Table 5. BAU Result Simulation

Year	Customer Demand (pcs)	Raw Material Stock Ready (pcs)	Finished Goods (pcs)	Profit (Rupiah)
2018	3587	3659	4862	3.929.586.689,39
2019	3653	5016	5087	7.389.117.779,52
2020	4041	6765	5340	6.917.670.439,77

Based on the BAU simulation results in Table 5, there was an increase in profit in 2018 to 2019 in the amount of Rp 3,459,531,090.00. However, in 2019 to 2020, the company's profits decreased by around Rp 471,447,340.00. This is possible because of an error in determining the company's strategy related to raw material inventories and production plans. Therefore, intervention is needed on several model variables to design future scenarios (future scenario simulation) in order to determine the right alternative strategies to answer existing problems or achieve optimal results. The simulation results for level finished goods, customer demand, and raw material stock ready have a fairly stable upward trend.

6. Future Scenario Simulation

Based on the trend of data from the previous BAU scenario model, it can be seen that in 2018 to 2019, the company's profits decreased. The solution to overcome the things that might happen in the future is to determine the alternative strategies that can be applied by the company. Determination of alternative strategies can be done by designing future scenarios by intervening on several model variables that may be influential and can be controlled.

Interventions are carried out to achieve several objectives, namely increasing company profits and minimizing costs by optimizing the supply of raw materials in accordance with the production plan. In the X Ltd. management system model, the intervention produced 3 scenarios, as follows:

1. Scenario 1: Increase the profit level of the company by optimizing the number of raw stock ready materials through intervention in raw material return variables, raw material checks, raw material purchases, warehouse stock, warehouse waste, target production, WIP, safety stock percentage, and domestic sales percentage.
   a. Overcoming raw material returns or returning defective items to suppliers by increasing raw material checking by 10% from the initial conditions. Raw material purchase variable intervention is 5%. Intervention of these variables is the desire of the company.
   b. Overcoming the waste warehouse by increasing raw material checking and reducing raw material returns by 5% from the initial conditions. Reducing the work in process (WIP) level by 1% affects the level of warehouse waste as a result of reducing the WIP stack.
   c. Increase the company's production target by 2% which has an impact on increasing the company's domestic sales percentage by 10%.
2. Scenario 2: Increase the profit level of the company by optimizing the amount of raw stock ready material through the target production variable intervention of 7%, WIP by 0%, export percentage by 10%, and domestic sales percentage by 10%.
3. Scenario 3: Combined with scenario 1 with the addition of a labor variable intervention of 100 people out of 50 people the initial number of variables. The increase in labor numbers is believed by the company to influence the amount of production which has an impact on increasing profits. The intervention is also performed on the custom production percentage variable. This variable intervention is trusted by the company if the custom production number increases by 5%, it can affect the number of finished goods production that follows the trend of customer demand data.
4. Scenario 4: Increase the company's profit level by optimizing the amount of raw ready stock material through the raw material check variable intervention of 10%, raw material return percentage of 8%, safety stock percentage of 20%, custom production percentage of 5% and return sales percentage of 5%. The percentage reduction intervention in the return sales variable is believed by the company to reduce shipment costs and reduce production costs. Decreasing the percentage of sales returns causes the company to check the quality of finished goods production so that defects do not occur. Product defects begin with defects in raw material.

6.1 Scenario 1
The result of the intervention simulation scenario 1 is presented in Table 6.

Table 6. Result of Scenario 1

Year	Customer Demand (pcs)	Raw Material Stock Ready (pcs)	Finished Goods (pcs)	Profit (Rupiah)
2018	3634	3948	4677	4.253.545.450,31
2019	3890	4592	4720	5.048.424.796,00
2020	4042	6073	5697	6.889.868.932,20

