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IMPROVING FINISHED GOODS INVENTORY MANAGEMENT DURING THE FESTIVE SEASON BY USING WITNESS SIMULATION

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ABSTRACT

Food industry companies are under pressure to increase production process efficiency and productivity. The use of simulation in the production process is one of the ways to achieve this. Witness simulation software can be used to simulate factory processes and procedures effectively. As to solve Salleh Food Industries Sdn. Bhd. problem the researcher has used modelling simulation tools to manage its inventory management. The research findings and proposed recommendations provide valuable insights for Salleh Food Industries to address challenges in their production processes, particularly during festive seasons. The identification of a production capacity shortfall led to the implementation of two proposed designs, with Proposed Design 1 emerging as the more optimal solution due to its effectiveness in meeting production targets and cost-efficiency. The crucial next steps for Salleh Food Industries involve the careful implementation of Proposed Design 1, ensuring that the workforce is adequately trained to operate and maintain the upgraded machinery safely. This not only enhances operational efficiency but also reduces the risk of workplace injuries resulting from a lack of skill. Additionally, establishing a regular maintenance schedule and incorporating quality checks at various production stages are vital strategies to prevent breakdowns, maintain consistent production, and meet required production standards.

1.0 Introduction

In today's competitive environment, food industry companies must prioritise production line efficiency and productivity. Companies are under pressure and required to increase production process efficiency for optimal inventory management in order to meet an uncertainly growing demand, to satisfy customers with the right quantity and timing, and eradicate production process lead time. The use of simulation in the production process is one of the ways to achieve the desired results without spending a large deal of money. The application of Witness simulation is a must to solve the production flow. Witness simulation software is extensively utilized in the administration and optimisation of production and logistics systems, simulations and planning of enterprise logistics, as well as the modelling and optimisation of a supply chain, and can simulate factory processes and procedures effectively. Using the Witness simulation software, (Wang et., al, 2020 as cited in Galankashi et al., 2016) created a comprehensive simulation and model that was used to optimize a petrol station queuing system and increase the sales rate.

Salleh Food Industries Sdn. Bhd. serves as the primary hub for gathering and distributing food products from small-scale industries, such as Batu Pahat. All of these products are sold at Salleh Food's walk-in stores in Ayer Hitam and Batu Pahat as well as on its website. Not only that, but Salleh Food has grown its business by distributing its goods to stores such as Lotus across Peninsular Malaysia. This shows how the positivity of their business has grown. For production businesses to continue fulfilling consumer orders, quality, and timeliness are crucial. The research was conducted to identify the problem that Salleh Food Industries faced in its production process and solve it by using the Witness simulation model. Salleh Food Industries Sdn. Bhd. is one of the companies that sell a variety of tapioca chips which are produced by its own factory. As to maintain their customer loyalty they need to maintain the services by providing quality products to customers. This idea of research is to improve finished goods inventory management at Salleh Food Industries Sdn. Bhd., due to the available machine cannot cope with the demand during the festive season and the available machine breakdown during the production process resulted in a long lead time to produce chips.

2.0 Literature Review

Simulation is the process of figuring out how a physical system works by watching how a copy of the system works. The system could already exist or be built in the future. So, modelling is the art and science of trying things out with models. A simulation study must have a goal, and there are many good reasons why simulation is useful. For example, simulation can be used to check and improve the design of a system before it is built. This helps avoid expensive design mistakes and makes sure that goods are safe, of high quality, and cost-effective. Other uses are analysis,

performance review, sensitivity analysis, comparing different options, forecasting, safety, training, teaching, and making decisions with a person in the loop (Kheir, 2018).

The application of Witness simulation is a must to solve the production flow. Witness simulation software is extensively utilized in the administration and optimisation of production and logistics systems, simulations and planning of enterprise logistics, as well as the modelling and optimisation of a supply chain, and can simulate factory processes and procedures effectively. Using the Witness simulation software, (Wang et., al, 2020 as cited in Galankashi et al., 2016) created a comprehensive simulation and model that was used to optimise a petrol station queuing system and increase the sales rate. According to Priniotakis and Argyropoulos (2018), Inventory management is the process of tracking and controlling the quantity of items in stock and ensuring that they are restocked in sufficient quantities to satisfy consumer demand. On the other hand, Nirmala et al. (2021) proposed that inventory Management is the practice of supervising, regulating, preserving, and utilising the quantities of raw materials and finished goods that an organization uses to produce its products. According to Choi (2012), effective inventory management is crucial for the success of any business. In order to satisfy customer demands without the danger of frequent shortages and while maintaining a high level of service, companies rely heavily on inventory management.

