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AGV OPTIMIZATION SIMULATION: HOW DIJITALIS SAVED $1.5 MILLION IN ELECTRONICS MANUFACTURING

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ABSTRACT

This case study presents how Dijitalis Consulting utilized simulation modeling to optimize Automated Guided Vehicle (AGV) investments for a major electronics manufacturing facility. The client, a TV manufacturing company with 15 assembly lines, was initiating significant investments including a new AGV fleet to replace their outdated system of 132 vehicles. Using Simio simulation software, Dijitalis created a comprehensive digital model of the facility's material handling operations, analyzing traffic patterns, potential bottlenecks, and resource utilization. The simulation revealed that only 95 AGVs were required instead of the initially proposed 132, resulting in capital expenditure savings exceeding $1.5 million. Beyond cost savings, the simulation model became a continuous improvement tool for testing layout modifications, process changes, and production schedule feasibility.

1 INTRODUCTION

The client operates a 34,000m² facility with 15 assembly lines supplied by AGVs from six parking locations to 169 delivery points. The existing AGV fleet of 132 vehicles was outdated, frequently causing delays in material delivery and production disruptions. The client sought a data-driven approach to determine the precise number of AGVs needed while addressing additional questions about production schedule feasibility, stockout risks, changeover timing, supply process design, loading station requirements, and potential network deadlocks and congestion areas.

2 METHODOLOGY

The project followed a structured approach combining data collection, process design, simulation modeling, and scenario testing:

Data Collection and Validation

The team collected and validated comprehensive data about the facility layout, bill of materials, warehouse locations, AGV specifications, and production schedules.

Supply Process Design

After analysis, the team designed a push-based supply system rather than a pull system, using a time-based trigger to initiate material supply before changeover. This decision balanced implementation complexity with operational efficiency.

Simulation Model Development

Using Simio simulation software, the team built a data-oriented baseline model of the AGV supply network. The model incorporated:

- 15 assembly lines with specific cycle times and changeover schedules
- 6 AGV parking areas with loading/unloading stations
- 169 material delivery points

- Complete path network with junction points
- Production plan with order sequences and lot sizes
- Material routing information for 435 different routings
- Bill of materials for 387 different SKUs

The model utilized Simio's object-oriented structure and data table capabilities to create a flexible, data-driven simulation that allowed for automatic creation of supply destinations and efficient updates to production plans and material routings.

Model Verification and Experimentation
The baseline model was verified with the client to ensure accuracy. The simulation revealed design issues, including potential deadlocks in bidirectional paths with high traffic, leading to layout improvements.

Using Simio's experiment module, the team conducted 35 scenarios testing different combinations of AGV numbers, loading stations, and order release timing. The primary KPI was production delay, with secondary KPIs including AGV utilization rates and parking area availability.

3 RESULTS

The simulation analysis yielded several key findings:

Optimal AGV Fleet Size
The optimal scenario required only 95 AGVs (compared to the initially proposed 132), distributed across the six parking areas. This reduction represented a capital expenditure saving of over $1.5 million based on an average AGV cost of $50,000.

Resource Optimization
The simulation determined the optimal number of loading stations needed in each AGV area to prevent bottlenecks during peak demand periods. The model also established that an order release time of 16 minutes before changeover was sufficient to ensure timely material delivery without excessive inventory buildup.

Utilization Patterns
The optimized scenario achieved average AGV utilization rates of 65-66%, representing an efficient balance between resource availability and operational requirements. The simulation revealed utilization patterns throughout the day, with peaks during morning changeovers and afternoon batch productions, and lower utilization during lunch breaks.

Traffic Analysis
Heat maps generated from the simulation identified high-traffic areas and potential congestion points in the path network. This analysis informed layout modifications to improve traffic flow and prevent deadlocks.

4 CONCLUSION

This case study demonstrates how simulation modeling transforms capital investment decisions from rough estimates to data-driven optimization. Beyond the immediate $1.5 million savings in AGV purchases, the project provided the client with a validated production schedule, prevention of potential bottlenecks, a continuous improvement tool for testing future changes, a decision support system for evaluating new investments, and the ability to validate production schedules as product portfolios evolve.