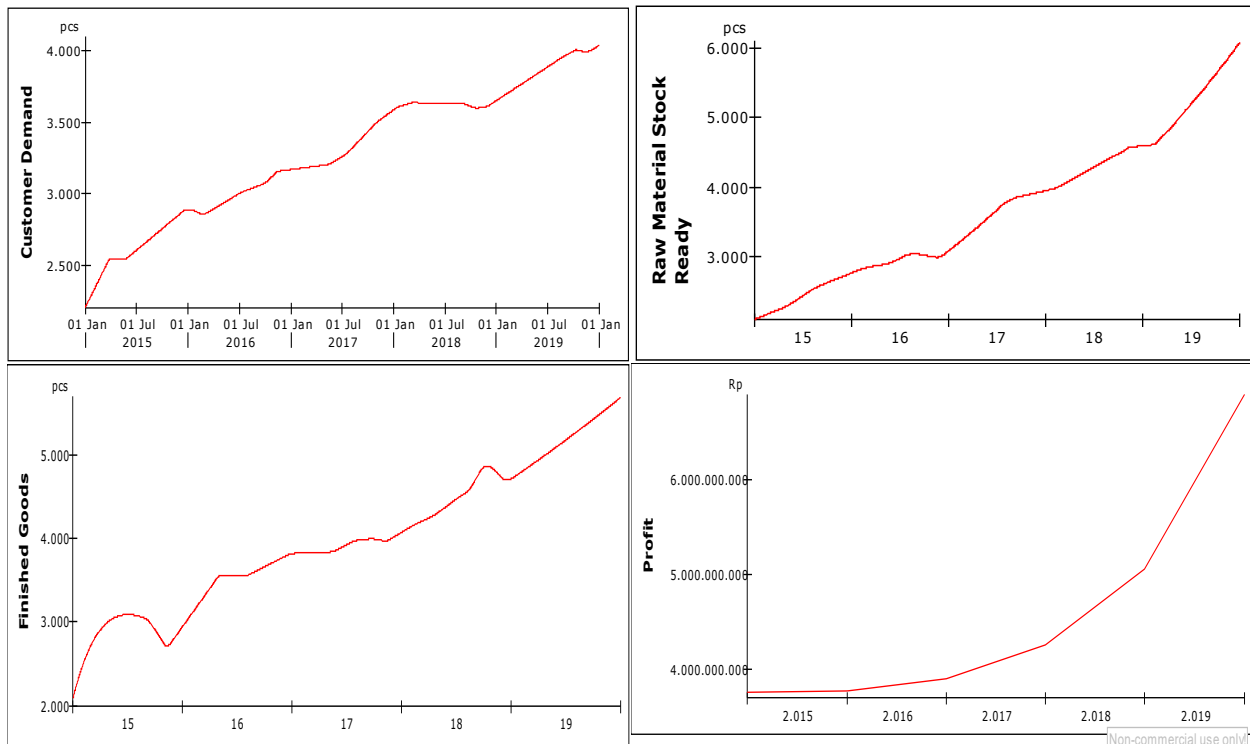The graph of the intervention scenario 1 simulation results can be seen in Figure 5.

Figure 5. Graph of Scenario 1

Scenario 1 was designed by intervening in several model variables, namely raw material return, raw material check, raw material purchase, warehouse stock, waste warehouse, production target, WIP percentage, safety stock percentage, and domestic sales percentage. Based on the results of the intervention simulation scenario 1, it can be seen that the company's profit began to increase steadily starting in 2018 until 2020. The increase that occurred at the profit level was Rp 794,879,346.00 (2018 to 2019) and Rp 1,841 .444,136.00 (2019 to 2020). The level of finished goods has increased significantly with an average growth of 43 pcs-977 pcs. The customer demand level has increased steadily with an average growth of 256 pcs-408 pcs. The level of raw stock ready material has increased with an average growth of 644 pcs-2125 pcs.

6.2 Scenario 2

The resultof the intervention simulation scenario 2 is presented in Table 7.