3.0 Research Methodology

Method of analysis that used by the researcher to collect the data is by quantitative method, whereby the researcher making an interview with the company and gather all the information that being needed in order to stimulate the company production scenario into the simulation. The data that is collected are in numerical data such as cycle time of the machine, number of raw materials, idle time, number of workers, working hours, number of machines and time processed product. Based on the information gathered from the interviews, a Witness programme will be used to simulate the way Salleh Food Industries Sdn. Bhd. makes its products. This study simulates the actual production process at Salleh Food Industries Sdn. Bhd. using Witness simulation software. The model includes a few components, including a machine, buffer, part, and labor, to accurately reflect the actual situation in the warehouse. the current situation at their manufacturing process will be implemented into the simulation then it will be compared to the after-improvement production process model. Based on information gathered by the researcher through interviewing people and watching how Salleh Food Industries Sdn. Bhd. produces its products.

4.0 Result and Discussion

Findings and outcomes depend on the methodological approaches used in interview sessions. The data obtained would be analysed first. The findings of the thesis will be compared to the previous research reported in the literature review. The findings of this chapter are focused on field visits and observations in the development of simulations to improve finished goods inventory management during festive season at Salleh Food Industries.

I. Current Design

This layout was created based on a specification machine that has been given by the Cik Norsa'diah the Admin and Public Relations of Salleh Food Industries. However, Cik Norsa'diah cannot give the picture of the machines due to company confidentiality. The researcher only gets the data such as cycle time of machines, the number of outputs can be processed in one time, breakdown of the machine. Figure 4.6 below is the current layout of the production process of Salleh Food Industries. After the researcher has run the actual simulation, the result from it shows that the total bundle of tapioca can be produced in 8 hours 30 minutes are 150 bundles.

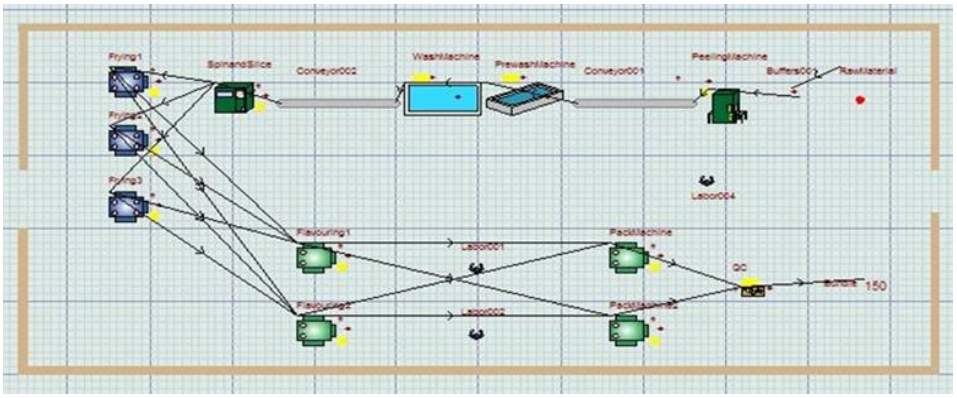

Figure 4.1: Final Development of Simulation for Actual Production Process

II. Proposed Design 1

In proposed design 1 the researcher has changed from an actual peeling machine to MQT-600 model machine due to actual peeling machine having a problem of breakdown during the production process. This MQT-600 is way better than the actual machine, the MQT-600 can process 20kg in 4 minutes while the actual machine can process 20kg in 5 minutes. This shows reduction of processing time per kilogram of tapioca. Next, the improvement that has been added to the proposed design 1 is QS-400 which is the peeling machine. QS-400 is the most affordable machine among the peeling machines but yet it still can process tapioca in good amounts. QS-400 machine can process 20kg in 6 minutes

while the actual peeling machine can process 20kg tapioca in 7 minutes. Figure 4.7 below shows final development of simulation model for first proposed design.

