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Designing an Information System for Inventory Forecasting (Case Study: Samsung Partner Plaza, Sorong City)

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ABSTRACT

Samsung Partner Plaza is a company that sells smartphones and serves large-scale sales by adopting the membership and computerized systems. The company's inventory management activities consist of the normal inventory flow direction and management, ranging from the inventory procurement, storage to sales. The company would often face a problem where it would be running out of finished goods inventory to be sold in coming months. The remaining inventory would be inadequate to meet the customer demands. Such situation, and the fact that the company has competitors both inside and outside Sorong city, might cause customers to find other companies that could meet their demands, thus reducing the company's capacity to generate profit. Given the situation, this research was conducted to create an information system which could be used by Samsung Partner Plaza for inventory forecasting. The system would provide information regarding the correct amount of inventory which could meet the customer demands. The waterfall method was employed to develop the system and the exponential smoothing method was employed by the system to perform forecasting, where this method uses sophisticated weighting, but is still easy to use so it is suitable for forecasting. The research produced a forecasting information system which was helpful for the company in predicting the adequate amount of inventory to be ordered to meet the customer demands. The system was tested using the Black Box testing and the results showed that all functions of the system worked well (valid).

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1. INTRODUCTION

Along with the rapid, ongoing advancement of technology, smartphones are no longer considered as luxury goods. They have become important and essential needs for many more people at various stages of life: children, teens and adults [1],[2]. Newer models are produced at a rapid rate, providing innovative features such as built-in high definition cameras which produce high quality images, the capability to transfer and manage data without computers and the ease access to the internet. These are just some of factors which drive smartphone users to buy newer products.

Samsung Partner Plaza is a company which sells smartphones and serves sales in large scale by adopting the membership and computerized systems. The sales are divided into two types: cash and credit. By reducing the operational cost and buying the finished goods from the suppliers in large quantities, the company is able to sells the goods with cheaper prices. The company has competitors both inside and outside Sorong city. The company's finished goods inventory management activities consist of the normal inventory flow direction and management, ranging from the inventory procurement, storage to sales.

Samsung Partner Plaza would often face a problem where it would run out of certain goods to be sold in certain months. The available inventory would be inadequate to meet the customer demands. The company used to predict the amount of goods to be ordered and its ordering period based on past experiences and intuition only [3],[4]. Such situation may cause customers to buy the goods in other companies, therefore potentially reducing the company's possibility to generate profit [5]. Based on the situation, the research problem was thus formulated: How should forecasting be performed so that the inventory provided by Samsung Partner Plaza would meet the customer demands?

Niswatin [6], in her research to develop the decision support system for forecasting the production of bottled water, dealt with a problem where the amount of production of bottled water had been determined manually, making it difficult to determine every amount of production every month. She developed a decision support system for aiding the production. The system uses the Trend Moment method in determining the amount of production. Unfortunately, the system has one weakness: it can only provide a forecasting result at certain times based on data in form of product sales records from previous periods.

Arminas and Karanga [7] in their analysis on Comforta's bed sales forecasts dealt with a problem of forecasting future demands. The products were still processed by manually counting the stocks in the warehouse. This was deemed ineffective. They used POM software for Windows to analyze and process the data. Their weakness is that there is no way to forecast the future with 100% certainty.

Zulhamidi and R. Hardianto [8] in their research on forecasting the green tea sales dealt with a problem where the company had never performed any prediction or forecasting methods before so that the stocks would be piled up in the warehouse as the sales were low. They used the AMIRA method to forecast. The method's weakness is poor accuracy of forecasting result for longer term.

Ryan and Wijarnato [9] developed a forecasting model for the exchange rate between Indonesian Rupiah and US Dollar for the last ten years which had been decreasing from 9.087 in 2010 to 11.900 at the beginning of 2015. Such condition demanded a carefully planned, focused and accurate fiscal planning. His forecasting model was based on the Moving Average algorithm. The model's weakness is that its forecasting accuracy could only be determined by the model's performance on new data which have not been used during the model fitting.

Another analysis study by Paruntu and Palendeng [10] on the sales and stocks forecasts of Suzuki motor cycles dealt with a problem where there was no fixed forecasting method used as a reference. The company had used several forecasting methods to predict the sales and to handle the required stocks, but the choice of the method used was based on the market's conditions. The researchers developed a forecasting model that uses the Moving Average method with POM-QM software.