Table 7. Result of Scenario 2

Year	Customer Demand (pcs)	Raw Material Stock Ready (pcs)	Finished Goods (pcs)	Profit (Rupiah)
2018	3624	3748	6115	4.298.425.200,02
2019	3880	4692	6547	4.821.044.204,01
2020	4112	6043	8211	6.821.339.533,22

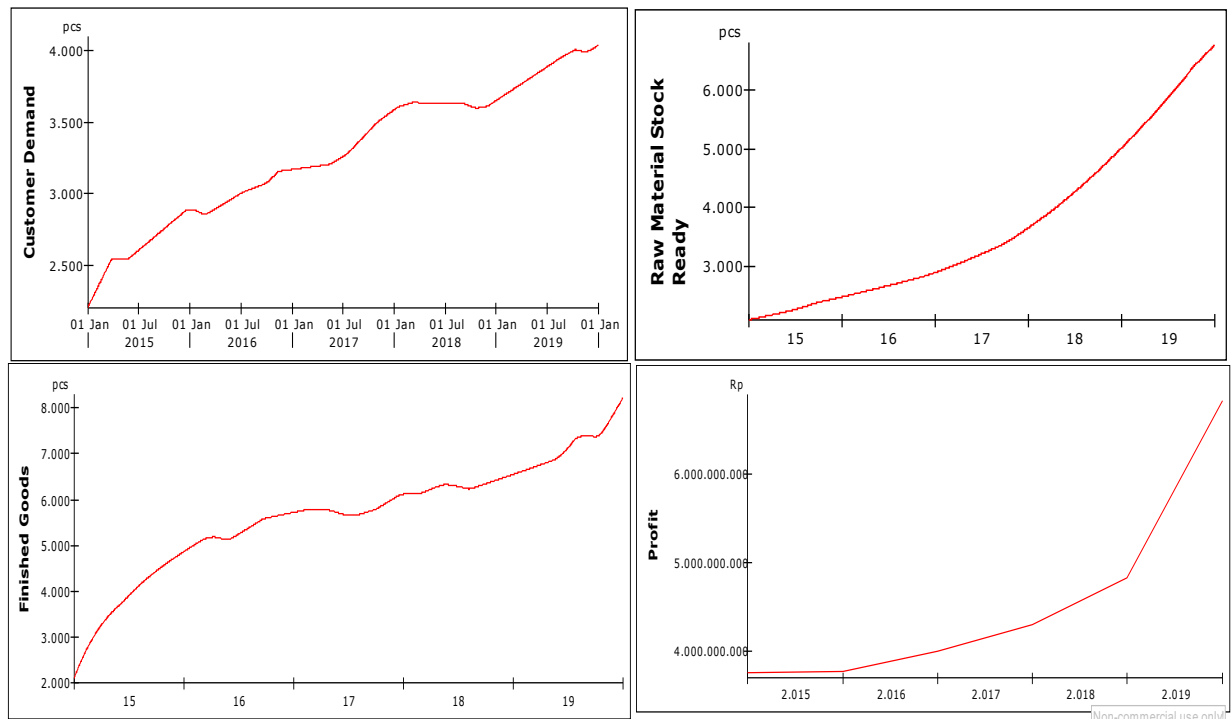The graph of the intervention scenario 2 simulation results can be seen in Figure 6.

Figure 6. Graph of Scenario 2

In Figure 6, it can be seen the trend pattern of data for the graph of profit that rose sharply but was stable from 2018 to 2020. Data trends for level finished goods also increased steadily following the trend of data for the level of customer demand. The fulfillment of increased finished goods production requires the company to increase the amount of ready-to-produce raw material supplies needed to fulfill the production plan. The optimal inventory of raw materials reduces the amount of waste in raw material warehouse due to the rare discovery of excess raw materials as a result of the wrong determination of raw material inventories.

6.3 Scenario 3

Scenario 3 was designed by intervening in several model variables, namely the variables intervened in the intervention scenario 1, labor variables amounting to 100 people out of 50 people the number of initial variables and the custom production numbers increased by 5%. The resultof the intervention simulation scenario 3is presented in Table 8.

