

Chapter 21

The Development of Simulation to Improve the Production Process Efficiency



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21.1 Introduction

Sime Darby Berhad is Malaysia's largest multinational corporation, and it is one of Southeast Asia's widest plantation company. It was established in 1910 by two businessmen William Sime and Henry Darby contrived Sime Darby. Sime Darby Berhad is a multi-faceted corporation with operations in transportation, motors, industrial machinery, and healthcare. Sime Darby provides engineering services, sales, rentals, maintenance of equipment, administration of port infrastructure, water treatment and distribution, insurance broking, supply of shared services, other commercial projects, car assembly and distribution, and after-sales support. In addition, the company is

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also listed on the main board of Bursa Malaysia Securities Berhad. The firm is the biggest multinational corporation in Malaysia and one of the biggest in Southeast Asia. The business is present in Malaysia, other Southeast Asian nations, China, and Australia. The business's headquarters are in Malaysia's Kuala Lumpur (Ravanera and Gorra 2010).

Additionally, the primary commercial activity is oil palm production in the variety sector. Sime Darby Berhad began as a rubber company that also provided engineering services, distributed heavy machinery and vehicles, developed real estate, and produced electricity.

They employ over 100,000 people internationally and operate in close to 20 nations. 38% of sales come from the local market, 25% from Hong Kong, 14% from Singapore, and 11% from Australia. The company has been a leader in the international business sphere thanks to all of its skills and corporate identity. These have a variety of industries that are globally competitive. The history of Sime Darby Plantation Sdn. Bhd. began in the nineteenth century, when intrepid English planters started rubber plantations in Malaya. These pioneers included Alexander Guthrie, Daniel and Smith Harrison, Joseph Crosfield, William Sime, and Henry d'Esterre and Herbert Mitford Darby, who founded the Sime Darby Group in 2007 after the merger of three successful businesses (Kumpulan Guthrie Berhad, Golden Hope Plantations Berhad, and Sime Darby Berhad). Creating a new company with such a completely different mission, vision, and objective (Syed and Philip 2008).

Sime Darby Diamond Jubilee Plantation Sdn. Bhd. in Jasin, Melaka, was established in 1971. H.E. Fraser was the factory manager. There are 16 nations in which the firm conducts its downstream processes, including the refining of crude palm oil (CPO) for use in edible oils and fats products, oleo chemicals, and biodiesel (Potter 2015) stated that maintaining the best quality at all times is key to Sime Darby Plantation's business concept while producing a broad range of goods based on palm oil. Sime Darby Plantation is dedicated to creating and promoting sustainable goods and practises in the palm oil business as the largest producer of certified sustainable palm oil in the world. The firm is constantly looking for new methods to promote the production, acquisition, and use of sustainable oil palm products as one of the founding members of the Roundtable on Sustainable Palm Oil (RSPO). Sime Darby Berhad had the opportunity to expand and build a few manufacturing branches during this time.

The Group changed the name of all of its downstream businesses to Sime Darby Oils (SDO) in March 2019 to fully explore the potential of SDP as a reputable brand known for its sustainability credentials and high product quality. Sime Darby Oils operations manage the trading, production, sales, and marketing of oils and fats products, palm oil-based biodiesel, nutraceuticals, and other variants through a vast global wide range of institutions in eight nations (Malaysia, China, The Netherlands, United Kingdom, South Africa, Thailand, Indonesia, and Papua New Guinea). SDO maintains and runs 11 refineries with a combined capacity of 3.8 million metric tonnes (MT) annually and a total bulking installation capacity of 300,000,000 tonnes within this core business. The company's slogan, "Realizing Possibilities, Together,"

captures its idea of working with partners to make high-quality, enlightening products and to ensure that consumers may live sustainably (Zahraee et al. 2019).

21.1.1 Problem Statement

The aim of this part is to improve the production process efficiency at this firm, located at Jasin, Melaka.

The production process has been facing with a variety of problems according to Tuan Muhammad Mukhtarul 'Arifin Bin Salimin' as Diamond Jubilee Sime Darby Plantation Sdn. Bhd.'s mill director.

