

Diary Plant Modeling, Simulation, and Optimization

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Abstract - Newly, dairy plants have been converted into an industrial method. As a result, the dairy industry plant has improved its services using different development methods and techniques. This paper aims to evaluate the current plans and processes in the dairy plant in the example above and enhance its efficiency and increase productivity. This paper's work scope uses simulation methods to produce a design that depicts processes in a plant. The plan analyzes the plant with ProModel, utilizing the facility manufactory planning method to evaluate the existing plant layout and propose new improvements based on specific considerations.

Keywords: Plant, Layout, ProModel, Simulation, Productivity.

I. INTRODUCTION

A. Introduction to the Dairy Plant

The dairy plant is a critical production project. It provides dairy products like Ultra Temperature, condensed milk, cheese, and curd. The factory concentrates on producing milk and other types of products. After the planning, design, and processing process, this project is transferred to the implementation site to help people benefit from their farms and market their milk, as well as give dairy products to the political economy that contribute to improving the economy, where it is planned to provide the factory with machines, designs, and prepared material and to train technical personnel conforming to the most advanced standard systems.

B. Introduction to Analysis

Systems engineering is applied to increase capacity and decrease primary and secondary industrial and non-industrial enterprise organizations. It can be described as a standard method to subject all primary and secondary ways. We practiced engineering techniques to draw a method flow diagram, which is "a kind of chart describing an algorithm, plan or workflow. It shows the steps like different types of squares and arranging them by attaching them beside arrows. In this description, we design each of them the determining step for all production processes to examine the efforts and work to reduce or develop consolidation.

Factory simulation is a computer application to model, analyze, simulate, visualize and optimize product regularities and processes, logistics operations, and material flow;

simulations can develop material flow, logistics, and resource use for all factory layout levels from overall production plants through specific factories to particular lines for the design. The application provides a measurement of complex composition alternatives, including independent process logic. Factory simulation is used essentially for strategic planning to plan and measure the reason and dimensions of long and complicated product investments.

The factory's layout design has enhanced a basic framework of today's technical buildings that can affect work productivity. It is essential to organize and assign personnel, elements, machinery, equipment, materials, and other product supports and tools to produce the different practical plant layouts. A factory planning study is engineering research used to examine various physical arrangements of a manufacturing factory.

II. METHODOLOGY

A. Process flow diagram

We followed the teachings of the flowchart: by explaining each process in the diagram, discussing and describing the boundaries of each method: when and where the plan begins, and when and where it ends, exploring and delimiting the extent of an item to be involved in the chart. Inspiration the actions which are happening, determine the operation's distribution, and arrange suitable line activities.

B. Plant simulation

To simulate factory records, we used ProModel, a separate case simulation technology used to outline, optimize and design modern or current assemble and functioning systems and logistics systems. It enables us to reproduce natural world methods, count natural variance and necessity accurately, implement predictive examination of possible modifications and optimize your strategy.

ProModel methodology

Visualize: Build an energetic and effective device pattern of your job situation from AutoCAD files, method flow maps, value, or Rule Simulator models. See and clearly explain present methods and procedures.

Analysis: Brainstorm with the pattern to recognize potential differences and create situations to examine improvements that will meet business purposes. Run the systems separately and analyze their effects in a Product Viewer improved using the most advanced Microsoft® WPF technology.

Optimization: Examine the impression of variations on the right and future processes directly and risk-free, with portentous summary measurements. Determine the optimum business achievement with a significant possibility of achieving your company objects.

C. Factory layout

Here will highlight six items and techniques utilized for plant planning are as regards:

1. Operation Process diagram: here, the production method is distributed differently with Processes Schum's aid function. It represents the points at that elements are accessed into the technique and the flow of progress and many examinations other than element treatment.
2. Flow process diagram: This diagram is a graphical depiction of all product actions on the workshop floor, including moving, warehousing, and stoppage.
3. Process flow charts: The structure plan chart graphically expresses the relative location of the productive machinery warehouse area, corridors, etc., and the path that men or supplies support. All paths followed by multiple factors are determined by combining icons with vertical lines in the factory.

4. Machine data cards: These provide full specifications for each item connected, intimating capacity, area, other conditions, functioning central systems, maintenance facilities, etc.

5. Models: After analyzing the method flow chart, machine data layers, and process flow chart, the floor plan of the factory is made by specifying the region maintained by each part (device, material treatment equipment, furniture, equipment, etc.) of these to be placed into the warehouse. Those diagrams are designed in a way to gives the best design. This system performs the layout evident before it is genuinely drained and thoroughly reviewed.