Table 8. Result of Scenario 3

No.	Year	Customer Demand (pcs)	Raw Material Stock Ready (pcs)	Finished Goods (pcs)	Profit (Rupiah)
1	2018	3864	3968	4531	4.289.681.131,40
2	2019	3910	4672	4714	5.096.495.658,76
3	2020	4142	6173	5797	6.949.820.373,17

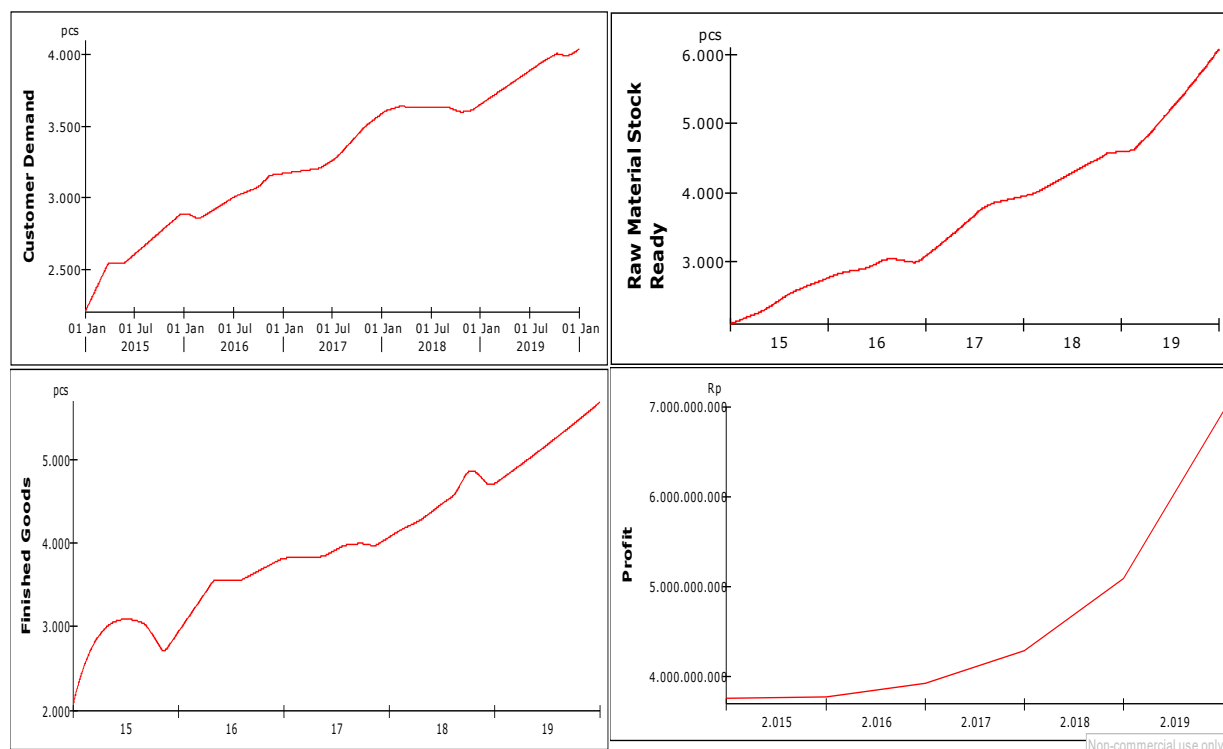Graph of Scenario 3 intervention results can be seen in Figure 7.

Figure 7. Graph of Scenario 3

Based on the simulation results of intervention scenario 3, it can be seen that the company's profits began to increase steadily starting in 2018 until 2020. The increase that occurred at the profit level was Rp 806,814,527.00 (2018 to 2019) and Rp 1,853 .324,471.00 (2019 to 2020). The level of finished goods has increased significantly with an average growth of 183 pcs-1266 pcs. The customer demand level has increased steadily with an average growth of 46 pcs-232 pcs. The level of raw stock ready material has increased with an average growth of 704 pcs-2205 pcs.

