Beerlicious - Simulation Experiment

A detailed simulation study of the operational performance of the production line of the respective brewery is the requirement of the report. This report is based on the guidelines from “General simulation methodology”. The ultimate goal is to improve the system performance with the help of simulation modeling by defining the problem statement, identifying the potential bottlenecks, and eliminating those bottlenecks. To identify possible bottlenecks and resolve complex business technical problems, this study based on DEGREE methodology [Rosetti, 2016] is been pursued. The AnyLogic software (version 8.5.2.) is been used to map and create a visual representation of the case study.

Simulation modeling based on the above-noted methodology is pursued to evaluate the numerous bottleneck scenarios in the present configuration. However, potential solutions are hereby calculated and generated based on the operational performance of the model using current and possible fluctuations in the future depending upon the requirements.

Model specifics

The simulation study is needed to be done to generate results of how the production line of the brewery is currently working. To start the study, basic assumptions (Appendix) has to be made, based on the data provided. The table of the arrival in form of the batches of beer is provided in the working schedule, starting from 15/06/2020 with the batches incoming whole day (24 hours) for processing. The model, however, might indulge in discrete-time event (stochastic) based input for each resource unit. The model is confirmed to specify the batch of beer to be Agent/entity moving throughout the processing blocks. To generate results, numerous replications were run based on random seed generating more random values for the count of 100 replications. These 100 replications concluded the steady-state averages depending upon which future study could be potentially pursued. [Flow chart & activity diagram could be referred from (Appendix)]

The KPIs (Appendix) were calculated and compared with the collaborations to validate the accurate outcomes. However, few random assumptions were made to pursue sensitivity analysis to stress the current setup of the model to prove to work with the forecasted data for 2025.

Results & Recommendations

The basic human interpretation could be possibly done after analyzing the output from the replications for the current setup of the model. However, it was recorded in the study that the last batch is done with processing a day later after its arrival. In the below *fig 1,* the average utilization of each resource unit until the filtering process is displayed to evaluate the bottleneck situation in the first half of the model in the current and future state scenarios, with the current setup. It is recorded that (*Series 1*) is typically *average utilization with current load* i.e. *current input quantity of batch*. However, this quantity of batch is assumed to be gradually increased by 5% every year which makes (*Series 2*) be the data for *average utilization with the future load* on the current setup. It can be observed from *Fig 1* that the *utilization of Fermenter, both coolers & filter is high and when compared with the future state of the model with high demand, the utilization seems to be higher than the current state*. In *fig 2*, the average utilization of small bottle packaging, large bottle packaging & can packaging is cumulative compared with current and future state combining the units such as bottling, capsuling & labeling after random 100 replications.

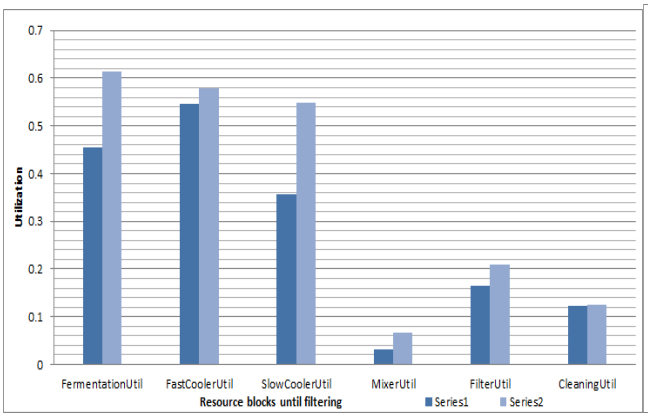

Fig 1: AVG utilization of 100 random replications until filtering

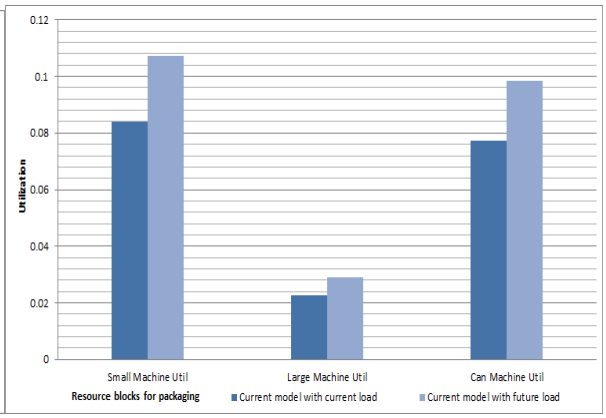

Fig 2: AVG utilization of 100 random replications for packaging

However, it is observed from *fig 2* that the average utilization of small bottles & Can packaging unit are high depending upon the demand, it could be concluded that there is a higher demand for small bottles or Cans in comparison with Large bottles.

Based on the above-illustrated scenarios, it could be observed that the main bottleneck is the fermenter, followed by the coolers, the filter (if considered), and the packaging units of Small bottle & Cans. Implementation of a new fermenter, new fast cooler & replacement of the slow cooler with the fast cooler to run in parallel(per requirement) could be recommended. The hypothesis is proposed for keeping the packaging blocks unchanged, however, the schedule can be manipulated in such way that all the machines in the packaging section could be utilized parallelly and could, therefore, exchange the role of generating the same set of outcomes.

The above recommendations are proposed regardless of any financial calculation involved. The total investment of the capital could be a major factor while following the proposal. However, it is essential to think through the scenario when the demand could be potentially high. It would be recommended to consider the recommendations before 2025 is approached (ideally 2024), however, it might take up to 1 year to do the systematical changes to the brewery if the recommendations are followed.

Conclusion

After examining the case study, it can be concluded that several situations are impacting the outcome of the production line and therefore, precautionary changes require to be taken before the demand rate is greater than the supply rate. The analysis, however, considers the finance to be out of scope for the analogy of the simulation modeling. The finance modeling could be potential further step to be considered. Thus, appropriate assumptions to be made based on the market analysis concerning the demand for the product, accordingly, definite forecasts could be presented.