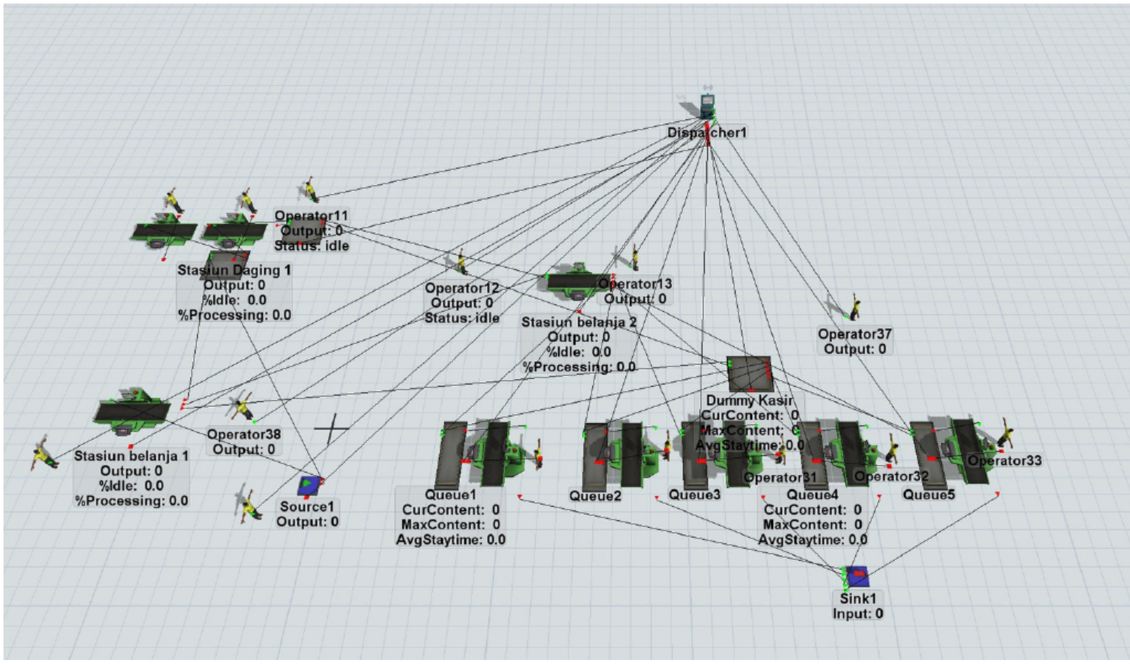
Driving Efficiency, Eliminating Queues: My Journey Optimizing YOGYA Ciwalk Supermarket



As a professional deeply committed to problem-solving and operational efficiency, I consistently seek opportunities to apply analytical expertise in real-world contexts. A pervasive challenge in the retail sector is queue management, which directly impacts customer satisfaction and operational effectiveness. At YOGYA Ciwalk Supermarket, we identified that

prolonged queues at the checkout not only diminish the shopping experience but also represent a significant potential for customer attrition and suboptimal resource allocation. This critical issue motivated me to embark on a comprehensive system simulation project aimed at identifying root causes and formulating concrete solutions. This project was designed to deliver substantial value to the company by enhancing customer experience and optimizing cashier performance.

In-Depth System Analysis: A Comprehensive Approach and Data Verification

My investigation commenced with a systematic

Preliminary Study and Field Study phase. I conducted direct observations at YOGYA Ciwalk Supermarket to gain an in-depth understanding of the customer journey, from their arrival to their shopping activities across various departments (including the meat section), and finally, to the checkout process. Primary data, specifically concerning customer inter-arrival times and service times at each processing station (shopping aisles, meat counter, and cashiers), were meticulously collected during the supermarket's peak operational hours.

The integrity and validity of this data were paramount to the research. Consequently, a series of inferential statistical tests were rigorously applied:

- **Randomness Test (Run Test):** This test was performed to verify the random nature of the collected data. The null hypothesis (
  H_0) stated that the data was random, while the alternative hypothesis (H_1) stated otherwise. At a significance level (
  α) of 0.05 , the computed P-Values for all variables (Inter-Arrival Time: 0.946; Shopping Station Process Time 1: 0.410; Meat Station Process Time: 0.862; Shopping Station Process Time 2: 0.804; Cashier Process Time: 0.285) were greater than 0.05. Thus, we failed to reject
  H_0, concluding there was insufficient evidence to suggest the data was not random.
- **Data Sufficiency Test:** This test aimed to ensure that the collected sample size was adequate and representative of the population. The formula used was
  N′=(A×x2Z1−α×σ)2. The test results indicated that the actual number of observations (
  `N`) met or even exceeded the theoretical number of observations (`N'`) required for all variables, for example, Inter-Arrival Time had N=340 and N'=337, and Cashier Process Time had N=50 and N'=31. This confirmed the reliability of the data for further analysis.
- **Probability Distribution Fitting:** Identifying the most appropriate probability distribution for each process time variable was a crucial step in simulation modeling. The fitting results indicated that:
  - Inter-Arrival Time followed a Weibull distribution.
  - Shopping Station Process Time 1 (Waktu Berbelanja Stasiun 1) followed a Weibull distribution.
  - Meat Station Process Time (Waktu Stasiun Daging) followed a Weibull (E) distribution.
  - Shopping Station Process Time 2 (Waktu Stasiun Belanja 2) also followed a Weibull distribution.
  - Cashier Process Time (Waktu Stasiun Kasir) followed a Weibull (Model 11) distribution.