The difference of this research with some previous research that has been described above, namely on issues, forecasting methods used, and the programs used. This research produced a forecasting information system which would be used by Samsung Partner Plaza to provide information regarding the amount of inventory which would adequately meet the customer demands.

2. RESEARCH METHOD

This research employed two methods: the waterfall method for developing the system and the exponential smoothing method for forecasting. In addition, data collection techniques performed by an interview with Mrs. Titik Ratna Kusumawati as Samsung Patner Plaza's Chairman.

2.1. The Waterfall Method

The waterfall method is a model for developing information systems systematically and sequentially [11]. Below is the illustration of the phases of the method.

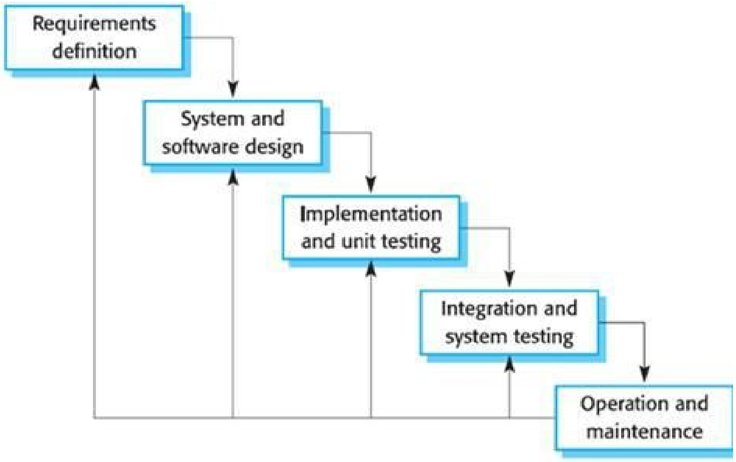

Figure 1. The Phases of the Waterfall Method

1) **Requirements Definition**. In this phase, data were collected from the Samsung Partner Plaza store via the direct interview with the head of the company. It was intended to identify any problem faced by the company and to design our information system and the way it would be implemented to solve the problem.
2) **System and Software Design**. In this phase, our system was designed using Unified Modelling Language (UML) [17] and the interface was designed using Delphi 7.0 software.
3) **Implementation and Unit Testing**. In this phase, our system design was developed as a set of programs or units. Then, each unit was tested and validated to see whether each unit had met its specifications.
4) **Integration and System Testing**. In this phase, the system was tested in order to see whether the system would still have problems and to ensure that the system would have met the requirements. As the system had passed the test, the system was delivered to users for Black Box Testing.
5) **Operation and Maintenance**. In this phase, the system was already installed in and used by the Samsung Partner Plaza party.

2.2. The Exponential Smoothing

The exponential smoothing model is often used to process unstable, changing data patterns. It is a moving average forecasting method with sophisticated weighting, but it is still easy to use. The method uses very few past data records. The model assumes that data fluctuate around a fixed, average value without following patterns or trends [12]. A formula of the exponential smoothing is given as follows:

$$F_t = F_{t-1} + \alpha (D_{t-1} - F_{t-1})$$

where:
F_t = Current demand forecast
F_{t-1} = Past demand forecast
α = Exponential constant
D_{t-1} = Actual demand

Let us try to calculate the exponential smoothing by using an example case from the research. A company that sells smartphone SM-G532 (Samsung Galaxy J2 Prime) wants to forecast the product in the market. The company uses α = 0,1. The past demand forecast for January is 10.000 units but as the time passes it turns out that the actual demand in January only reaches 9.000 units. Therefore, how many the product forecast for February will be?

Identified:
$\alpha = 0,1$
F_{t-1} = 10.000 units
D_{t-1} = 9.000 units
F_t = ?

Answer:
$F_t = F_{t-1} + \alpha (D_{t-1} - F_{t-1})$
$F_t = 10.000 + 0,1 (9.000 - 10.000)$
$F_t = 10.000 + 0,1 (-1.000)$
$F_t = 10.000 + (-100)$
$F_t = 9.900$
Therefore, the current demand forecast for February is 9.900 units.

3. RESULTS AND DISCUSSION

The research results and discussion are divided into several parts: the design process using the use case diagram and the displays of our forecasting information system [13-16].