6. Scale models: this step is an enhancement of the design style. In this device, somewhat of templates, a 3D system design is done. Therefore, these patterns may be wood, synthetic, or metal. When planning, a range of extra data is obtained about the proposed height and machine parts.

III. RESULTS AND DISCUSSIONS

A. Process flow diagram "Figure 1."

B. Plant simulation

It was analyzed with ProModel Stat. suitable. The exponential distribution resulted in an average of 40.1 minutes. Besides, scattering, autocorrelation, and playback considering tests were conducted and showed no similarity in the data.

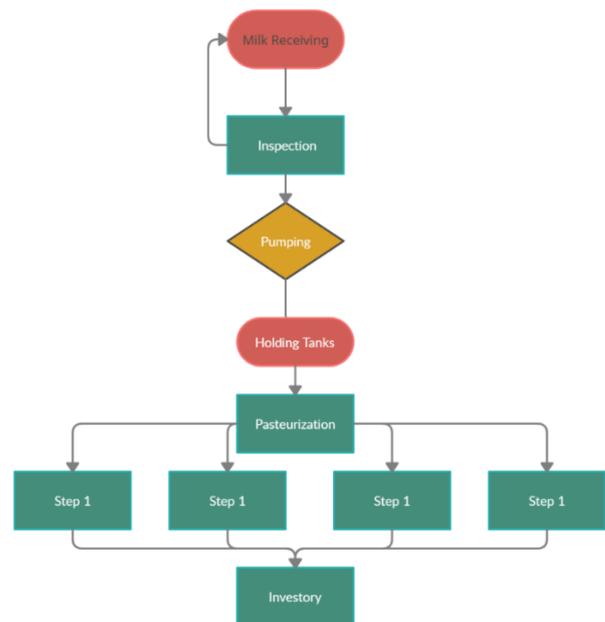


Figure 1: Process Flow Chart

The following numbers represent the data obtained as well as the ProModel Stat results:

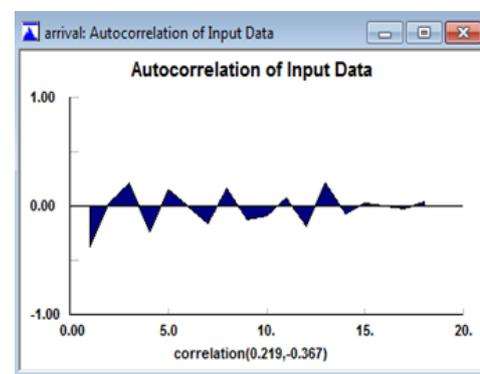


Figure 2: Inter arrivals analysis

The following chart displays the principal distributions of each exercise along with its appropriate plot as examined in Stat Fit:

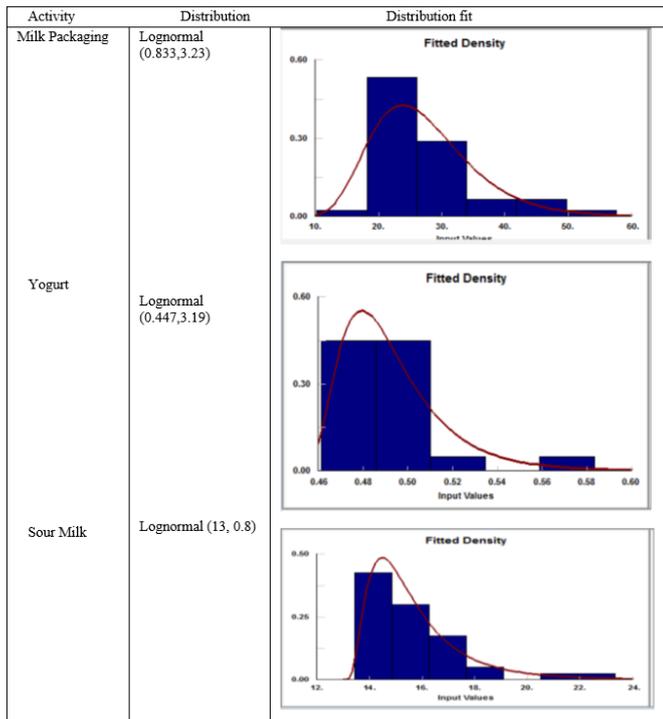


Figure 3: Distribution fitting

Model Building (ProModel):

There is just one item, and that is milk. Milk arrives in the receiving field, undergoes several processes, and is presented in various styles. The following table displays the items as described in ProModel:

Table 1: Entities

Name	Speed	State	Note
Milk	160	Time Section	

Access:

Milk arrives at the plant from farmers in exponential population, with 1100 liters per operator. The below figure shows the entries as described in the Pro Model:



Figure 4: Arrives

Planning:

The below figure shows the method mapping described in ProModel, and explains the significant places and positions.