1. Process efficiency of the production.
2. The lack of worker in detecting defects.
3. The efficiency in time management.

To solve this issue, the organization needs to take action with contributions such as hired additional employees in the production process of manufacturing activities, adding more machines which contribute directly to one of the biggest impacts. In addition, the organization wants to reduce its workers and computer efficiency in a concept for increasing productivity.

Simulating the proposed production process improvement allows it to be assessed. The organization may recognize by using the simulation which would be better for real work and that the problem can also be resolved to increase performance in manufacturing activities. Khalili and Zahedi (2013) claimed using simulation software would allow to better understand the actual output structure and correctly forecasting the performance of the device over time makes modeling and simulation an excellent method for program planning. Alternatively, it allows to assess the performance and offer data that may be used to gauge capacity. Simulation models are animations of designs that are identical to the real-world systems, and they can help investors better comprehend the designs (Yasir and Mohamed 2018). The production system for a manufacturing firm is the key factor in the competition between the enterprises. Therefore, enhancing the production system is a crucial way to boost an enterprise's ability to compete. The key influencing elements may be identified and improved upon after the simulation results have been examined (Enrico et al. 2010).

21.1.2 Research Objective

The research has three objectives, each of which will lead to the anticipated outcome the researcher needs. The following are the research objectives that should be attained:

1. To identify the production process.
2. To discuss on ways to overcome the problem of the production process.
3. To apply the ProModel Software into the production process.

21.2 Methodology

21.2.1 Research Design

The research development for the research subject will be clarified in this section. A collection of research that involves conceptual analyzes, the product definition, literature review, problem statement and research methodology is given before the beginning of the project.

According to Setyanto (2013), the preliminary analysis is the fundamental process that determines the definition of the project at the beginning of the project. The analysis should be carried out in the process flow, problem statement and draft.

Next phase is the creation of the research project prototype, in the case study Diamond Jubilee Sime Darby Plantation Sdn Bhd, and the construction of a simulation model centered on the collection of data in order to define the plant layout production process. The simulation model will be evaluated before the programme is put into use, and if there are problems with the project, the model may also be tested and given advice.

Finally, the evaluation of the simulation software research methods may be carried out. The evaluations of the whole model would also be conducted by utilizing the performance data for the development of the production process in the manufacturing process.

21.3 Results and Discussion

Depending on the study methodologies employed in the interview sessions, the part would cover research, findings, and results. First, the data would be examined. The research findings will be contrasted with earlier research described in the literature review. The findings of this section are focused on field visits and observations in the development cycle of Diamond Jubilee Sime Darby Plantation Sdn. Bhd. Development to prove the problem and an experiment was carried out by the researchers. The researchers simulated the problems and outcomes of the simulation mentioned in this section after collecting evidence or information based on interviews.

21.3.1 *Research Objective 1*

The research objective 1 is to describe the development cycle at the company. In order to achieve this goal, the researcher did an interview to get the results. The research question for the interview is described in Table 21.1.

21.3.2 *Research Objective 2*

Research objective 2 in this work is to explore how to solve the problems of the production process. The study question below has been created:

Research Question: How to overcome the problem of the operation system at Diamond Jubilee Sime Darby Plantation Sdn. Bhd.?

- **Method.** In order to address the research question two, the researcher developed a simulation for the production process using the Promodel Simulator software.
- **Promodel Simulation.** ProModel describes the production system as a manufacturing location structure, such as machines or workstations, from which parts (or entities) are treated according to some manufacturing definition. The network will also have routes, such as transportation aisles, as well as support facilities, such as operators and material handling equipment used to process and move items. The Promodel Simulator will fix the issue where there is a void in the development cycle by producing a new design or adding an additional design in the production phase.
- **Model Elements.** We must define all the basic modeling elements in constructing this model, and some of the optional elements are shown in Fig. 21.1. The researcher used the position model aspect, entities (parts), arrivals, processes, resources, path networks, and attributes for this study. The model element in order will be used to represent the production process.
- **Building Models.** By completing the corresponding modules chosen in the build menu, models are produced. This module is made up of a number of edit tables and dialogue boxes that are used to offer layout specifications. A setup window is also present for setting up paths and other modelling features for simulation tools.

