Business Intelligence System using Simple Moving Average Method (Case Study: Sales Medical Equipment at PT. Semangat Sejahtera Bersama)

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Abstract. Business Intelligence is a technique or method for transforming raw data into useful and meaningful information for a company. There are the various utilization of BI such as for product pricing determination, placement of goods, or sales forecasting. Some problems that often occur in a company, especially in a company engaged in the sale of goods is the difficulty of processing data with an equal form and the amount of data to be analyzed, as happened at PT. Semangat Sejahtera Bersama. One of the problems that occur in the company is the difficulty of forecasting stock of goods that must be stored in the warehouse. Limited warehouse capacity causes each branch is required to wisely perform demand for stocks of goods that must be stored in warehouses that have limited capacity. The process on this study is building a dashboard to generate reports and sales trends. Through this report, it can be seen sales trend by month, or season in Indonesia, given the season is one factor that determines the type and number of items sold in a period. The system will generate the forecast type of goods that must be prepared in each branch based on sales data in some determined data range. Sales prediction is generated through computation process using a simple moving average method. This method works by doing the calculation of the average value of sales value by the number of previous periods so it is able to display sales trends that occur.

Keywords — Business Intelligence, Sales Forecast, Simple Moving Average

1. Introduction
Optimal sales results in a company cannot be separated from the utilization of information systems that continue to grow rapidly. Increasingly intense business competition makes companies must follow the increasingly innovative times to be successful and survive in competition in its implementation. The use of information systems must be supported by a good and appropriate strategic plan. The information system that runs at PT. Semangat Sejahtera Bersama is structured by utilizing desktop-based software that can be accessed online. The system produces a variety of information in the form of tables both sales, goods, marketing, showrooms, customers, but this makes it difficult to make a decision from an information because the data is still mixed and only consists of a collection of numbers that sometimes confuse, so the decision-making process requires a relatively long time.
In order for managers to determine business strategies properly and quickly, software is needed that can be accessed online to monitor developments. Another problem arises when the manager wants to know the influence of the season in each branch, because this will result in the supply of goods which in order to determine the inventory will be hampered because the warehouse owned by the branch is not as big as the warehouse in the center, therefore, the manager's delay in determining the decision will the calculation of goods to be stocked must be carefully thought out because it will have an impact on the company's progress.

The need for companies to be able to make decisions quickly and precisely can actually be overcome with business intelligence. Business intelligence is a concept that uses a variety of methods and technologies, so that a business intelligence system can generally cover a broad field ranging from processes, software, and manufacturing techniques, starting from data collection, integration, analysis, to presenting these data into information that is useful for users [6]. Business Intelligence is a technology that is often used nowadays, this is because it provides businesses with the possibility to analyze their business practices and improve them [8].

By using a business intelligence application, it is expected to be able to see and make decisions quickly based on reports produced in a concise and accurate manner, especially in analyzing and providing data access to help make better decisions. Business intelligence is able to turn data into quality information that supports business decision making and business processes.

Based on the problems, PT. Semangat Sejahtera Bersama requires the application of business intelligence because companies that implement business intelligence have advantages over competitors who do not implement business intelligence. Business intelligence that will be built based on the web, so that the access process is easier to do, and the method used is simple moving average where the method can work to produce sales predictions, predictions of items sold. This is done by calculating the average value of the average sales value of the average sales in a certain previous sales period so that it can display the sales trends that occur. Then the data will be easily understood and analyzed that can help for the decision making process.

2. Literature Review

There are 2 main theories used in this research, namely Simple Moving Average and Business Intelligence.

2.1 Simple Moving Average

Simple Moving Average uses historical data to produce predictions and can working good when the value is unstable [3]. A Simple Moving average is a model for predicting. The simple moving average technique is used in predicting demand by calculating the average value of the actual demand value from a number of previous specific periods. Each new prediction is set for a long period and replaced with a request from the new period, so that the data in the calculation moves over time, according to the name of this method. The simple moving average method is used for data that is unstable, has no trends, and does not use weighting on data. The equation used in this method is [5]:

\[ Y_{t-1} = Y_t + Y_{t-1} + \cdots + Y_{t-m+1} \]  

(1)

Where \( Y_t \) is the data in the current period, while \( m \) is the length of the moving average period used. \( Y \) value will be recalculated for each new data. The average value is then combined to form a curve that sets the moving average curve.

2.2 Business Intelligence

Edward [2] states that business intelligence is a way to collect, store, organize, reshape, summarize data and provide information, both in the form of internal business activity data, as well as data on external business activities, including accessible business activities of competitors and analyzed for various management activities.
Nadia [4] stated that business intelligence is a category commonly used for applications and technology to collect, store, analyze, and provide access to data in order to help users from the company to make better and more informed decisions. In general, solutions provided by BI are data sources where transactional data is collected, data warehouses/data of mart, reporting and visualization tools, such as prediction and modeling analysis.