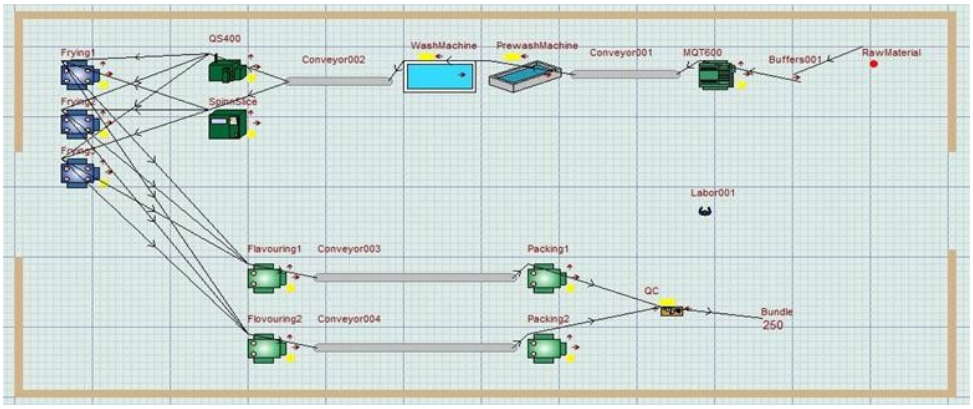

Figure 4.2: Final Development of Simulation Model for First Design Proposed

III. Proposed Design 2

Researcher has made a second proposed design to find out which is the best solution for Salleh Food Industries that can increase production in efficient way. In this proposed design 2, the researcher has used different types of machines from proposed design 1 to replace spin and slice machine in the actual production. Figure 4.10 shows the final development of simulation model for second proposed. The new specification of spin and slice machine proposed in design 2 is more powerful than in proposed design 1 due to its capacity and power of machine. However, the researcher remains to use the MQT-600 peeling machine inside this proposed design 2. After the researcher has mimicked the machine into the improvement layout in Witness Simulation it shows that these specification machines can produce 281 bundle of tapioca in a day.

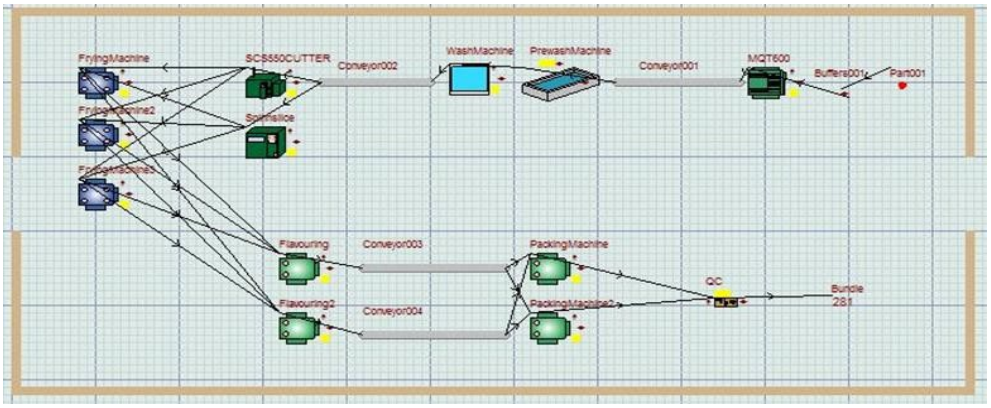

Figure 4.3: Final Development of Simulation Model for Second Proposed Design

5.0 Recommendation

I. Choose Proposed Design 1

Proposed Design 1 demonstrated its ability to efficiently enhance production capabilities, ensuring that Salleh Food Industries could cope with the heightened demand during festive periods. Importantly, this solution appeared more economically viable, as the required upgrades to the machinery were deemed to be less costly when compared to alternatives presented in Design 2. Therefore, the recommendation for Salleh Food Industries is to consider implementing Proposed Design 1 as it offers a practical and cost-efficient strategy to address the production limitations observed during festive seasons and improve finished goods inventory management.