3.1. The Use Case Diagram

The use case diagram in Figure 2 below involves two actors: the admin (administrator) and the head of the company. The admin can manage stocks, forecasting process and results while the head may see the forecasting result.

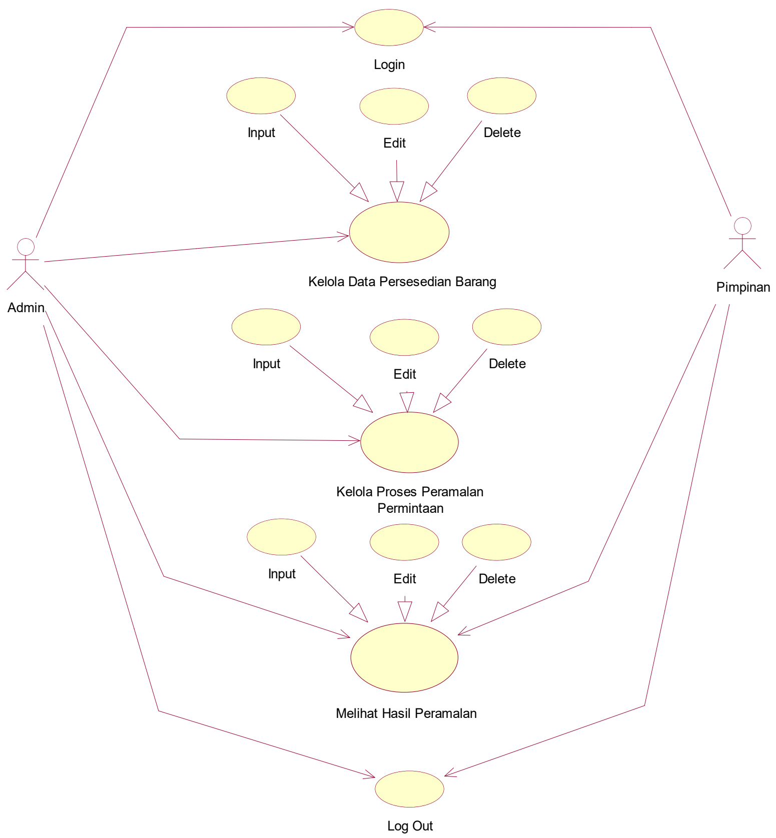

Figure 2. The Use Case Diagram

3.3. The Activity Diagram

The activity diagram in Figure 3 illustrates the admin's system activities where the admin may process data regarding stocks, forecasting process and results.

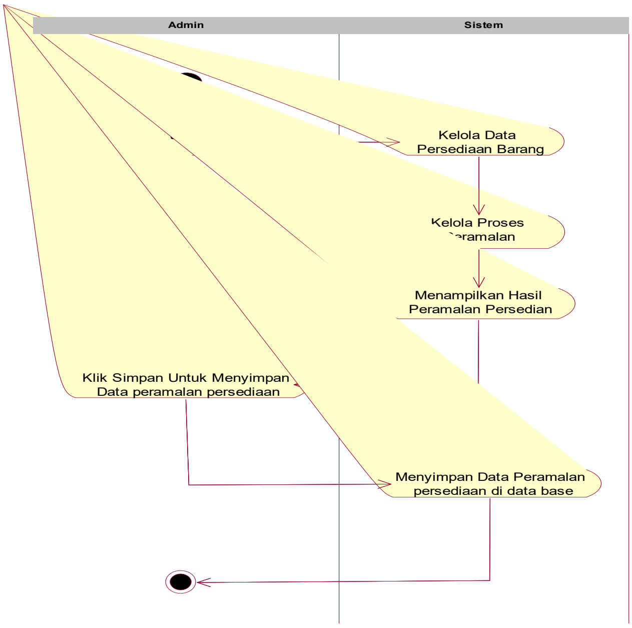

Figure 3. The Activity Diagrams

3.4. The Class Diagram [18]

The Figure 4 below illustrates the interconnection of classes in form of class diagram. There are three classes that connect to each other namely the stocks, the forecasting process management and the forecasting result management.

