Topic 1

Title

Machine Learning and Artificial Intelligence for Operations Management: Due Date Prediction

Background

Machine Learning and Artificial Intelligence are increasingly applied in many different industries and contexts. However, real applications and benefits in Operations Management are still scarce. The main objective is therefore to explore the literature to identify possible applications of machine learning and Artificial Intelligence in Operations Management and test the proposed methodologies in a simulated environment.

Research Question

Can Artificial Neural Networks improve due date predictions and thus delivery related performance?

Research Methodology

Literature Review in the related areas to identify methods to be included

Design of methods to be tested

Determine experimental design including necessary environmental factors

Build simulation

Run experimental design

Report results

Contextualize results in the literature

Topic 2

Title

Machine Learning and Artificial Intelligence for Operations Management: Machine Failure

Background

Machine Learning and Artificial Intelligence are increasingly applied in many different industries and contexts. However, real applications and benefits in Operations Management are still scarce. The main objective is therefore to explore the literature to identify possible applications of machine learning and Artificial Intelligence in Operations Management and test the proposed methodologies in a simulated environment.

Research Question

Can Artificial Intelligence improve the prediction of bottlenecks?

Research Methodology

Literature Review in the related areas to identify methods to be included

Design of methods to be tested

Determine experimental design including necessary environmental factors

Build simulation

Run experimental design

Report results

Contextualize results in the literature

Topic 3

Title

Machine Learning and Artificial Intelligence for Operations Management: Bottlenecks

Background

Machine Learning and Artificial Intelligence are increasingly applied in many different industries and contexts. However, real applications and benefits in Operations Management are still scarce. The main objective is therefore to explore the literature to identify possible applications of machine learning and Artificial Intelligence in Operations Management and test the proposed methodologies in a simulated environment.

Research Question

Can Artificial Intelligence improve the prediction of machine failures?

Research Methodology

Literature Review in the related areas to identify methods to be included

Design of methods to be tested

Determine experimental design including necessary environmental factors

Build simulation

Run experimental design

Report results

Contextualize results in the literature

Topic 4

Title

Worker Training in Unbalanced Lines

Background

Most research on make-to-order shops assumes capacity to be reasonably fixed in space. However, in practice workers are often flexible and can be shifted from one station to another. In other words, workers are assigned to an overlapping range of stations, something called baton-zone bumping in Protzman et al. (2016). While it is obvious that techniques as baton-zone bumping are most effective if all workers are equally efficient at all stations, it is often not desirable to rely on such a highly skilled work force. Using a heterogenous workforce, instead of a homogenous, can provide significant reduction in training need and costs for companies. However, existing literature does not explain which is the best way to allocate workers in a flow shop where workers have different proficiency. The main objective is therefore to explore different matrix designs for worker proficiency and their impact on worker allocation policies, such as baton zone bumping, via simulation.

Research Question

What is the best policy to allocate workers in a flow shop contingent on different skills and efficiencies?

Research Methodology

Literature Review in the related areas to identify methods to be included

Design of methods to be tested

Determine experimental design including necessary environmental factors

Build simulation

Run experimental design

Report results

Contextualize results in the literature

Topic 5

Title

Production Planning and Control in MTO: An Assessment of Methods with Labor Flexibility

Background

Production Planning and Control methods in make-to-order environments are subject to high variability. This limits their application. Labor flexibility is a common means to increase the potential of accommodating variability even for rigid planning methods. The main objective is therefore to explore different matrix designs of worker flexibility and their impact on common Production Planning and Control methods.

Research Question

What is the impact of labor flexibility on Production Planning and Control methods?

Research Methodology

Literature Review in the related areas to identify methods to be included

Design of methods to be tested

Determine experimental design including necessary environmental factors

Build simulation

Run experimental design

Report results

Contextualize results in the literature

Topic 6

Title

Production Planning and Control in MTO: An Assessment of Methods with Capacity Adjustments

Background

Production Planning and Control methods in make-to-order environments are subject to high variability. This limits their application. Capacity adjustment is a common means to increase the potential of accommodating variability even for rigid planning methods. The main objective is therefore to explore different matrix designs of worker flexibility and their impact on common Production Planning and Control methods.

Research Question

What is the impact of capacity adjustments on Production Planning and Control methods?