II. Using Upgraded Machine

After observations were conducted, the researcher identified a critical issue at Salleh Food Industries is the production capacity was insufficient to meet the heightened demand during festive seasons. The examination revealed that the total input processed by the existing machines was notably low, and the time taken for each processing step was excessively long. This inefficiency significantly impacts on the daily production output, creating a bottleneck in the production process. The prolonged processing times not only limited the quantity of goods manufactured but also posed challenges in meeting customer demands, particularly during periods of increased market activity such as festive seasons. Addressing these constraints became imperative for Salleh Food Industries to enhance its production capabilities and better align with market demands. So as to solve the problem, the company should change its actual peeling machinery to MQT-600 and for spin and slice machine Salleh Food Industries should change one of their actual machines to QS-400 which it can decrease time processing of tapioca during spin and slice step.

III. Continuous Monitoring and Adjustment

After implementing the proposed design, it is crucial for Salleh Food Industries to continuously monitor production processes and make necessary adjustments. This includes tracking key performance indicators, analysing efficiency metrics, and promptly addressing any operational challenges that may arise. This helps Salleh Food to identify either with the proposed machine influence increasing in production. Continuous monitoring of production processes post-implementation allows the company to track key performance indicators (KPIs) such as production output, processing time, and resource utilisation. Analysing efficiency metrics provides insights into the effectiveness of the new machinery and the overall impact on the production workflow.

5.1 Conclusion

The research findings and proposed recommendations provide valuable insights for Salleh Food Industries to address challenges in their production processes, particularly during festive seasons. The identification of a production capacity shortfall led to the implementation of two proposed designs, with Proposed Design 1 emerging as the more optimal solution due to its effectiveness in meeting production targets and cost-efficiency. The crucial next steps for Salleh Food Industries involve the careful implementation of Proposed Design 1, ensuring that the workforce is adequately trained to operate and maintain the upgraded machinery safely. This not only enhances operational efficiency but also reduces the risk of workplace injuries resulting from a lack of skill. Additionally, establishing a regular maintenance schedule and incorporating quality checks at various production stages are vital strategies to prevent breakdowns, maintain consistent production, and meet required product standards.

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6.0 References

[1] Achee, B., Kundu, S., & Latif, M. (2022). Exploiting discrete event simulation to improve a chicken supply chain. BOHR International Journal of Advances in Management Research, 1(1), 65-75.

[2] Aourir, J., Locment, F., Sechilariu, M. (2022). Power and Energy Management Of A DC Microgrid For A Renewable Curtailment Case Due To The Integration Of A Small-scale Wind Turbine. Energies, 9(15), 3421. https://doi.org/10.3390/en15093421

[3] Aspers, P., Corte, U. What is Qualitative in Qualitative Research. Qual Sociol 42, 139–160 (2019). https://doi.org/10.1007/s11133-019-9413-7

[4] Choi, T. M. (Ed.). (2013). Handbook of EOQ inventory problems: Stochastic and deterministic models and applications (Vol. 197). Springer Science & Business Media.

[5] Kheir, N. (Ed.). (2018). Systems modeling and computer simulation. Routledge.

[6] Nirmala, D. a. R., Kannan, V., Thanalakshmi, M. V. S., Gnanaraj, S. J. P., & Appadurai, M. (2021). Inventory management and control system using ABC and VED analysis. Materials Today: Proceedings, 60, 922–925. https://doi.org/10.1016/j.matpr.2021.10.315.

[7] Wang, Q., Chen, J., Tseng, M., Luan, H., & Ali, M. T. (2020). Modelling green multimodal transport route performance with witness simulation software. Journal of Cleaner Production, 248, 119245. https://doi.org/10.1016/j.jclepro.2019.119245.

[8] Winsberg, E. (2010). Science in the age of computer simulation. In Science in the Age of Computer Simulation. University of Chicago Press.

[9] Waller, A. (2012, December). Witness simulation software. In Proceedings of the Winter Simulation Conference (pp. 1-12).

[10] Yasir, A. S. H. M., & Mohamed, N. M. Z. N. (2018, March). Assembly line efficiency improvement by using WITNESS simulation software. In IOP Conference Series: Materials Science and Engineering (Vol. 319, No. 1, p. 012004). IOP Publishing