21.3.3 *Research Objective 3*

The research objective 3 in this research is to apply the Promodel Simulation software into the production process. The research question below was created:

Research Question: How to improve the process of operation system in Diamond Jubilee Sime Darby Plantation Sdn. Bhd. by using the Promodel Simulation software?

Table 21.1 Coding interview

No.	Question	Answer
1	Can you brief about the company background and history?	Diamond Jubilee is one of the subsidiaries of Sime Darby which has five key sectors in the fields of plantation, property, manufacturing, motors and energy and utilities with increasing healthcare business. At Diamond Jubilee our main business is oil palm and the company's initial industry is rubber. That is because in 1910, William Sime of Scotland believed that Malaysia had similar jungle to Brazil, and because of rubber, he chose to create Sime Darby. That is long afterwards. This company produces raw material oil palm and crude oil in another branch at Kempas, Jasin, to make cooking oil. Before starting the next process, the best quality oil needed time to get the right pH result from the laboratory. Sime Darby is listed in Bursa Malaysia and is one of Southeast Asia's largest company. The company was founded in 1971 by H.E. Fraser. That is to say that this company is 49 years old
2	What is the role of the company?	Making Diamond Jubilee Plantation Sdn. Bhd. as sustainable producers of edible oils in the world
3	What is your current position in the company and how long you been in the position?	I'm as a Mill Manager at Diamond Jubilee Sime Darby since 2018 and I was 19 years in this industry
4	What is the main product the company produce?	As a raw product this company manufactures processed palm oil (crude palm oil) and palm kernel oil products, and the product will be manufactured in another division as I said
5	What time did this company start operating?	Every day at 8 a.m. to 12 a.m. for the plantation and at 8 a.m. to 5 p.m. for the office section
6	Does the factory operate under shift pattern?	Yes. There have two shift which is first shift will be at 8 a.m. until 4 p.m. and 4 p.m. until 12 a.m.
7	How many workers handling the operation and their position in the production process?	There are 30 workers per shift at plantation. Which is 60 workers for a day working process and 40 workers for support such as from maintenance and office section. The workers have been divided for 10 production process. Weight bridge until ramp process has 2 workers, sterilization process has 6 workers, threshing process has 6 workers, pressing process has 3 workers and clarifying and handle storage tank process has 3 workers. This is number of workers for only refinery oil process. For kernel needed 10 workers to handle processing stage until dispatch process. So, the balance of the workers will be office department, laboratories, security, maintenance, cleaners and safety department
8	Does this company operate on a full machine or involve worker as well?	Totally half automatic machine for the process, workers needed for monitoring the production process to ensure the machine not stuck and need make a report every day

(continued)

Table 21.1 (continued)

No.	Question	Answer
9	How many machines involved in the process?	For every stage of production have two machine which is the origin and one for backup as a spare part is any obligation
10	How regular the maintenance for the machine?	One a week, every Sunday or based on the report for the last shift
11	How many conveyors, forklift, or other equipment that used in the process?	For every stage of production, we provide many types of conveyors such ribbon and staple
12	How many products that can be produced by a machine at one time?	Unpredictable, depends on palm oil. For average that can be conclude, we can only produce 22% in one hour which is 25 ton
13	Did the production have time- break?	As I said, depends on palm oil it is because they have own season. So, if palm oil less than 200 ton, the production will drag to the next shift
14	Did company have any issues regarding production process?	There are some issues in this company which are the problem of machine production that produce limited production and is the lack of detecting defect (maintenance) which is drag the time production process
15	What is the proper solution of the production issues?	I have no idea but think this company need to upgrade the machine to the new design as oil and gas industry which is the machine known as NIR (infrared technology)
16	How the company transport the goods?	We use pipeline and tanker to deliver the product to the consumer (another branch of Sime Darby)
17	How the company manage the documentation of the production?	By register to MPOB to get the ticket and through the only in the system



Fig. 21.1 Model elements

(a) **Result Statistics**—The researcher’s statistics are classified into 10 processes that result in the production of crude oil and kernel extraction. In other words, without the information gleaned from the observation and interview sessions, the entire process would fall short. In order to update a model element and obtain statistics for comparisons between or more efficient designs, data from interviews and observation is also utilized.

