

Factory Throughput Simulation

Use a digital twin to balance robot, conveyor, and buffer capacity before changing the physical line.

Customer Nova Factory Systems	Department Industrial Simulation	Difficulty Advanced	Time 2-3 class periods
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Production Goal: Select the best production-line configuration virtually.

Background

Nova Factory Systems is considering three production-line configurations. Building each physically would be costly, so your team must simulate the alternatives and recommend the best design for throughput and reliability.

Learning Objectives

- Build and compare production scenarios
- Identify bottlenecks and buffer effects
- Analyze throughput and utilization data
- Complete an evidence-based trade study

Equipment

- Digital twin or factory simulation
- Three provided layout scenarios
- Spreadsheet
- Engineering notebook

Student Instructions

- 1 Define the production sequence and output target.
- 2 Build or load Scenario A with the baseline robot and conveyor settings.
- 3 Run a simulated production period and record output, idle time, and blocked time.
- 4 Create Scenario B by changing conveyor speed or buffer capacity.
- 5 Create Scenario C by changing robot path or station assignment.
- 6 Run each scenario for the same simulated duration.
- 7 Calculate throughput, robot utilization, and average work-in-process.
- 8 Create a weighted decision matrix using output, reliability, complexity, and cost.
- 9 Recommend one scenario and identify one risk before physical implementation.

Engineering Requirements

- Compare exactly three scenarios
- Use identical simulated production duration
- Report throughput and at least two additional metrics
- Support recommendation with a decision matrix

Constraints & Safety

- Use only approved changes for each scenario

- Do not change multiple unrecorded variables
- Simulation assumptions must be listed
- The recommended scenario must preserve safety

Deliverables

- Three simulation configurations
- Scenario data table
- Graphs of key metrics
- Decision matrix
- Recommendation memo
- Reflection

Reflection Questions

- 1 Which scenario had the highest throughput?
- 2 Did highest throughput also produce the least work-in-process?
- 3 What assumption could change the recommendation?
- 4 Which result should be verified physically first?

Engineering Support

Engineering Tip

Record every simulation assumption; a precise answer from an unrealistic assumption is still unreliable.

Common Mistake

Comparing scenarios with different run durations or starting inventory produces misleading results.

Stretch Goal

Perform a sensitivity analysis by changing demand or failure rate.

Career Connection

Manufacturing simulation engineers test factory layouts and schedules before companies commit capital.

Before You Submit

- Notebook evidence included
- Requirements checked
- Testing documented
- Reflection completed