Approximate organizations:

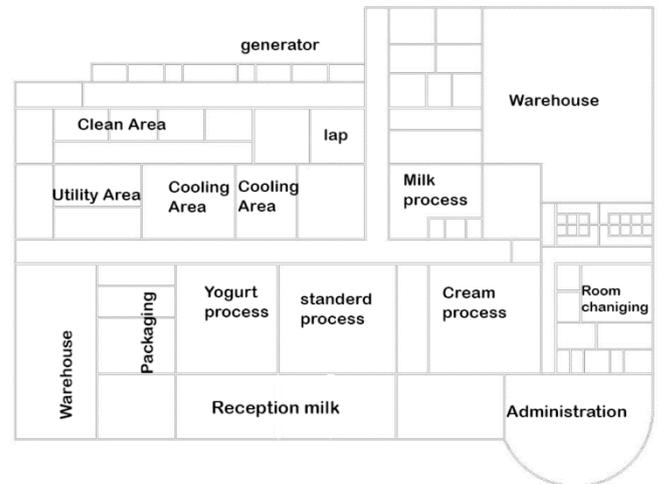


Figure 5: Layout

Processing:

The treatment is clearly outlined and charted for each process; the below figure presents Processing as Shows in ProModel:

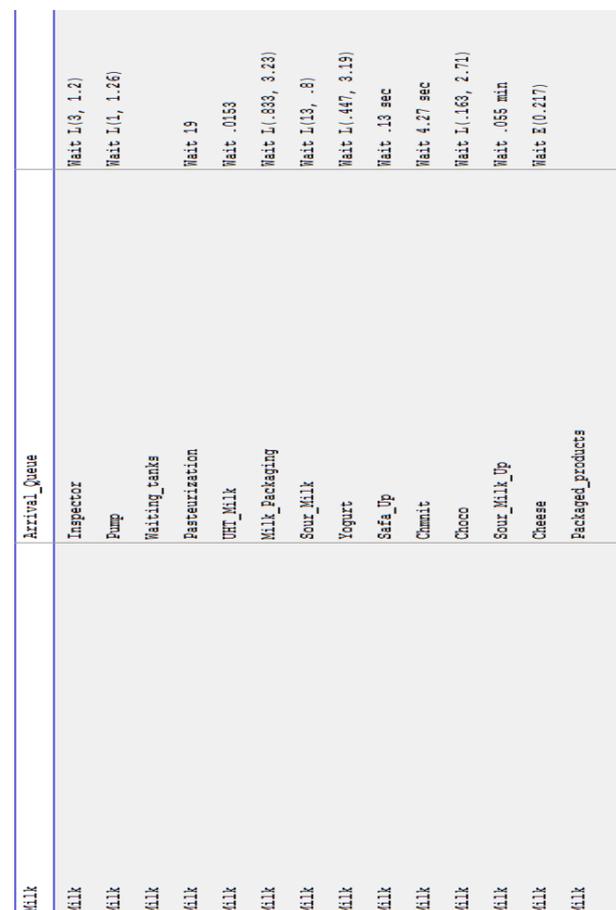


Figure 6: Processing

After built the design, it ran for 2000 hours to achieve sound production and control the steady-state benefits system. The whole milk provided in 1,100 hours was 3,063,500 liters, with an average of 27.91 minutes in the liter's method. The below figure presents the states of multi-capacity positions during 2200 producing hours.

C. Factory layout

This tool evaluates and assesses existing dairy plant planning and creates a new dairy plant plan by implementing judgment and production planning processes. We have measured the fields and distances of each part of the plant to meet the required requirements.