- (b) **Comparison for Total Production in Current Design and Proposed Design**—According to Figs. 21.2 and 21.3, the researcher made an experiment using two end products to get the efficiency of the production process. After the experiment test, the researcher got the result of efficiency production process after making improvements. Improvements have been made towards the system which was reducing the number of processes that have been taken from 13 process into 8 processes, which included the fruit digestion process, clarifying process for crude oil, kernel drying process, kernel crushing process, and kernel separation process. Benefits of minimal process can help the production, produce more products in the same actual time instead of wasting waiting time between a gap process to another process. It also can reduce human error among the workers. Since the simulation is essentially an experimental tool of analysis and predicting the system, the result might not be accurate when the company applied into the system. From the bar graph, the statistics show that the percentage of entities stated of the end product for actual design: crude oil, 79.50% and kernel, 86.63% while the percentage of entities stated of the end product for proposed design: crude oil, 98.77% and kernel, 100%.
- (c) **Comparison for Single Capacity Location States in Current Design and Proposed Design**—Based on Figs. 21.4 and 21.5, the researcher made an experiment by upgrading the process from 13 into 8 processes to get the efficiency of the production process. After the experiment test, the researcher got a result that by upgrading 3 processes which include the oil clarification using ORP sensor (pH sensor), purifying process and silo process indirectly can reduce the number of processes and boost the product within actual time. The best result of the proposed design is an efficiency as much as 100% of ramp, 64.58% of bunch sterilization process, 32.29% of bunch threshing process, 6.6% of pressing process, 33.33% of oil clarification process, 22.92 of kernel recovery process, 52.21% of purifying process and 50.31% of silo process.

Fig. 21.2 Entities states of the end product statistics for current design





Fig. 21.3 Entities stated of the end product statistics for proposed design



Fig. 21.4 Statistics for single capacity location states in current design

- (d) **Comparison for Multiple Capacity Location Stated in Current Design and Proposed Design**—Figures 21.6 and 21.7 shows the best results of proposed design efficiency as 1.20% busy time of fruit elevator compared to the current design are 53.84% busy time. Furthermore, the percentage decrease is around 52.28 with an addition upgrading fruit digestion process.
- (e) **Comparison for Total Location Utilization in Current Design and Proposed Design**—According to Figs. 21.8 and 21.9, the best results of the proposed design efficiency of ramp utilization as 100%, bunch sterilization as 64.58%, bunch threshing as 32.29%, pressing as 2.70%, oil clarification as 33.33%, kernel recovery s 22.92%, purifying 52.21%, silo as 50.31%, kernel extraction as 21.09%.