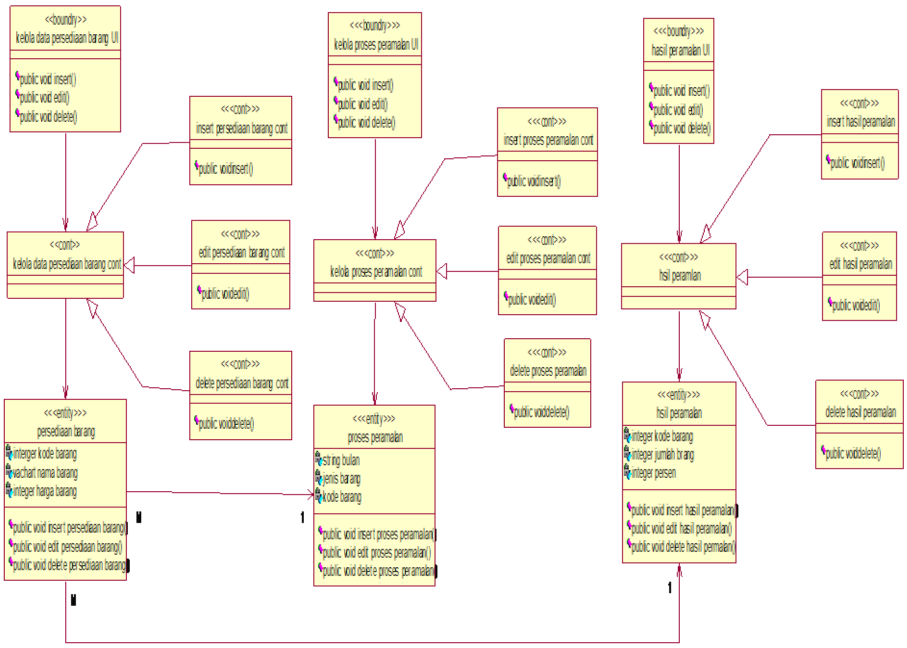

Figure 4. The Class Diagrams

3.4. The Displays of the Forecasting Information System

The information system for forecasting inventory/stocks data in Samsung Partner Plaza was developed using Delphi 7.0 software. The system consists of several menus and features such as the login form (Figure 5), the admin's main form (Figure 6), the inventory form (Figure 7), the officer data form (Figure 8), the sales data form (Figure 9), and the forecasting form (Figure 10).

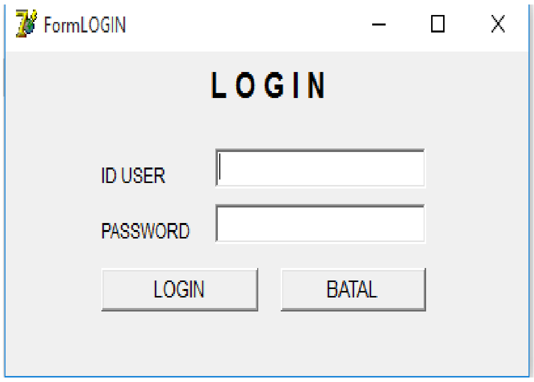

Figure 5. The Login Forms

Figure 5 displays the login form to access the system as administrator by entering user name and password correctly.

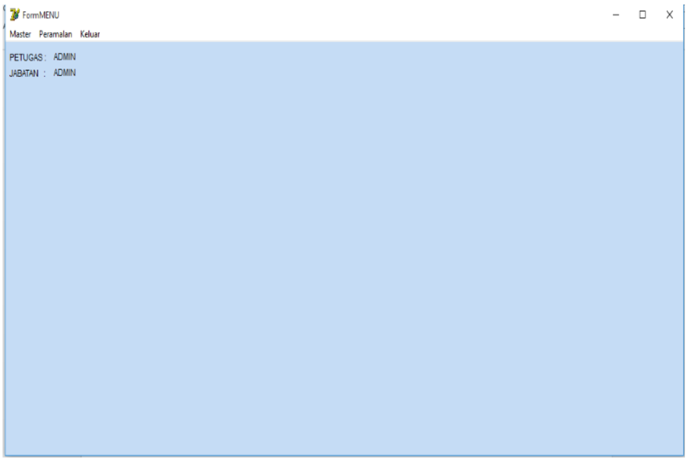

Figure 6. The Admin's Main Form

Figure 6 displays the admin's main form which consists of three menus: Master, *Peramalan* (Forecasting), and *Keluar* (Log out).

