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Utilization of Business Intelligence in Sales Information Systems

Alya Aulia Nurdin [1*], Ananda Prasetya[2], Annisa Rachma Wijayanti[3], Gading Nur Salmi[4]
[1,2,3,4] *Department of Computer Science, Universitas Negeri Semarang, Indonesia*

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Abstract

Business intelligence is one of the concepts that can facilitate the process of processing data of a company which will later become the basis for the decision-making process of the sales process. Distributor company needs an information system that can help the company in managing and analyzing data and can make sales and profit predictions in the future. This study aims to create an information system that can visualize data analysis and the results of forecasting sales data by avocado fruit distributor companies. In this study, we will apply the concept of Business Intelligence using Power BI Desktop which is equipped with sales prediction analysis on the sales information system. The data processing process in this study uses the process of integrating Excel tools with Power BI Desktop. The dataset of sales in this study was obtained from the Kaggle site and the software development in this study using the SDLC (system development life cycle) waterfall development method. In this study, we found that the development of business intelligence in the sales information system provides convenience that can be felt by distributors, namely in terms of revenue and time. In this case, forecasting is done with the forecast feature in Power BI Desktop with a confidence interval of 95%.

1. Introduction

The rapid development of information technology [1] provides many conveniences and benefits to various aspects of human life. A business needs an information system support in the midst of the rapid development of information technology today [2]–[4]. From this, the use of information technology must be carried out optimally to help processes and activities to save energy, time, and be more accurate. Today's business era requires companies to support performance in carrying out processes and operational activities by using information technology packaged according to company needs [5], [6]. One of them is the application of the Business Intelligence (BI) concept, which can present great opportunities for companies [7] to increase profitability and reduce risk [8]–[10]. Business intelligence is considered as a powerful tool to improve operational capability [11]–[14]. Business intelligence helps

* ***Corresponding Author:***

Alya Aulia Nurdin,
Department of Computer Science,
Universitas Negeri Semarang,
Sekaran, Gunungpati, Semarang, Indonesia.
Email: alyaaulianurdin@gmail.com

gather essential information from a wide variety of unstructured data and convert them into actionable information that allows firms to make informed policy decisions and improve business efficiency and productivity [15], [16]. The increasingly fierce business competition makes companies must be careful to survive in the business world, especially in terms of data analysis for the decision-making process. Business intelligence (BI) and communication technologies play in how firms may achieve organizational sensing agility, decision making agility [17], and acting agility in different organizational and environmental contexts [18]. Good and appropriate data analysis can help organizations in deciding a policy, carrying out strategic actions, or in making a decision that concerns a business [19]. Business intelligence adoption become widespread as organizations continue to search for ways to support business performance management [20]−[22]. Besides that, the big data analytics adopters were five times faster in making good decisions than their competitors and twice as likely to be in the top quartile of financial performance within their industries due to the business intelligence obtained from the big data analytics [23].

In businesses related to several partners, especially distributors who must manage sales data that includes the sale of goods to several related partners, there is a great opportunity if the data can be analyzed using information systems relevant to the goals of the distributor company. An avocado distributor company has an avocado sales data from various markets in several regions with a very large amount, but this sales data has not been able to produce a forecast analysis that can help the company in predicting sales for some time in the future so that business processes can run optimally. The creation of economic opportunities can provide an increase in the income of local people [24].

Information technology is widely used in almost all fields, including education, business, social, and so on [25], [26]. In this study, we will apply the concept of Business Intelligence using Power BI Desktop which is equipped with sales prediction analysis on the sales information system. Currently, this avocado distributor company needs an information system that can help the company in managing and analyzing data and can make sales and profit predictions in the future. Because of this need, this study aims to create an information system that can visualize data analysis and the results of forecasting sales data by avocado fruit distributor companies.

Business Intelligence (BI) is a set of concepts and methods used by organizations to improve effective decision making by using fact-based support systems [27]. BI is expressed as an approach in organizational architecture based on the speed with which information is analyzed to make accurate and intelligent business decisions within a minimum period that includes a collection of analytical and functional programs. A BI system can quickly discern factual issues and their interactions in business operations, and prompt business firms to respond with executable actions to reach their goals [28]. Business Intelligence includes data warehouse processes, business analysis tools and content or knowledge management [29]. These systems rely on online analytical processing (OLAP) [30], [31] and data mining techniques [32]−[34]. Meanwhile, business analytics can define as the technology and information systems that enable Big Data analysis and reporting in businesses using different analytic techniques [35]. There are the various utilization of Business Intelligence such as for product pricing determination, placement of goods, or sales forecasting [36]. Forecasting is a discipline that predicts future conditions by projecting past data into the future using subjective estimates and mathematical models [37]. Sales forecasting is useful for organizations in estimating budget allocations, predicting sales in a certain period and others. Thus, organizations that implement sales forecasting, the company's management can move forward with more certainty. Data visualization is a series of processes for displaying information or data in the form of graphs or other visuals, so that they are easily understood by ordinary people. The main purpose of data visualization is to communicate information through graphics clearly and effectively. With data visualization, it is useful to make data interesting and not look boring [37]. Therefore, an effective system can improve knowledge and improve decision-making models. In addition, the use of BI operational systems can also increase the profitability of a company. It can also be seen from the existing research entitled "The impact of business intelligence systems on profitability and risks of firms", where this study took samples from 278 manufacturing companies in the US that have used the BI system from 2005 to 2014, showing that these companies on average can increase their profitability and reduce the risk of direct returns on profit after the implementation of the BI operational system.