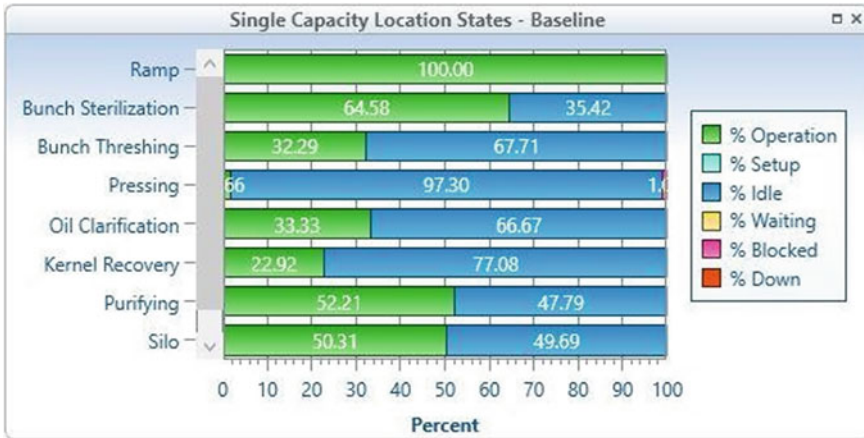


Fig. 21.5 Statistics for single capacity location states in proposed design

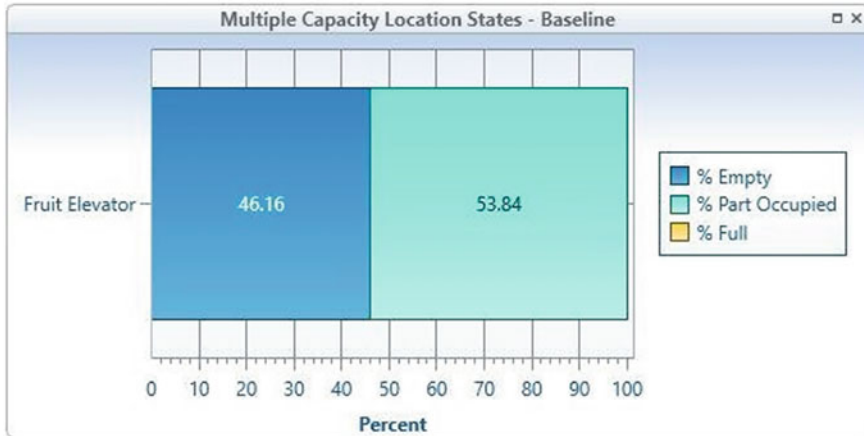


Fig. 21.6 Statistics for multiple capacity location states in current design

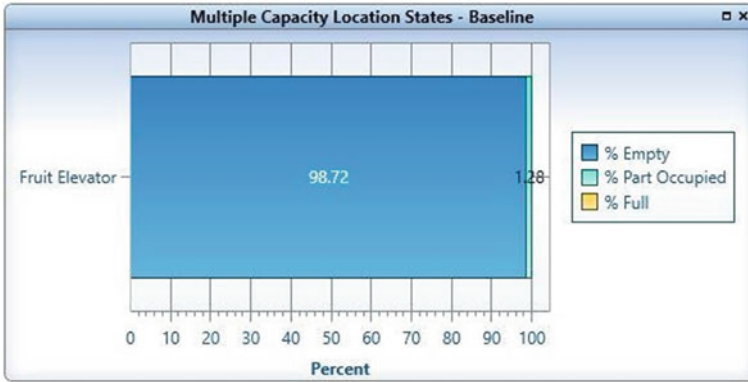


Fig. 21.7 Statistics for multiple capacity location states in proposed design

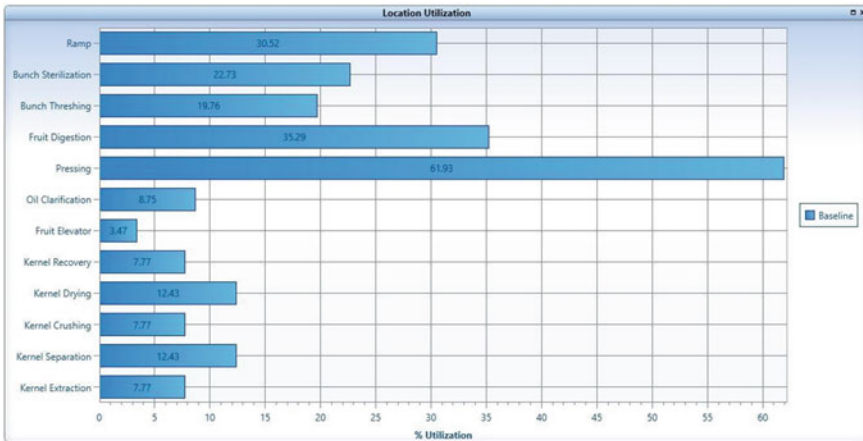


Fig. 21.8 Statistics for location utilization in current design

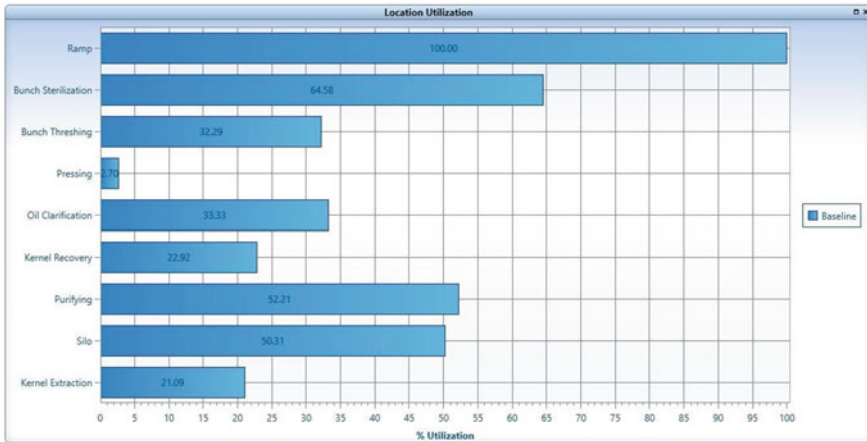


Fig. 21.9 Statistics for location utilization in proposed design

21.4 Conclusion

21.4.1 Overview of the Study

The goal of this research is to investigate the production process operations, create simulation models to determine the plant’s production process efficiency, and discover the differences between the production process’s present and suggested designs. Hopefully, everyone will get something from this study.

21.4.2 Recommendation

Several recommendations and suggestions on the effectiveness of the manufacturing process will be offered at the conclusion of the research based on the findings and analysis of the preceding section.

21.4.2.1 Upgrade the Machine

The study team looked at the production-related issues Diamond Jubilee Sime Darby Plantation Sdn. Bhd. was experiencing. Due to a shortage of machines in the operation of their production process, they experienced a short time difficulty when there are several procedures for raw material input. This occurs because they desire to meet their daily output targets. To make improvements, the researcher suggests the company to reduce the occupation times of each machine while upgrading the

equipment to enhance and improve their operations. The production activities are greatly improved with the addition of a machine. As a result of this development, the company decreases the wastage of unfinished raw materials and spares their workers from working till the wee hours of the morning since it would be more effective if implemented.

21.4.2.2 Usage of More Technology Than Manpower

