1972 - 2022

50

Years Of Excellence

The International Maritime Transport
and Logistics Conference

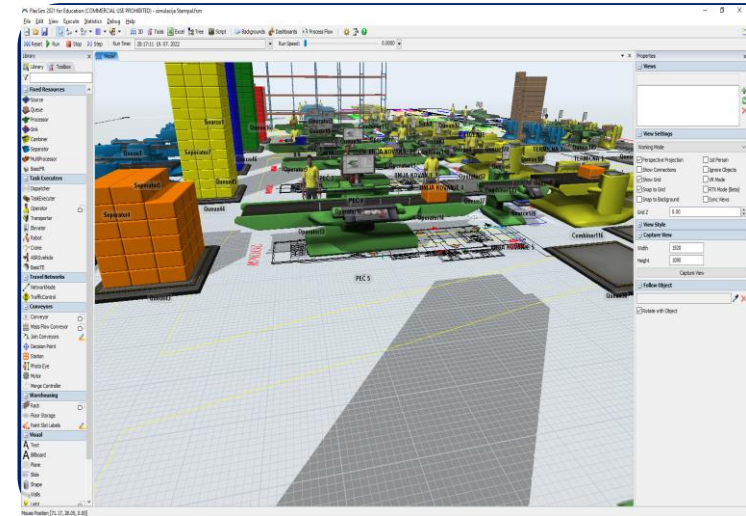# "MARLOG 12"

Sustainable & Innovative
Technologies

Towards a Resilient Future

12 - 14 March, 2023 Alexandria - EGYPT

2023 12

MarLog

Nik Knez, Bojan Rupnik, Tomaž Kramberger

Mapping forging industry manufacturing optimization approaches to port operations

Introduction

- **Slovenian metal industry company consisting of multiple subsidiary companies specialized in aluminum processing for automobile industry**
- **Small series production**
- **Over 700 different products ranging from 30 g to 6 kg**
- **The goal: increase production capacities by layout optimization**
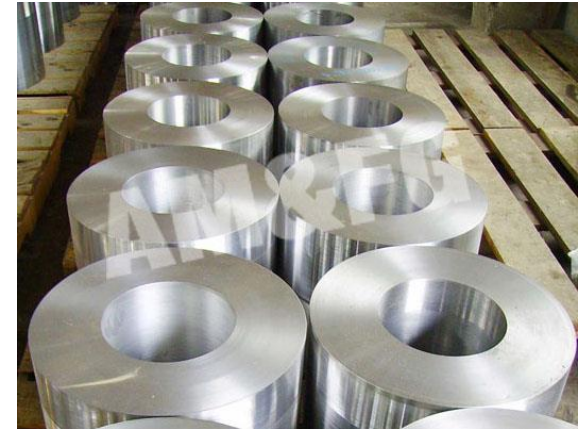
Manufacturing process

Aluminum processing:

- **Inbound stored material**
- **Sawing raw goods**
- **Forging**
- **Trimming**
- **Thermal processing**
- **Leaching**
- **Finalization and sanding**
- **Quality control & packing**
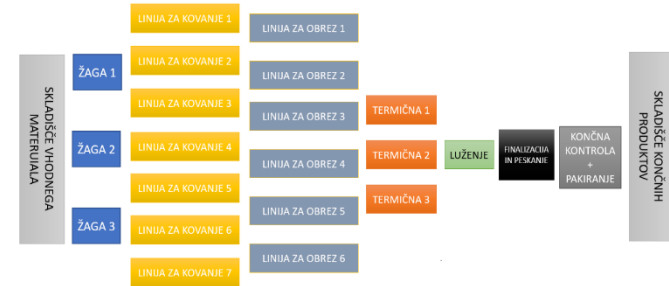
# Simulation and modelling steps:

1. Process flow identification
2. Network analysis material flow analysis
3. Creation of a draft simulation model.
4. Data acquisition and analysis.
5. Creation of a simulation model.
6. Running the simulation under different conditions and for different time periods.
7. Analysis of results and development of improvement proposals.