Once the data was validated and its distributions identified, I proceeded to construct the **baseline simulation model** of the YOGYA Ciwalk Supermarket queuing system using the **FlexSim** software. This model meticulously replicated the customer flow, including arrivals, activities at various stations, queuing, and cashier service. Each object within the FlexSim model was configured with specific properties based on the collected data. For instance, the "Source1" object's Inter-Arrival Time was set to a Weibull distribution derived from the data analysis. Similarly, "Stasiun belanja 1" (Shopping Station 1) and other processors had their Process Times configured according to their fitted distributions.

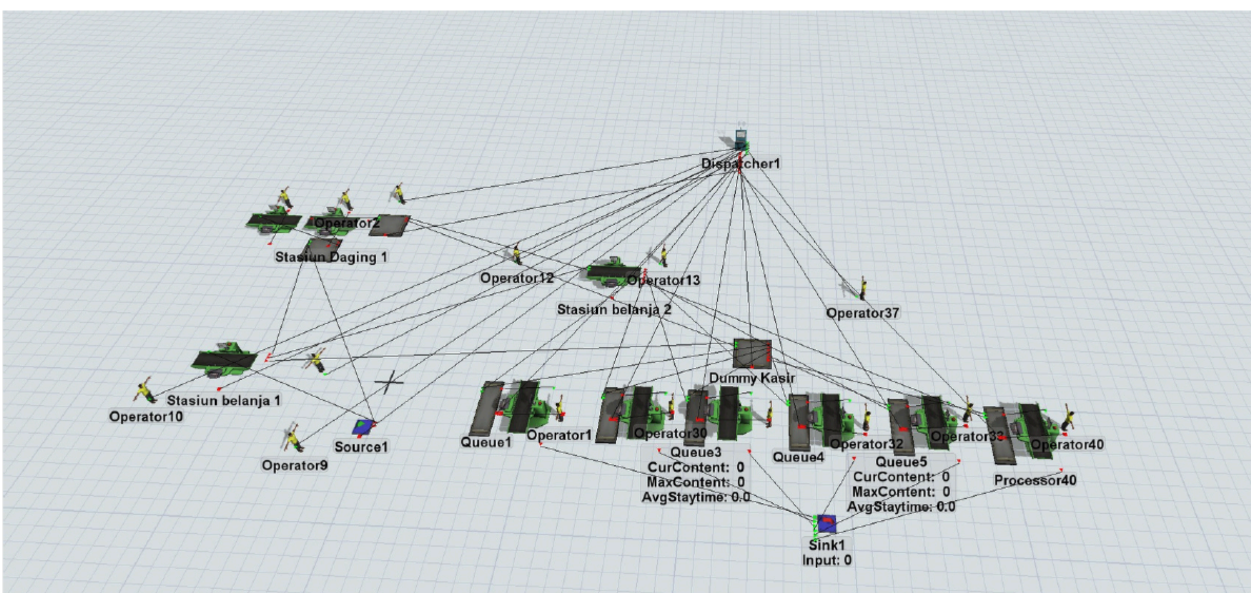
Model validation was performed by comparing the average simulation data (e.g., 2.293314205) with the average actual data (μ=2.439) using a hypothesis test (t-test). With the null hypothesis (H0) stating that the average simulation data equals the actual average (μ=2.439) , the calculated t-statistic (T0=−1.663) did not fall within the rejection region (T0>2.262 or T0<−2.262). Consequently,

H0 was failed to be rejected, confirming that the simulation model I built was a valid representation of the real system.

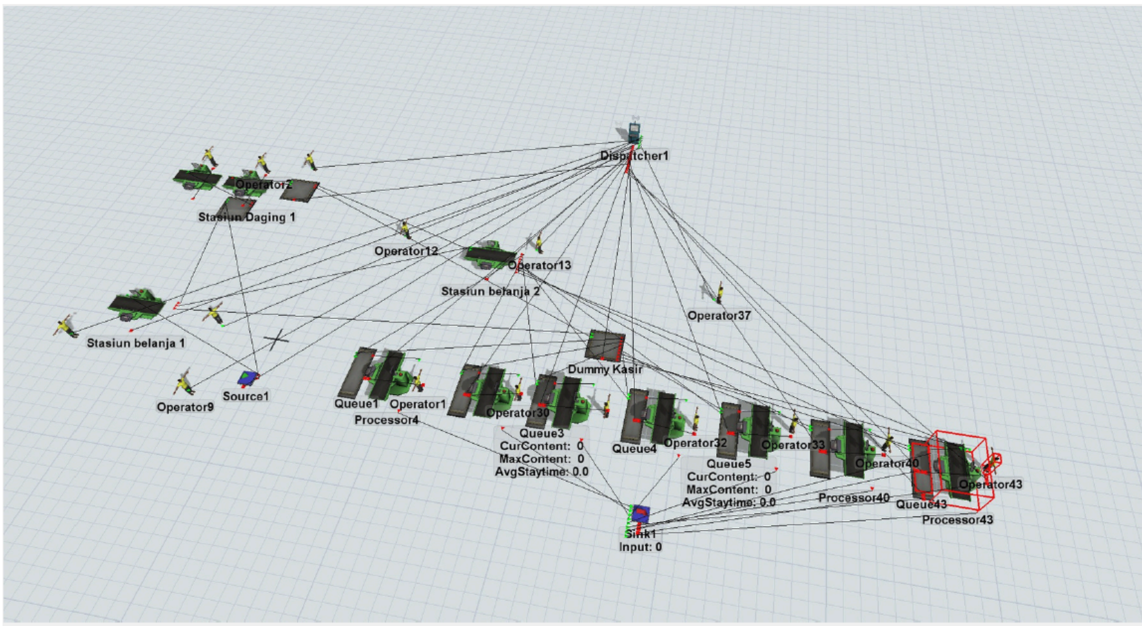
Designing and Evaluating Improvement Proposals for Optimal Efficiency