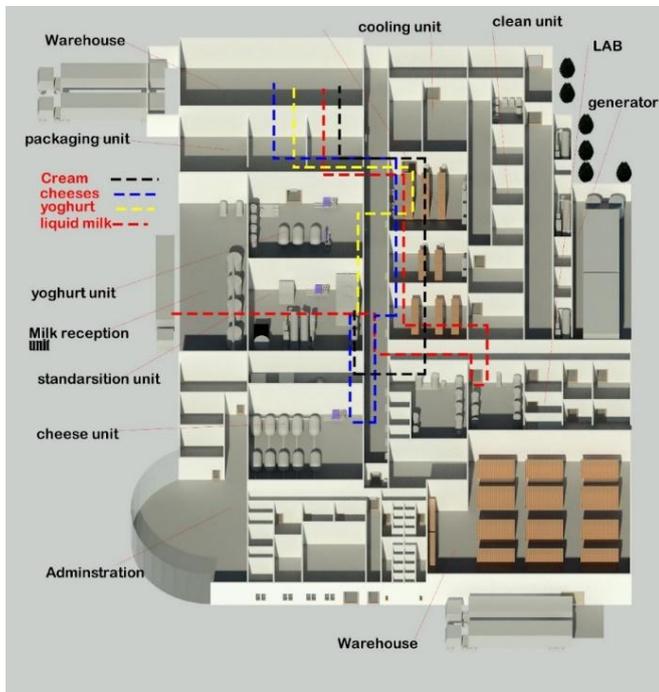


Figure 7: Layout plant

After measuring the areas and distances and observing the supposed operator flow between sections, we created a table. We determined that the highest flow was between the incubator and refrigerator sections. A high amount of output must be kept in the incubator for hours to get a suitable substrate. Next, we evaluated the interdepartmental relationship diagram, divided the most significant number of flows by five, and constructed this convergence concerning ship areas. We have one strong relationship between the incubator and refrigerator units and only a typical relationship of importance between Safeno and the incubator; the stock and the outstanding areas have insignificant relationships.

Accordingly, we can build the placement classification to create a layout plan. Arrangement sequence: Incubator - Savino - Preservation - Condensed milk filling - Receipt -

Cleaning – Storage tanks - Lab - Refrigerator - Pasteurization - Raw materials cleaning. Arranging based on serial relationships in production.

We have applied a professional technique to refine the existing layout. Initially, we evaluate the existing design corresponding to the juxtaposition-based result by multiplying the flux with distance by the unit cost. Flight cost = operator's salary / (number of working hours per day) * (number of working days per week) * (average number of influx) = 2000 / (6 * 7 * 32.6) = 1.4

Table 2: Flow * Distance * Cost table

F*d*c	Departments
17682.4	Cleaning
95402.4	Receiving
772325	Holding Tanks
83058.6	Roll Material
577307	Condensed Milk filling
18844	Electric
259604	Maintenance
99642	Sour milk up
153941	Sour Milk
321785	Safeno
737616	Incubator
	Fridge
43512	Inventory
	Raw Material
	Cleaning 2
	Cheese
29824	Lab
6811.2	Holding Tanks 2
	Pasteurization
3217349	Total

By achieving various systems based on connection and flow between schemes, we shifted the laboratory to the receiving area to have a new department, "Research and Improvement."

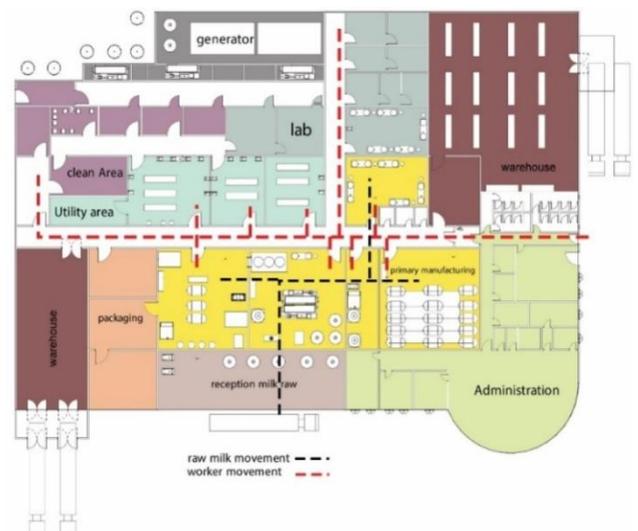


Figure 8: Multiple Method

IV. CONCLUSION

After long research, we found that the facility achieves our optimization goals:

The flow of elements and labor in the factory is complex, so the design is not optimized because there are time and costs wasted in transportation.

The factory's failure to own the manufacturing teachings or the supply chain leads to production being halted due to decreased raw materials or packaging requirements.

Failure to involve the human resources department's supervision in planning will lead to a loss of workers' commitment to working hours to be late for work and leave work early.

Thus, incorrect planning will lead to delaying production lines and the production method. So, spotting these issues with flowcharts, simulations, and plant layout will resolve them.

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