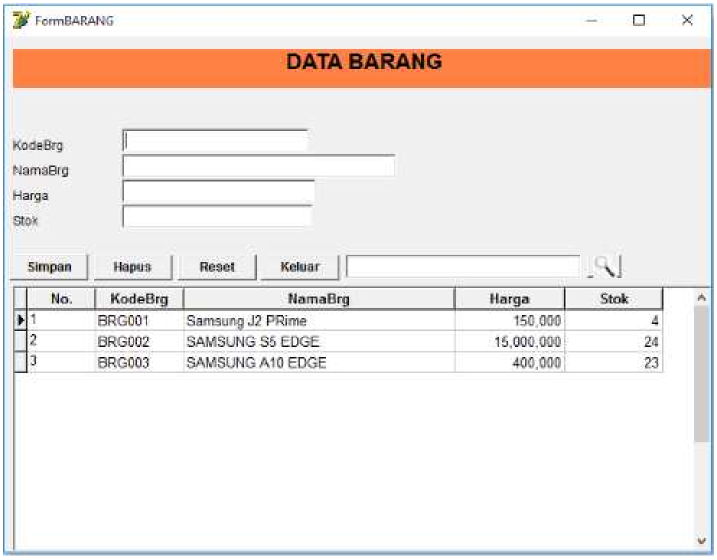

Figure 7. The Inventory Forms

Figure 7 displays the inventory form inside the menu Master where the admin may input, edit or delete inventory/stocks data.

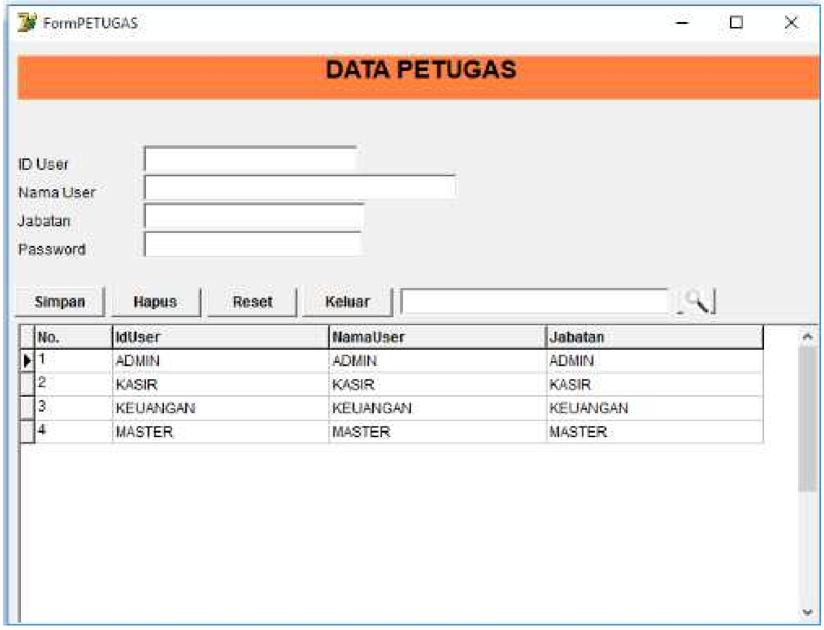

Figure 8. The Officer Data Form

Figure 8 displays the officer data form inside the menu Master where the admin may input, edit or delete any officer's data.

