carried out. The following are the results of acceptance testing.

Table 8. Acceptance Test results

Kebutuhan Informasi	**Jenis Visualisasi**	**Hasil**
Summary of inventory information	*Simple Text*	Accepted
Information on the highest turnover value in 3 months	*Horizontal Bar Chart*	Accepted
Information on each PO status every month	*Simple Text*	Accepted
Information comparison of good and reject goods every month	*Simple Text*	Accepted
The best vendor information for each item group	*Table*	Accepted
Best Seller Item Information in 3 months	*Sysbol and Simple Text*	Accepted
TL arrival rate information every month	*Line Chart*	Accepted
Information on 10 Tour Leaders with the best profit	*Horizontal Bar Chart*	Accepted
Information 10 Resellers with the best profit	*Vertical Bar Chart*	Accepted
Percentage Information of Each Sales Segment	*Simple Text*	Accepted

The conclusion of the results of acceptance testing is that the form of visualization is appropriate. This is evidenced by the results received from all information needs.

F. Prototype Implementation

The prototype implementation discusses how prototypes are built. The following is an interface implementation that is realized in the form of a website:

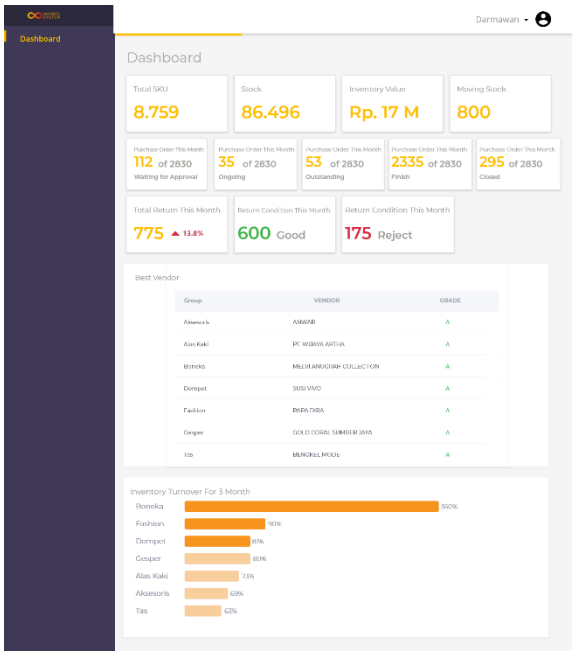


Figure 12. Purchasing Dashboard Page



Figure 13. Marketing Dashboard Page

G. Testing

Testing is carried out using the usability testing method. Testing is done to find out the level of ease of the user interacting with the system being built. Scenario table testing 1 for purchasing division and scenario testing table 2 for marketing division.

Table 9. Testing Scenario 1

No	Task	Scenario
1.	Get information about inventory	You are a purchasing division officer who wants to know information about inventory value
2.	Get information about goods turnover	You are a purchasing division officer who wants to know information about the highest turnover of 3 item groups in 3 months
3.	Knowing the information of each PO status every month	You are a purchasing division officer who wants to know information about the percentage of PO
4.	Knowing the comparison information of return items	You are a purchasing division officer who wants to know information about reject reject items
5.	Know the best vendor information for the item group	You are a purchasing division officer who wants to know information about the best footwear group vendors

Table 10. Testing Scenario 2

No	Task	Scenario
1.	Get the best seller information	You are a marketing division officer who wants to know information about the 10 best seller items
2.	Get information on the level of arrival of the tour leader	You are a marketing division officer wanting to know information about the upcoming tour leader in June
3.	Knowing the best tour leader information	You are a marketing division officer wanting to know information about 5 leader tours with the best turnover
4.	Knowing the best turnover reseller information	You are a marketing division officer who wants to know information about 10 resellers with the best turnover
5.	Knowing the company's sales segment information	You are a marketing division officer who wants to know information about the retail sales segment

Following are the results of usability testing conducted, the results of test 1 are employees of the purchasing division and the results of testing 2 are the marketing division:

Table 11. Hasil Pengujian 1

Task	Anomaly	Level Of Success
Task 1	Nothing	100%
Task 2	Nothing	100%
Task 3	Nothing	100%
Task 4	Nothing	100%
Task 5	Nothing	100%

Table 12. Hasil Pengujian 2

Task	Anomaly	Level Of Success
Task 1	Nothing	100%
Task 2	Nothing	100%
Task 3	Nothing	100%
Task 4	Nothing	100%
Task 5	Nothing	100%

From the results of usability testing, it was found that the effectiveness level was 100%. So that it can be concluded that the data visualization system testing has fulfilled the expected objectives. Officers from each division can understand information from every need.

3. CONCLUSION AND SUGGESTION

Based on the results of the implementation and testing that has been done on the data visualization system in grutty shoes, it can be concluded that the existing data visualization on the prototype is proper visualization to fulfilling the information needs of the purchasing division and marketing division. Visualization makes it easy for marketing and purchasing division officers to understanding information about inventory, purchase, marketing and information about sales partners in the company, namely tour leaders and resellers. From the information understood can be used to plan inventory management strategies and formulate the company's marketing strategies.

The system developed certainly still has many shortcomings. For this reason the authors hope that this research can be continued and developed again so that it becomes better along with the needs. Some points suggested by the author are as follows:

a) Make visualization results based on the needs of each person in a division. So that the person can only access the information that is his job. Because the system developed is a comprehensive form of information for a division.

b) Because this research only focuses on the main business processes of the company, especially in the field of procurement and sales, it would be much better if the system was developed to facilitate understanding of the information in other divisions such as Human Resource (HR).
c) The results of visualization are made based on mobile applications so that they can be accessed anywhere easily.

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