Research Methodology

Literature Review in the related areas to identify methods to be included

Design of methods to be tested

Determine experimental design including necessary environmental factors

Build simulation

Run experimental design

Report results

Contextualize results in the literature

Topic 7

Title

Overtime vs Labor Flexibility: An Assessment

Background

The workforce is often the most flexible resource for managing capacity in manufacturing companies. Workers can work at different stations and be reallocated when needed. Workforce flexibility may be attained through employee cross-training or by adopting adaptable work schedules, including the strategic use of overtime. Overtime defined as the time workers work beyond their regular or scheduled working time is often used in production systems to address short-term capacity problems, to deal with demand variability, to manage uncertainty in production time, and to meet orders due dates. Despite its widespread use in practice, overtime as a capacity adjustment mechanism has been relatively overlooked in academic research. The main objective is therefore to explore labor flexibility and overtime.

Research Question

Under what conditions should overtime be preferred over labor flexibility?

Research Methodology

Literature Review in the related areas to identify methods to be included

Design of methods to be tested

Determine experimental design including necessary environmental factors

Build simulation

Run experimental design

Report results

Contextualize results in the literature

Topic 8

Title

Labor Flexibility and Absenteeism: An Assessment

Background

Absenteeism is a major challenge for many companies. A main means to accommodate the negative effects of absenteeism is worker flexibility. The main objective is therefore to explore which worker flexibility matrices and worker allocation rules best accommodate different forms of absenteeism.

Research Question

Which worker flexibility matrices and worker allocation rules best accommodate different forms of absenteeism?

Research Methodology

Literature Review in the related areas to identify methods to be included

Design of methods to be tested

Determine experimental design including necessary environmental factors

Build simulation

Run experimental design

Report results

Contextualize results in the literature

Topic 9

Title

Walking Worker Strategies Considering Bottlenecks

Background

Manufacturing and service systems often involve workers who move between stations to perform tasks, inspect materials, or support automated processes. These walking workers play a critical role in maintaining production flow, especially in labor-intensive industries, warehouses, and hybrid automated-manual systems. Their efficiency may be highly influenced by system characteristics, such as bottleneck operations, impacting throughput, cycle time, and worker utilization. Despite growing attention to flexible manufacturing with walking workers, limited research explicitly analyzes the interplay between walking worker strategies and bottleneck constraints. The objective is therefore to close this gap by developing and evaluating strategies for walking worker allocation and movement under such conditions.

Research Question

How do walking worker strategies influence throughput in systems dominated by bottlenecks?

Research Methodology

Literature Review in the related areas to identify methods to be included

Design of methods to be tested

Determine experimental design including necessary environmental factors

Build simulation

Run experimental design

Report results

Contextualize results in the literature

Topic 10

Title

Walking Worker Strategies Considering Batching Processes

Background

Manufacturing and service systems often involve workers who move between stations to perform tasks, inspect materials, or support automated processes. These walking workers play a critical role in maintaining production flow, especially in labor-intensive industries, warehouses, and hybrid automated-manual systems. Their efficiency may be highly influenced by system characteristics, such as batching processes, impacting throughput, cycle time, and worker utilization. Despite growing attention to flexible manufacturing with walking workers, limited research explicitly analyzes the interplay between walking worker strategies and batch processes. The objective is therefore to close this gap by developing and evaluating strategies for walking worker allocation and movement under such conditions.

Research Question

What batching policies (fixed-size, dynamic) best complement walking worker allocation strategies?

Research Methodology

Literature Review in the related areas to identify methods to be included

Design of methods to be tested

Determine experimental design including necessary environmental factors

Build simulation

Run experimental design

Report results

Contextualize results in the literature

Topic 11

Title

Demand Driven MRP and Workload Control: System Integration

Background

In today's volatile and complex manufacturing environments, companies face increasing pressure to improve responsiveness, reduce delivery times, and enhance overall operational efficiency. Traditional Material Requirements Planning (MRP) systems, while foundational, often struggle to cope with demand variability. Demand-Driven Material Requirements Planning (DDMRP), a more recent approach, aims to address these limitations by strategically decoupling the supply chain and using demand-driven buffers to improve flow and reduce lead times. Meanwhile, Workload Control (WLC) mechanisms are crucial for managing capacity constraints and ensuring smooth production flows on the shop floor. By regulating the release of jobs into the production system, WLC aims to prevent overloading, reduce work-in-progress (WIP), and improve due-date performance. While both DDMRP and WLC offer significant benefits independently, their synergistic potential remains largely unexplored. The main objective is therefore to investigate the integration of DDMRP principles with various WLC strategies to understand how they interact and influence overall manufacturing system performance. Discrete Event Simulation (DES) will be employed as the primary research methodology to model and analyze the dynamic behavior of these integrated systems under different operational conditions.