Some previous studies on sales forecasting and visualization were research entitled "Data Visualization And Sales Prediction of PD. Asia Agung (Ajinomoto) Pontianak in 2019" [37]. This research was conducted to predict the turnover obtained in the coming year and made a visualization using a dashboard. The information that will be visualized is sales and turnover data of each product using Tableau Software and using the Visualization Data Mining method. As well as SPSS is used as a predictive

tool. This research produces data visualizations with the highest-lowest sales products that can make it easier for companies to analyze data.

The next research is entitled "Marketing Research: The Application of Auto Sales Forecasting Software to Optimize Product Marketing Strategies" [38]. In this study, researchers examined the impact of using forecasting systems to predict sales transaction data. This software consists of two main features, namely the descriptive analysis feature and the forecasting feature along with its visualization. As a result, this software successfully analyzed sales transaction data using the Robust Exponential Smoothing method with the smallest RMSE value of 0.83 on the variable number of products sold. Another study, investigate business intelligence activities using data analytics and the impact on firm or corporate performance [39]−[45], organizational agility [46], corporate performance in the hotel industry in Thailand [47], medium and large sized firm in Slovenia [48], small and medium enterprises (SMEs) [49]−[51], retail supply chain management (SCM) in India [52], European fast-moving consumer goods (FMCG) retailer [53], manufacturing enterprises [54], [55], bank [56], textile and apparel industry [57], and start-ups [58]. Besides that, another study investigate the antecedents of BI capability [59], [60], deep learning for business analytics [61].

2. Methods

This research uses a qualitative descriptive analysis method in the form of literature review, which is carried out in the search stage for previous research studies and is carried out through Google Scholar. In addition, qualitative descriptive analysis methods are also carried out in the data mining stage. The dataset of sales in this study was obtained from the Kaggle website. In addition to conducting qualitative descriptive analysis, this study also used the SDLC (system development life cycle) waterfall development method like the previous study about sales information systems [62]. The Waterfall model assumes that once the initial requirements are set and each goal has been clear in terms of ambiguity, then the team will follow the existing flow to complete the project [63].

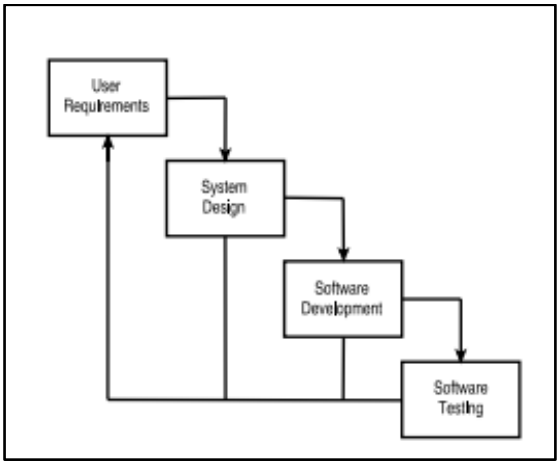

Figure 1. SDLC waterfall model [64]

Figure 1 shows a diagram of the SDLC Waterfall model used in the study. There are several sequences of stages. In the first stage, namely the analysis of user needs, a series of processes of analyzing existing problems are carried out as well as determining specifications that are in line with the needs of the system to be built. In this case, determine what needs are needed in building a sales information system with the use of business intelligence based on users [65]. Furthermore, in the second stage, namely system design, design is carried out based on the analysis of needs. In this case, database design and dashboard design for the needs of utilizing business intelligence. Then in the third stage, namely software development, in this research was carried out only to the process of prototyping the initial display and integration of Excel tools with Power BI Desktop. Meanwhile, in the last stage, namely software testing. Testing aims to reduce the lack of software created and adjust to the needs needed [66]. But the software testing phase was not carried out in this study. In this classical project management, following a "waterfall" process of planning and execution, expected results are communicated relatively clearly by the client at the beginning of the project [67].

3. Results and Discussion

Design of the necessary system database as a source of sales information system data. The database used is MySQL, creating and managing databases on the server side that contain various information using the SQL language. The following can be seen in Figure 2 which is the result of designing the database system, and Figure 3 showing how the relationships between existing database tables are.

