OPTIMIZING PRODUCTION EFFICIENCY THROU SIMULATION

Benjamin Marmolejo | IT | Fresno State

Background

Effective production planning and control are crucial for organizations to achieve their goals and maximize profitability. However, traditional methods of production planning can be time-consuming and costly and may not always result in optimal outcomes. Simulation-based approaches can provide a more efficient and cost-effective way to optimize production efficiency.

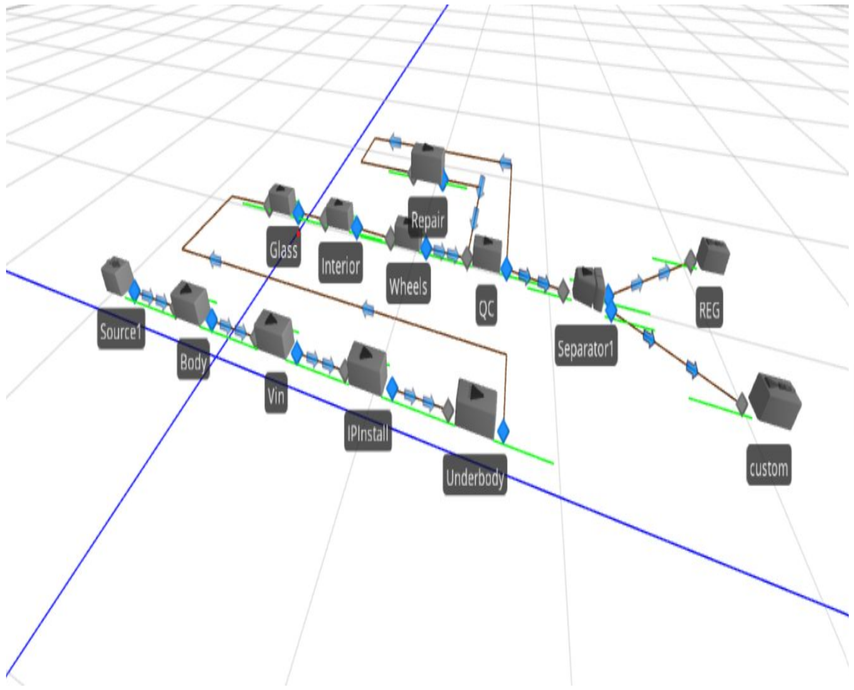
Objective

The objective of this study is to investigate the impact of resource allocation on production efficacy through simulation modeling. Specifically, we aim to analyze how different resource allocation strategies affect production output, lead time, and inventory levels.

Methodology

- Literature Review: A comprehensive review of existing studies on production simulation, resource allocation, and performance metrics was conducted to identify key findings and gaps in the literature.
- Case Study: A real-world manufacturing case study was selected to demonstrate the application of simulation modeling in optimizing production efficiency.
- Simulation Modeling: A discrete-event simulation model was developed using commercial software to model the production process. The model included variables such as machine capacity, labor allocation, and inventory levels.
- Experimental Design: A series of experiments were conducted to test different resource allocation strategies, including:
  - Randomized resource allocation
  - Priority-based resource allocation
  - Dynamic resource allocation
  - Optimization-based resource allocation
- Performance Metrics: Output, lead time, and inventory levels were measured as performance metrics to evaluate the effectiveness of each resource allocation strategy.

Production Line Simulation & Results



- Results show that optimization-based resource allocation outperformed other strategies in terms of output ($p < 0.05$), with an average increase of 12% compared to randomized resource allocation.
- Dynamic resource allocation resulted in shorter lead times ($p < 0.01$) compared to priority-based and randomized resource allocation.
- Inventory levels were lowest under optimization-based resource allocation ($p < 0.01$).

Future Work

- Explore the use of machine learning algorithms in conjunction with simulation modeling to optimize production efficiency.
- Investigate the impact of uncertainty and variability on production efficiency under different resource allocation strategies.

Conclusion

This study demonstrates the effectiveness of simulation modeling in optimizing production efficiency through resource allocation. Optimization-based resource allocation was found to be the most effective strategy in terms of output, lead time, and inventory levels. These findings suggest that organizations can improve their production efficiency by using simulation modeling to optimize resource allocation.

Recommendations

- Organizations should consider using simulation modeling as a tool for optimizing production efficiency.
- Optimization-based resource allocation should be prioritized over other strategies.
- Further research is needed to explore the applicability of simulation modeling in different industrial settings.

References

Acknowledgments

I would like to express my gratitude to the following individuals and organizations for their assistance and support of U.S. Department of Education, Title V Promoting Postbaccalaureate Opportunities for Hispanic Americans, Finish in Five, (P031M210039) and Dr. Nambiar.