Research Question

How does the integration of DDMRP principles with different Workload Control strategies impact key manufacturing performance metrics (e.g., throughput time, inventory levels, on-time delivery, resource utilization, etc.)?

Research Methodology

Literature Review in the related areas to identify methods to be included

Design of methods to be tested

Determine experimental design including necessary environmental factors

Build simulation

Run experimental design

Report results

Contextualize results in the literature

Topic 12

Title

Demand Driven MRP and Workload Control: Parameter Setting

Background

In today's volatile and complex manufacturing environments, companies face increasing pressure to improve responsiveness, reduce delivery times, and enhance overall operational efficiency. Traditional Material Requirements Planning (MRP) systems, while foundational, often struggle to cope with demand variability. Demand-Driven Material Requirements Planning (DDMRP), a more recent approach, aims to address these limitations by strategically decoupling the supply chain and using demand-driven buffers to improve flow and reduce lead times. Meanwhile, Workload Control (WLC) mechanisms are crucial for managing capacity constraints and ensuring smooth production flows on the shop floor. By regulating the release of jobs into the production system, WLC aims to prevent overloading, reduce work-in-progress (WIP), and improve due-date performance. While both DDMRP and WLC offer significant benefits independently, their synergistic potential remains largely unexplored. The main objective is therefore to investigate the integration of DDMRP principles with various WLC strategies to understand how they interact and influence overall manufacturing system performance. Discrete Event Simulation (DES) will be employed as the primary research methodology to model and analyze the dynamic behavior of these integrated systems under different operational conditions.

Research Question

What are the critical factors and interactions between DDMRP parameters (e.g., buffer sizing, penetration time) and WLC parameters (e.g., release rate, workload norm) that influence the performance of the integrated system?

Research Methodology

Literature Review in the related areas to identify methods to be included

Design of methods to be tested

Determine experimental design including necessary environmental factors

Build simulation

Run experimental design

Report results

Contextualize results in the literature

Topic 13

Title

Demand Driven MRP and Workload Control: Contingency Factors

Background

In today's volatile and complex manufacturing environments, companies face increasing pressure to improve responsiveness, reduce delivery times, and enhance overall operational efficiency. Traditional Material Requirements Planning (MRP) systems, while foundational, often struggle to cope with demand variability. Demand-Driven Material Requirements Planning (DDMRP), a more recent approach, aims to address these limitations by strategically decoupling the supply chain and using demand-driven buffers to improve flow and reduce lead times. Meanwhile, Workload Control (WLC) mechanisms are crucial for managing capacity constraints and ensuring smooth production flows on the shop floor. By regulating the release of jobs into the production system, WLC aims to prevent overloading, reduce work-in-progress (WIP), and improve due-date performance. While both DDMRP and WLC offer significant benefits independently, their synergistic potential remains largely unexplored. The main objective is therefore to investigate the integration of DDMRP principles with various WLC strategies to understand how they interact and influence overall manufacturing system performance. Discrete Event Simulation (DES) will be employed as the primary research methodology to model and analyze the dynamic behavior of these integrated systems under different operational conditions.

Research Question

Under what operational conditions (e.g., demand variability, capacity constraints, product mix) do the integration of DDMRP and specific WLC strategies yield the most significant performance improvements?

Research Methodology

Literature Review in the related areas to identify methods to be included

Design of methods to be tested

Determine experimental design including necessary environmental factors

Build simulation

Run experimental design

Report results

Contextualize results in the literature

Topic 14

Title

Discrete Event Simulation and AI for Workload Control in Manufacturing Systems

Background

Modern manufacturing systems are increasingly complex, characterized by high product variety, fluctuating demands, and complex workflows. Workload Control (WLC) has emerged as a key production planning and control concept, particularly suited for make-to-order (MTO) environments. WLC aims to balance workload and capacity by controlling the release of jobs to the shop floor, improving delivery performance, and thus competitiveness. Discrete Event Simulation (DES) has been widely used to model, analyze, and evaluate WLC systems due to its ability to capture system dynamics over time. Meanwhile, Artificial Intelligence (AI), particularly machine learning and heuristic optimization, presents new opportunities to enhance WLC by enabling adaptive, data-driven, and predictive decision-making. The main objective is therefore to develop an integrated framework combining DES and AI for adaptive and intelligent workload control in manufacturing systems.

Research Question

What is the performance effect of combining DES and AI for adaptive and intelligent Workload Control in manufacturing systems?

Research Methodology

Literature Review in the related areas to identify methods to be included

Design of methods to be tested

Determine experimental design including necessary environmental factors

Build simulation

Run experimental design

Report results

Contextualize results in the literature