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Management of Raw Material Needs and Safety Stock Based on Data Forecast and System Dynamics Modeling

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Abstract— For companies engaged in the manufacturing industry, procurement and inventory control are significant and play an important role in productivity within the company. The case study that occurred at XYZ Ltd. was the frequent occurrence of shortage of raw material stock in PVC resin which causes the production process of ceiling panels to stop. To eliminate this shortage of raw materials, material requirement planning and safety stock calculation need to be conducted. Therefore, the methodology of this research is by utilizing forecasting verification to find the best forecast method according to the demand data plot and the forecast result, and combining them with safety stock calculation and a variation of material requirement planning methods to determine the best material requirement planning method to obtain the optimal control, then a model could be created using a system dynamics approach to verify the improvements on the increased productivity and the income before tax by including the material requirement planning and safety stock calculations on the initial system. The result of this research is by using a variety of forecasting methods, the best method to forecast future demands is the additive decomposition method, by using the safety stock formula, the safety stock is obtained which is 2649.136 Kg of polyvinyl chloride resin, by using a variety of material requirement planning calculations methods, the best method is silver meal and least unit cost methods because these methods obtained the same result for a total cost of USD 164.07, and lastly, by using the suggested improvement on the system, the company will have an increase in the level of productivity by 67.906 (40%) and an increase in average income before tax by USD 32.480,52 (28 %).

Keywords— forecasting, material requirement planning, safety stock, system dynamics, productivity

I. INTRODUCTION

Along with the times, technology and science are also growing, especially in the industrial world. This can be seen in the application of special methods that are continuously being developed to increase productivity. One of them is Production Planning and Inventory Control (PPIC). PPIC is a series of activities designed to increase accuracy in the implementation of the production process in planning and controlling the inventory of raw materials. PPIC is carried out to fulfil market demand and the right distribution process to minimize production costs [1-3]. In PPIC, forecasting methods (especially regarding demand), have a role as planning as well as a decision-making tool in the field of production in which there are planning activities for the needs of raw materials, labour, production capacity, and production machines that will be used in the future [4]. To control inventory, there is a section in PPIC called Material Requirement Planning (MRP) so that availability can be truly

balanced and not excessive, because inventory is a cost, excessive inventory will certainly burden the company's cash flow.

Forecasting methods have a significant role in business because this method could reduce losses due to excessive production. In determining how many goods need to be produced, this method uses historical data as a reference. In general, companies use the MRP method to balance the company's conditions both in terms of demand for raw materials and raw materials for production [5].

Meanwhile, system dynamics is a system in which variables can continue to change due to changes in inputs and interactions between elements in the system. Since it was created in the 1950s, the development of system dynamics aims to create a model that has dynamic relationships between its influential variables. Nowadays, the application of system dynamics can be done with the help of computer software, where applying simulation models on modern computers can provide advantages in low costs, calculations on strong simulations, recognizing system behaviour, evaluating policies, and knowing what is achieved through policy analysis [6].

These approaches are very useful and versatile, which can be seen based on previous studies, for example by using system dynamics to help analyze the interrelations factors that affect the performance of employees and create causal loop diagrams (CLD) and stock flow diagrams (SFD) to improve the average performance of a company but did not take into account to create an activity cycle diagram to take into account the cycle of activity that happens in the company. Even so, based on this research, the system dynamics approach can help a company to improve its average performance of a company by analyzing the variables or factors that could affect the productivity of a company [7].

Forecasting methods are used to conduct an estimation based on the historical data as inputs in determining the direction of future trends, this can be seen in previous studies such as by using forecasting to analyze the sales pattern of liquid fertilizer products during the covid-19 pandemic and compare the forecasting method that can produce the smallest error value in forecasting sales of the company, but only used 2 forecasting methods, these forecasts were done manually using a formula, meanwhile, this research uses mathematical based software to conduct forecasting to reduce any human-based error [8]. This shows that forecasting can be used not only to determine demand but can also to make predictions on other things such as sales.



CSPA 2023



CERTIFICATE OF PARTICIPATION

This certificate is proudly presented to

Thomson Richard, Lina Gozali & Frans Daywin


whom have successfully presented the paper with the title of

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Based On Data Forecast and System Dynamics Modeling**

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PROF. DR. RAMLI ADNAN
General Chair
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