6.4 Scenario 4
The resultof the intervention simulation scenario 4 is presented in Table 9.

Table 9. Result of Scenario 4

No.	Year	Customer Demand (pcs)	Raw Material Stock Ready (pcs)	Finished Goods (pcs)	Profit (Rupiah)
1	2018	3864	3968	4531	4.329.581.231,40
2	2019	3910	4672	4714	5.133.425.558,76
3	2020	4142	6173	5797	6.429.520.473,17

Graph of Scenario 4 intervention results can be seen in Figure 8.
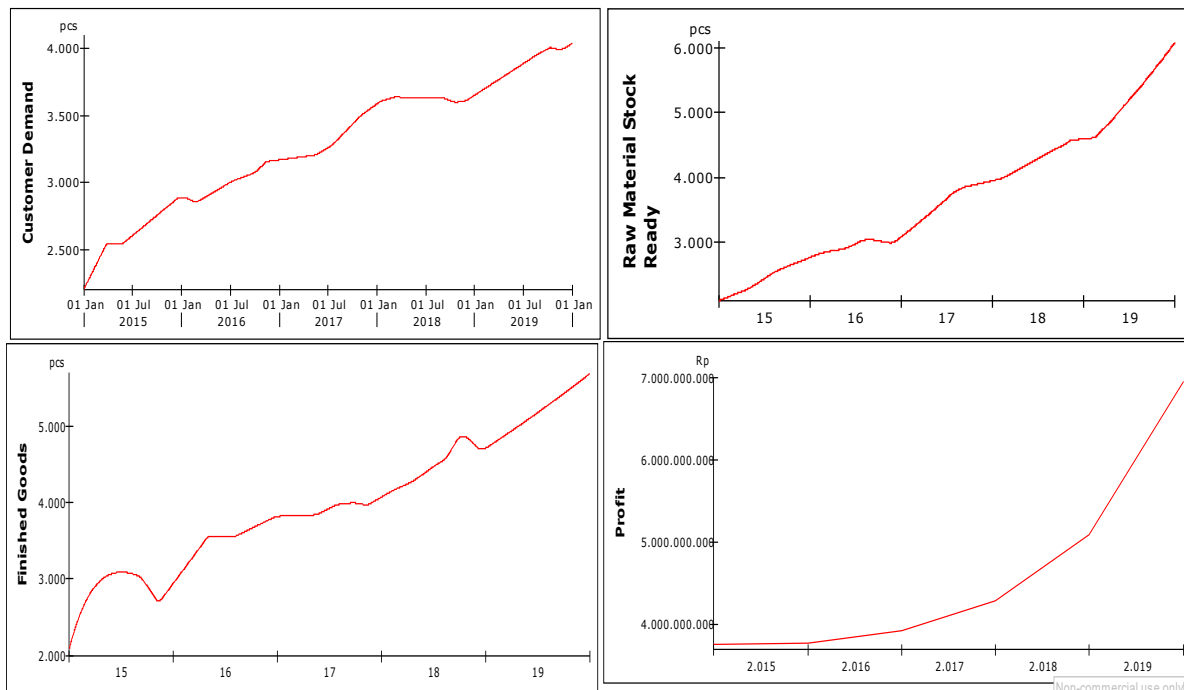

Figure 8. Graph of Scenario 4

7. Conclusion

Researchers produced conclusions and suggestions for the management of X Ltd.. Based on the analysis and discussion presented in the previous chapter, wecan conclude some of the following:

1. The BAU condition of X Ltd. management system projection model shows that in 2017-2018, X Ltd. experienced a decrease in the company's profit level of Rp 788,340,648.00 (starting from Rp 4,717,927,337.00 (in 2017) to Rp 3,929,586,689, 00 (in 2018)). The finished good level has steadily increased from 2015 to 2017 by 2057 pcs (in 2015) to 4656 pcs (in 2017) following the fulfillment of fluctuating customer demand of 2200 pcs (in 2015) to 3169 pcs (in 2017). Decreasing company profits in the period 2017 to 2018 causes company needs to simulate and design new alternative strategies to overcome problems, and increase output to the optimum point.