With a validated model in hand, I embarked on developing

two distinct improvement scenarios focused on increasing the number of cashiers, aiming to optimize queuing times and service. Each proposal was designed for quantitative evaluation to determine its efficiency impact:



- **improvement Proposal 1:** This scenario involved **adding 1 cashier to the existing system**, increasing the total number of active cashiers. A hypothesis test for variance comparison between Proposal 1 Data (Average: 1.148089256 , Stdev: 0.4500819609) and Baseline Simulation Data (Average: 2.293314205 , Stdev: 0.2773027884) yielded an F-statistic of $F_0=2.634$. This value did not fall within the rejection region ($F_0>3.77$ or $F_0<0.265$) , indicating that the variance of Proposal 1 was not significantly different from the simulation's variance. However, the hypothesis test for mean comparison showed a t-statistic of $T_0=-7.205$, which fell within the rejection region ($T_0<-1.711$). The conclusion was that the average queuing time for Proposal 1 was significantly lower than the baseline simulation.



- **Improvement Proposal 2:** This scenario involved **adding 2 cashiers to the existing system**, further increasing the total number of active cashiers. The hypothesis test for variance comparison between Proposal 2 Data (Average: 0.9303791224 , Stdev: 0.3829270394) and Baseline Simulation Data (Average: 2.293314205 , Stdev: 0.2773027884) yielded an F-statistic of $F_0=1.906$, also not falling within the rejection region ($F_0>3.77$ or $F_0<0.265$). This suggested that the variance of Proposal 2 was not significantly different from the simulation's variance. Furthermore, the hypothesis test for mean comparison showed a t-statistic of $T_0=-9.74$, which was within the rejection region ($T_0<-1.711$). This indicated that the average queuing time for Proposal 2 was significantly lower than the baseline simulation.

Through a **Rank & Selection** process, comparing the performance of both improvement proposals ,

Improvement Proposal 2 emerged as the optimal scenario. A direct comparison between Improvement Proposal 2 and Improvement Proposal 1 also revealed no significant difference in variance ($F0=0.7238$, outside rejection region $F0>2.89$ or $F0<0.349$) , but the average queuing time for Improvement Proposal 2 was significantly lower ($T0=-9.225$, within rejection region $T0<-1.697$). This reinforced the recommendation of Improvement Proposal 2 as the most effective solution.

Project Conclusion: Tangible Impact and Developed Competencies

From this project, the conclusion is:

the number of cashiers significantly impacts queuing time in the supermarket.

By adding cashiers, allowing more than 5 cashiers to be operational, queuing time at the checkout can be substantially reduced, thereby enhancing both operational efficiency and customer satisfaction.

From this project, I gained and honed the following skills:

- **System and Process Analysis:** I am capable of identifying and mapping complex process flows and pinpointing inefficiencies that require improvement.
- **Quantitative Data Collection & Processing:** I mastered methodologies for accurate and structured data collection, followed by rigorous processing and validation using relevant statistical tests.
- **Discrete Event Modeling & Simulation (FlexSim):** I possess in-depth expertise in utilizing **FlexSim** to build representative simulation models, configure entities and process logic, and execute "what-if" scenarios for robust impact evaluation.
- **Applied Inferential Statistics:** I am proficient in applying various hypothesis tests (Run Test, Data Sufficiency Test, Goodness-of-Fit Tests for distributions, t-tests, F-tests) to validate data, compare system performance, and make evidence-based decisions.
- **Solution Design & Optimization:** My ability to formulate and evaluate innovative improvement proposals to address operational problems and achieve optimal efficiency has been significantly sharpened.
- **Technical Presentation and Communication:** I effectively translate complex technical analysis into clear, concise, and persuasive recommendations for management stakeholders.

This project is not merely an academic accomplishment but also an invaluable practical experience in applying simulation theory to solve real-world problems. It underscores my dedication to operational excellence and my capability to deliver impactful solutions that benefit business operations.