Material flow analysis

The production capacity of the simulated model yielded a 97% match compared to the historical data.
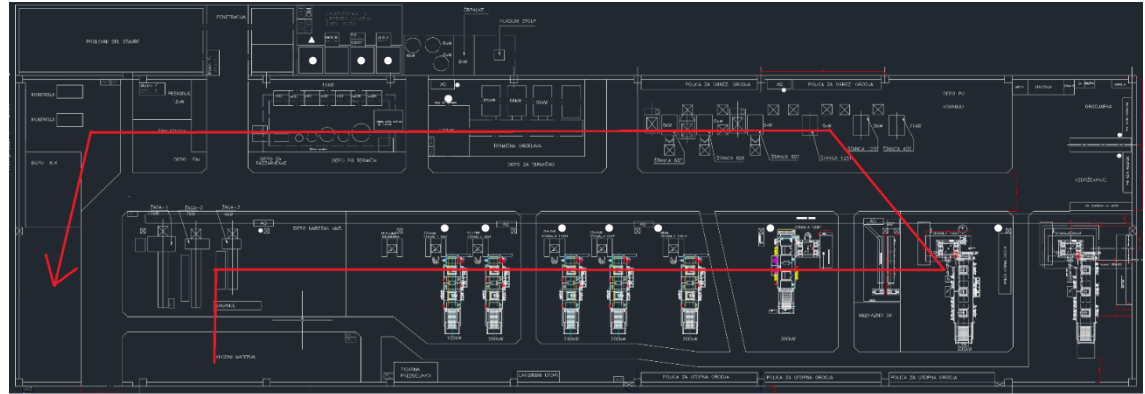
The main KPIs for further analysis are the occupancies and waiting times at the buffer zones.
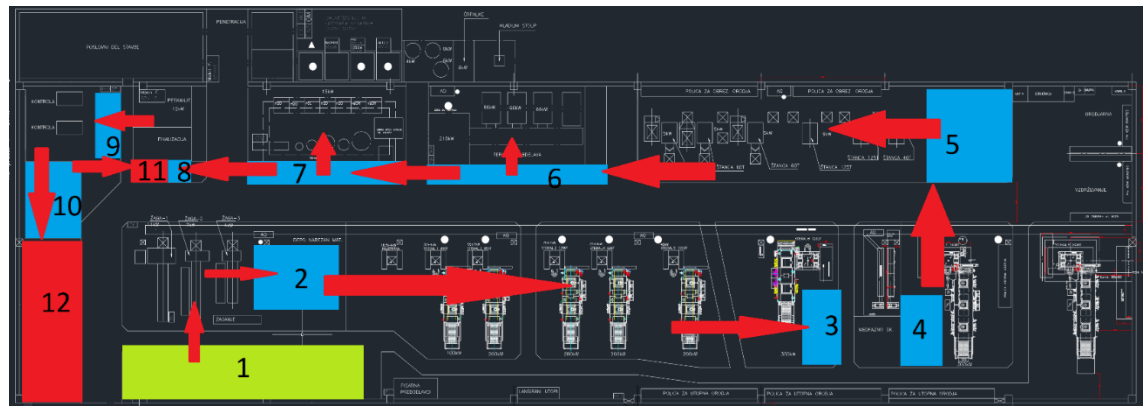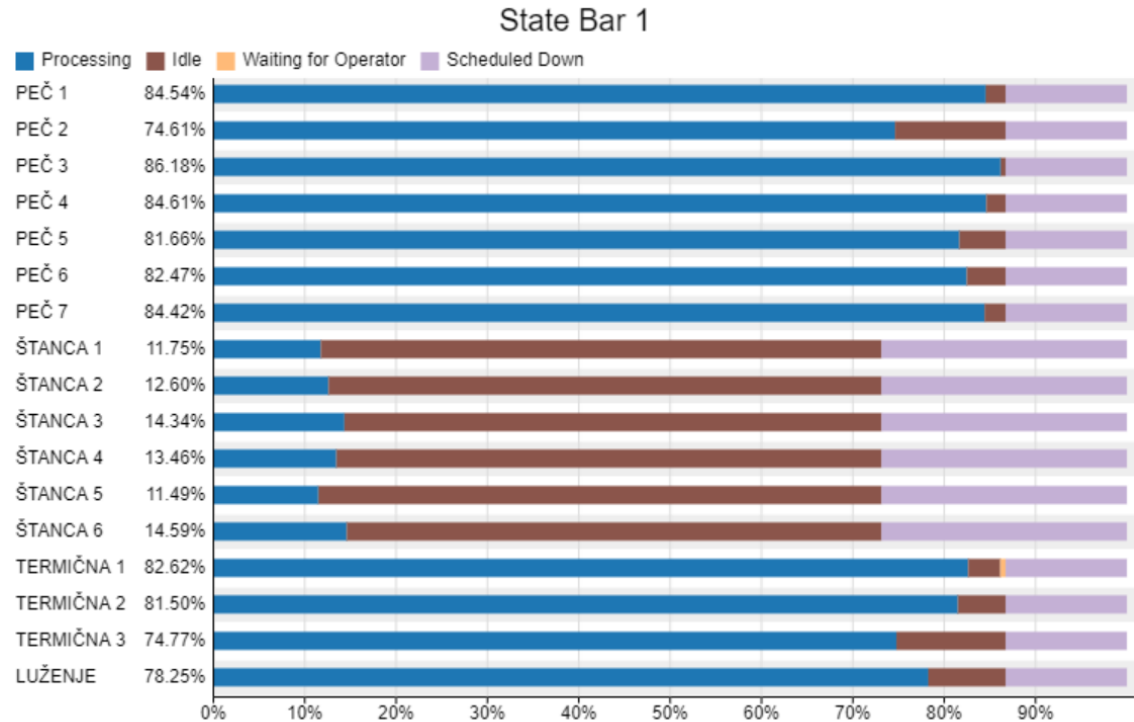
Performance analysis