2. X Ltd. company profit increase is influenced by the number of optimal raw material stock ready that are able to meet the needs of finished goods production to meet customer demands. The minimization of waste warehouse, the level of raw material return, and the amount of WIP can reduce the cost of the warehouse and production section. Increased custom production, domestic sales, and export companies can increase the number of finished goods production companies and increase the number of company profits as a result of the many products sold to the market both locally (domestic) and overseas (export).

3. Alternative strategies to overcome crisis problems will determine the optimal raw material inventory to the level of finished goods production in meeting customer demand at X Ltd. is by intervening in raw material return variables, raw material checks, raw material purchases, warehouse stock, waste warehouse, production targets, WIP percentage, safety stock percentage, and domestic sales percentage.

4. The decision scenario chosen by the company is scenario 1 with the company's profit level starting to increase steadily from 2018 until 2020. The increase that occurs at the profit level is Rp 794,879,346.00 (2018 to 2019) and amounting to Rp 1,841,444,136.00 (2019 to 2020). The level of finished goods has increased significantly with an average growth of 43 pcs-977 pcs. The customer demand level has increased steadily with an average growth of 256 pcs-408 pcs. The level of raw stock ready material has increased with an average growth of 644 pcs-2125 pcs. The reason the company chose scenario 1 as the selected scenario was the trend in data for company profits and other levels that had a trend that increased stably and significantly than the other two scenarios.

References

Ackoff. (1994). *System Thinking and Practice*. USA: Institute of Technology.

Bertalanffy. (2002). *System Theory*. USA: MC Graw-Hill.

Blank, Leland. (1980). *Statistical Procedures for Engineering, Management, and Science*. USA: MC Graw-Hill.

Forrester JW. (1997). *Building a System Dynamic Model Part 1: Conceptualization*. Massachusetts: Institute of Technology.

Law, Averill M. and M.G. Comas. (1997). *Simulation of Manufacturing System*. Proceedings of 1997: Winter Simulation Conference, pp 86-89.

Law, Averill M. and W.D. Kelton. (2000). *Simulation Modelling and Analysis*, 3rd*edition*. USA: MC Graw-Hill.

McGarney B, Hannon. (2004). *Dynamic Modeling for Business Management An., Introduction.* New York: Springer.

P. Eykhoff. (1974). *Identification of Systems*. London: Wiley.

Peter, Senge. (1990). *The Art and Practice of TheLearning Organization*. New York: Doubleday Currency.

Purnomo. (2012). *Teori dan Komplesitas Sistem*. Jakarta: Gramedia Pustaka Utama.

Richardson, Udo. (2011). *System Dynamics: Theory & Practice*. Pensylvania: Ventus Publishing.

Soesilo, Karuniasai. (2014). *Pemodelan System Dynamics*. Jakarta: Gramedia Pustaka Utama.

Sterman, J. D. (2000). *Business Dynamics Systems Thinking and Modeling for a Complex World.* USA: Jeffrey J. Shelsfud. The McGraw-Hill Companies.

Takahashi, Y. (2003). *Translation from Natural Language Though Stockflow Diagram*. Japan: School of Commerce Senshu University.

Barlas, Y. (1996), *Formal Aspects of Model Validity and Validation in System Dynamics*. *System dynamic Journal Review*. Vol.12 Number 3Fall 1996.

Ibrahimy, Muhammad. *Design and Application of Radio Frequency Identification System*. *Internation Journal Conference On*, 1-6, 77. (2011): 1-6.

Badan Pusat Statisik Indonesia. (2015). Statistik Produksi Kehutanan 2015. Jakarta: BPS.

Badan Pusat Statisik Indonesia. (2017). Statistik Indonesia 2017. Jakarta: BPS.

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Kevin Oktavian is currently active as student of Industrial Engineering Department, Universitas Tarumanagara. Mr. Kevin was born in Jakarta, October 26th 1997. He started his higher education in Industrial Engineering, Universitas Tarumanagaraand will be graduated in 2019. His research interests are in System Dynamics and Modeling Field.

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