Based on the observations, the researcher concluded that Diamond Jubilee Sime Darby Plantation Sdn. Bhd. had a cap on the amount of labour that could be utilised in the manufacturing process. Moving items from one activity to another and handling the machine both take time. Because of this, the researcher advised Diamond Jubilee Sime Darby Plantation Sdn. Bhd. to employ more technology to replace the labour force so that items may be moved from one operation to another without concern for the productivity of the labour force. The PH sensor (ORP sensor), which detects the amount of oxygen a liquid can hold, is one type of technology that Diamond Jubilee Sime Darby needs to deploy. Alternatively, they can determine the pH value of an oil instead of waiting for laboratory results. It is much fastest result than manpower.

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References

- Enrico B, Claudia C, Roberto R, Roberto M (2010) Using WITNESS™ simulation software as a validation tool for an industrial plant layout. In: Proceedings of the 9th international conference on system science and simulation in engineering Iwate
- Khalili MH, Zahedi F (2013) Modeling and simulation of a mattress production line using promodel. In: Proceedings of the 2013 winter simulation conference, Washington, 8–11 Dec 2013
- Potter L (2015) Managing oil palm landscapes: a seven-country survey of the modern palm oil industry in Southeast Asia, Latin America and West Africa. Center for International Forestry Research, Bogor, Indonesia
- Ravanera RR, Gorra V (2010) Commercial pressures on land in Asia: an overview. International Land Coalition, Rome, Italy
- Setyanto AE (2013) Memperkenalkan Kembali Metode Eksperimen dalam Kajian Komunikasi. JIKOM 3(1):37–48
- Syed ZA, Philip KJ (2008) Transnational corporations from Asian developing countries: the internationalisation characteristics and business strategies of Sime Darby Berhad. Int J Bus Sci Appl Manag 3(2):21–36
- Yasir AS, Mohamed NM (2018) Assembly line efficiency improvement by using witness simulation software. IOP Conf Ser: Mater Sci Eng 319:012004
- Zahraee SM, Golroudbary SR, Shiwakoti N et al (2019) An investigation of the environmental sustainability of palm biomass supply chains via dynamic simulation modeling: a case of Malaysia. J Clean Prod 237(117740):1–64