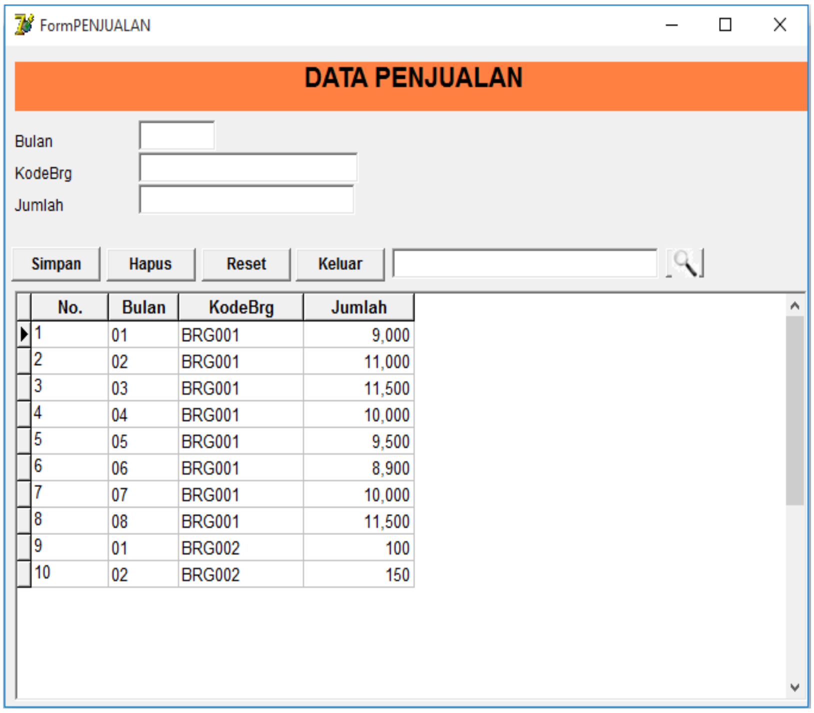

Figure 9. The Sales Data Form

Figure 9 displays the sales data form inside the menu Master where the admin may input, edit or delete any sales data.

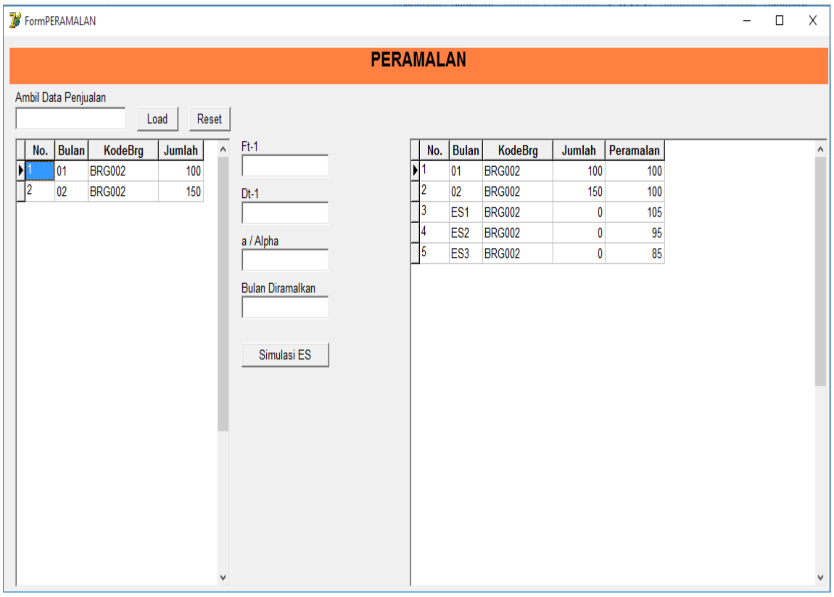

Figure 10. The Forecasting Form

Figure 10 displays the forecasting form where the admin may forecast inventory/stocks to be ordered.

3.3. The Black Box Testing

The black box testing was performed to observe any execution result through data testing and to check the software's functionality. It is like when one sees a black box. He may only observe the outer appearance without the need to figure out what is going on inside. Therefore, testers only evaluate the system's interface and functionality without examining the internal mechanism and processes. They want to know the input and output only. Table 1 enlists the results of the black box testing on the system.

Table 1. Black Box Testing Results

No	Functions	Status
1	Administrator logs into the system	Valid
2	Logging in with wrong username and password is rejected by the system	Valid
3	Logging in with correct username and password is accepted by the system	Valid
4	Input officers, stocks and sales data	Valid
5	Edit officers, stocks and sales data	Valid
6	Delete officers, stocks and sales data	Valid
7	Reset officers, stocks and sales data	Valid
8	Load sales data in the forecasting form	Valid
9	Simulate the exponential smoothing forecasting	Valid
10	The admin logs out from the system	Valid

4. CONCLUSION

Based on the explanation and discussion, it can be concluded that:

1) In this case study, the exponential smoothing method is fit for forecasting.
2) The information system for forecasting inventory/stocks is very helpful for the company in making next orders.
3) The information system could also help the company to identify which products that will be in demand in the market for next month or two

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