Production performance is based on the processed item requirements

Specific items require specific equipment

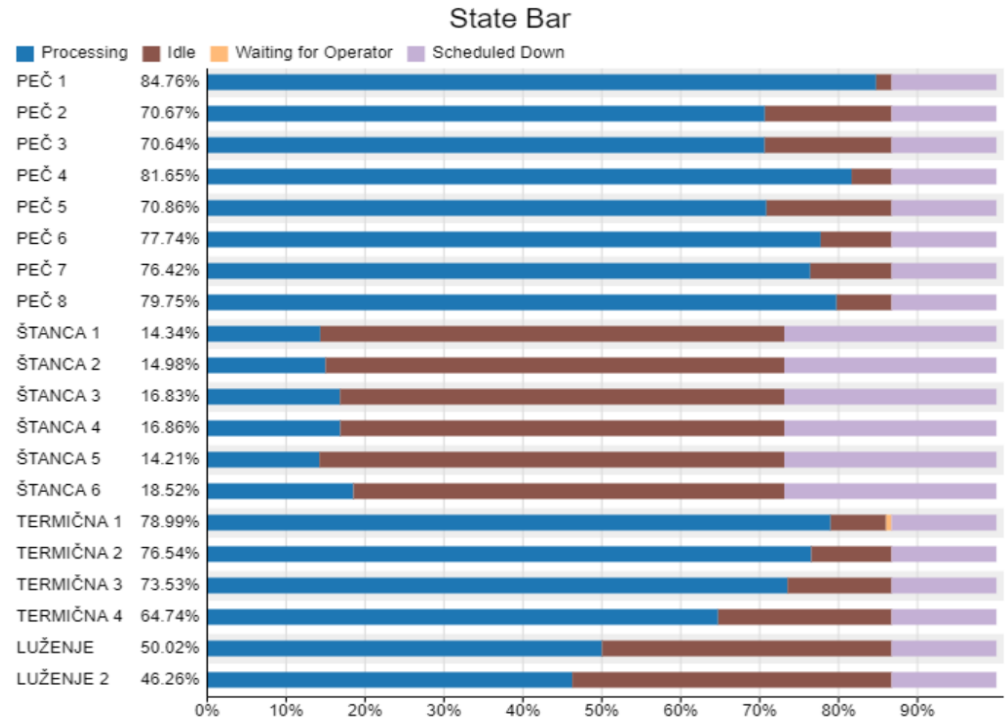**Thermal processing represents the bottleneck of manufacturing**

State Bar 1

Introducing new production lines

Adding an additional oven, thermal processing and leaching machine

Increased performance of forging equipment

Production increase by 1.25

State Bar

Machine	Value
PEČ 1	84.76%
PEČ 2	70.67%
PEČ 3	70.64%
PEČ 4	81.65%
PEČ 5	70.86%
PEČ 6	77.74%
PEČ 7	76.42%
PEČ 8	79.75%
ŠTANCA 1	14.34%
ŠTANCA 2	14.98%
ŠTANCA 3	16.83%
ŠTANCA 4	16.86%
ŠTANCA 5	14.21%
ŠTANCA 6	18.52%
TERMIČNA 1	78.99%
TERMIČNA 2	76.54%
TERMIČNA 3	73.53%
TERMIČNA 4	64.74%
LUŽENJE	50.02%
LUŽENJE 2	46.26%

Legend: Processing, Idle, Waiting for Operator, Scheduled Down

Simulation results

New shop floor layout

Faster material flow despite adding additional machines

Shorter waiting times at buffer zones.

Mapping the simulation approach to port operations

- **Simulation of service rates of individual production lines is based on historical data**
- **Supplying successive production lines and material buffers depends on the layout**
- **Adding additional machinery and changing the layout allows simulation of a different system (layout, production lines) with the same base specifications**
- **The main process requires that the incoming raw material is produced and moved through the plant as fast as possible**

Mapping the simulation approach to port operations

- **Port operations processes follow a related flow as in the manufacturing process**
- **The cargo should move through the port as fast as possible**
- **How does the layout influence the material flow?**
- **How do additional cranes, forklifts, conveyors, and their layout and process flow influence the performance and speed of moving the cargo?**
- **Simulation of port operations can be performed in a comparable fashion as in metal industry and provide possibilities for improvement**

Thank You