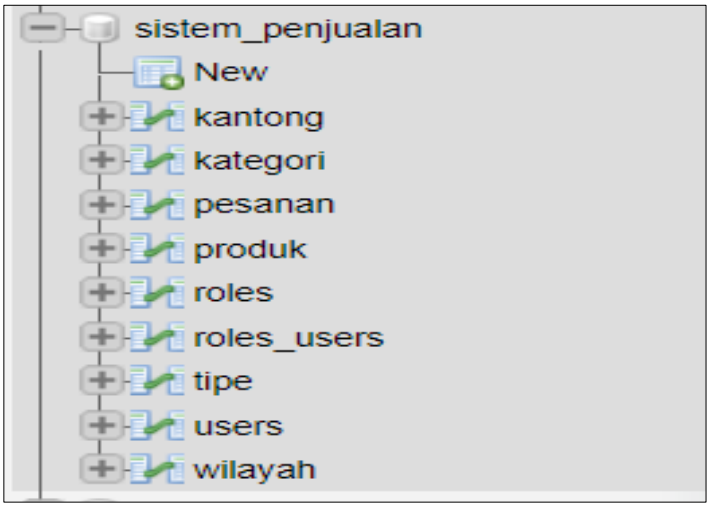

Figure 2. Information system databases

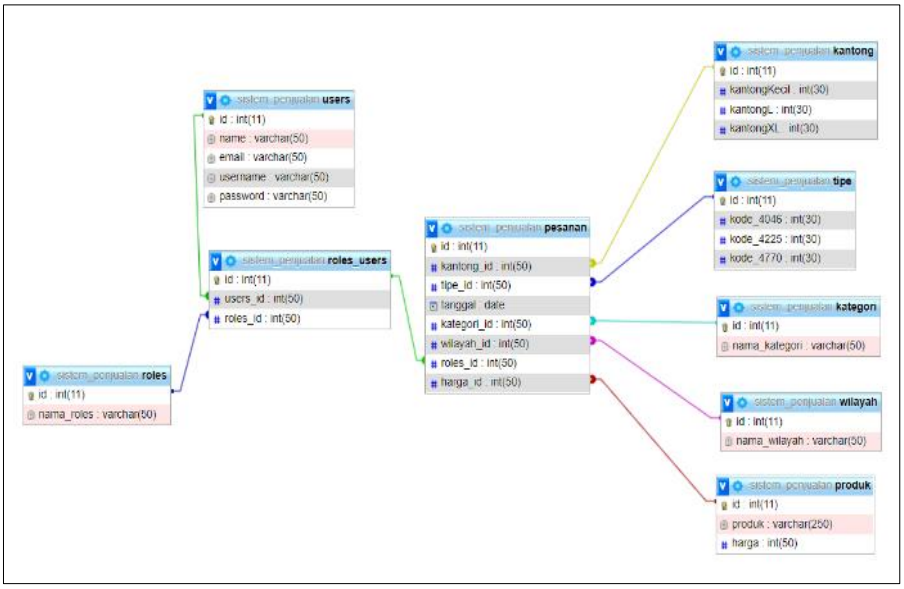

Figure 3. Relationships between tables

Figure 2 shows the database system that will be designed on this sales information system. The design of this database has the aim of optimizing the analysis of system data that will be designed so that it can be in accordance with the goals and targets of the company. Figure 3 shows the relationships between the database tables that have been designed, which describes the relationships or relationships between one table and another.

After that, in creating this data model, dimension tables are built to form a data warehouse. Before designing a data warehouse, it must first be determined the scheme to be used and in this study using a fast constellation scheme, which is a scheme that has one or more-dimension tables and has several fact tables. Here are the dimension tables from the data warehouse modeling and some fact tables from the dimension table results:

Table 1. Dimension table description

Dimension	Information
Region	Storing product distribution area information
Dates	Storing information about time descriptions
Product	Storing information about avocado data

Table 2. Sales fact table description

Fact	Information
SalesKey	Contains a sales id
PouchKey	Contains the product pouch id from the product dimension table
TypeKey	Contains the product type id of the product dimension table
Date	Contains a sales date with a date type.
Category	Contains product category descriptions from the product dimension table
Region	Contain a region description from the regional dimension table

Table 3. Category table description

Fact	Information
CategoryKey	Contains category IDs of type integer
Category	Contains product category descriptions from the product dimension table

Table 4. Region table description

Fact	Information
RegionKey	Contains a region id with an integer type
Region	Contain a region description from the regional dimension table

Table 5. Pocket Table Description

Fact	Information
PouchKey	Contains the product pouch id from the product dimension table
Small Pouch	Contains a description of the total number of small bag-sized avocados sold
PouchL	Contains a description of the total number of L-bag size avocados sold
PocketXL	Contains a description of the total number of XL bag-sized avocados sold