Powers [1] states that business intelligence describes a concept and method of how to improve the quality of business decision-making based on data-based systems. From the three sources above the author concludes that business intelligence is the concept of collecting data, storing data and selecting data to provide information to help and improve the quality of business decision making for companies. So that it can be said that an information system is a place for data entry, while business intelligence applications as a place for data analysis. Where the concept of business intelligence changes information into new knowledge and understanding for an organization.

A business intelligence system, in other words is a combination of data warehouse and decision support systems. This explains how data from different sources can be extracted and stored and then taken for analysis. The main business intelligence activities include collecting, preparing and analyzing data. In the business intelligence process the data used must be of high quality, by obtaining it from various data sources collected, then modified, then cleaned up, then loaded and stored in the data warehouse. Figure 1 is the basic concept of the Business Intelligence system.

![Figure 1. Basic Understanding of Business Intelligence Systems](image)

3. System Development

To illustrate a general description of a system that shows the activities that occur between the system and its entities, a Data Flow Diagram (Context Diagram) is created to specifying, constructing, and visualizing the system in a model [9]. The context diagram explained that there are two users involved in the system, namely Admin and Manager. Admin can do a lot of interaction into the system such as logins, item data analysis, managing data manager, showroom data analysis, analyzing sales data, data marketing analysis, customer data analysis while interactions that can only be carried out by managers into the system include login, data analysis goods, analysis of data showroom, analyzing sales data, data analysis, customer data analysis.
Figure 2. Context Diagram

The general description of the system built in this study through the following stages:
1. The source of the data to be processed is in (.xlsx) extension. The data that used is valid sales data for the last 6 months of PT. SSB.
2. The data source is processed using Pentaho to perform the cleaning and data integration process.
3. Data that has been cleaned will be integrated with the database that has been created. This process describes the process of inputting data sources to the database.
4. Data that has been integrated will be entered into the database and ready to be processed with the PHP programming language.
5. Dashboards and processing data in databases with PHP programming languages and using the simple moving average method to analyze sales data in accordance with existing data.

Figure 3. Snowflake scheme
The dimensional modeling that formed in this system is shown in Figure 3. Dimensional modeling is a logical design technique that aims to present data into a standard, intuitive form that can be accessed with high performance. Each dimensional model consists of a table with a composite primary key called a fact table, and a smaller set of tables called dimension tables. Each dimension table has a simple primary key that corresponds exactly to one composite key in the fact table. In other words, the primary key of the fact table is made of two or more foreign keys.

4. Result and Discussion
The proposed system is then implemented using The PHP language. It also employs MySQL [7] to facilitate the database management system. Since there exist numbers of form, we will only describe some main pages of our proposed system.

Figure 4 is the dashboard page interface. Where on this page displays information about the number of items, number of showrooms, number of marketing, number of customers, which for all boxes with content already integrated with the pages that are available to display the report in detail.

Figure 5 shows the sales report, on the sales report page will display overall sales of marketing, customers, showrooms, goods. User can choose to see the data for each period (years) and the details, it can be done by selecting the details of each month, on this page there is also a section for the dry season and rainy season. On the sales details page will display the sales transactions details at the selected month. On the dry season page will display information about the sale of the most sold items during the dry season starting from the month (April-September). For each item has their own sales details, making it easier to see the details of the sale.
Finally, on the forecasting page will show forecasting for the next month both goods, marketing, showrooms so that they are able to help maximize the inventory of goods in the future. For the method used, the simple moving average method.

![Forecasting Results Using the Simple Moving Average Method](image)

5. Conclusion

The result of building a business intelligence system at PT. Semangat Sejahtera Bersama based on the web is a system capable of displaying data items, showrooms, marketing, sales trends as well as for forecasting so that it can help managers in the decision-making process assisted with accurate data and sales forecasting with the simple moving average method.

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References

[1] Powers D J 2002 Decision Support Systems : Concepts and Resources for Managers (United States: Green Wood Publishing Group)
[2] Edward D 2000 Definisi Business Intelligence (United States :Addison Wesey)
[3] Wisner J, Leong G and Tan K 2005 Principles of Supply Chain Management : A Balanced Approach (United Kingdom : Thomson)
[4] Nadia 2002 Business Intelligence and E-Discovery J Intellectual Property & Technology Law Journal vol.22
[5] Nau R 2014 Forecasting with Moving Averages Duke University
[6] Rajagukguk R 2007 Memulai Business Intelligence dengan MS Performance Point Server (Indonesia Elex Media Kompetindo)
[7] Seyed M.M, Tahagoghi, and Williams H.E 2006 Learning MySQL: Get a Handle on Your Data (United Stated : O’Reilly Media, Inc.)
[8] Siemen C, Clever N, Barann B, Becker Reqruitments Elictation for an Inter-Organizational Bussiness Intelligence System for Small and Medium Retail Enterprises J Proc. 2018 IEEE 20th Conference on Business Informatics (CBI) (Vienna : Austria/IEEE)
[9] Ibrahim R 2010 Formalization of the Data Flow Diagram Rules for Consistency Check J International Journal of Software Engineering & Applications DOI: 10.5121/ijsea.2010.1406