Table 6. Type Table Description

Fact	Information
SalesKey	Contains a sales id
Code4046	Contains a description of the total number of avocados with product search code 4046 sold
Code4225	Contains a description of the total number of avocados with product search code 4225 sold
Code4770	Contains a description of the total number of avocados with product search code 4770 sold

Table 7. Product Table Description

Fact	Information
ProductKey	Contains the product id of the product dimension table with an integer type
Price	Contain the price of a product with a decimal type

Next, in the process of designing this prototype, it was created to provide an overview of the system dashboard that we created. This makes it very easy for developers to continue to build the system. The front-end prototype image can be seen in Figure 4.

Figure 4. Prototype front-end sales information system

After designing the prototype, we are integrating datasets using Microsoft power BI software, by inputting data in excel into Microsoft power BI, then processing and analyzing data, as well as implementing sales forecast models based on time and region. The following Figure 5 is a dataset view of avocado sales from several markets by one distributor company in excel.

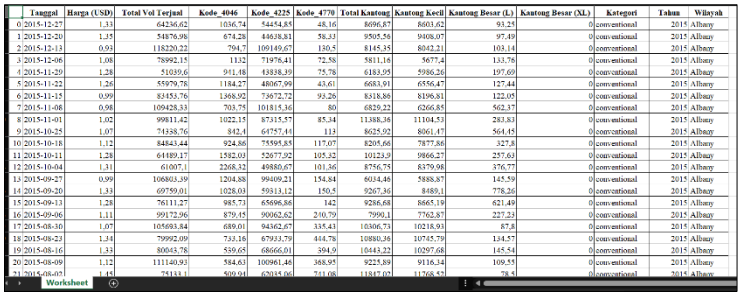

Figure 5. Data in excel format that has not been processed

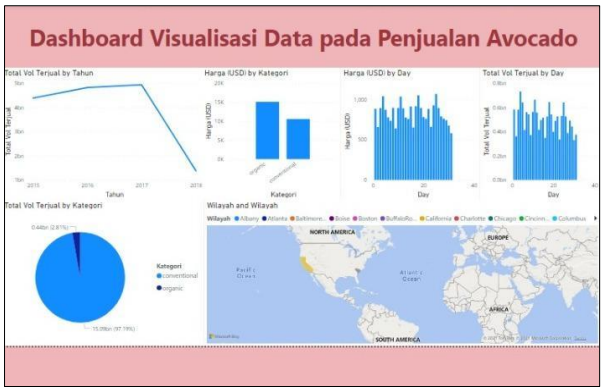

Figure 6. Actual data visualization

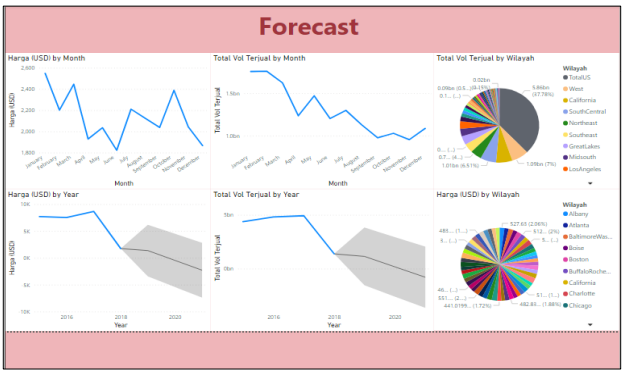

Figure 7. Forecast data visualization

Through the data processing process that has been carried out, the dashboard visualization can be seen in Figure 6 and Figure 7. From this visualization, companies can get data knowledge within a certain specified period. On the line chart, there is a significant decrease in sales volume from 2015-2018. Then for the price of conventional category products which reached USD 15K higher when compared to the price of organic category products. It is known that product prices and sales per day also tend to fluctuate. Furthermore, in the pie chart for the sales volume of conventional category products which reached 97.19% is still much higher than the sales volume of organic category products which is only 2.81%. Meanwhile, in the visualization forecast, the price data and sales volume per month are unstable and tend to fluctuate, and it is predicted that there will be a decrease in prices along with a decrease in product volume demand. In this case, forecasting is done with the forecast feature in Power BI Desktop with a confidence interval of 95%. By utilizing Power BI, the data needed can change according to the selected area so that it can facilitate the process of gaining knowledge.

4. Conclusion

The development of business intelligence in the distributor information system provides convenience that can be felt by distributors, namely distributors can find out the income and profits they will get according to the desired time period. In this paper, distributors can find out which types of avocados provide the most and least profit so that distributors can determine marketing strategies to increase sales on types of avocados that do not provide profits. As well as determining the measures to maintain the quality of the type of avocado that makes the most profit.

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