Project „Flexible Assembly Processes for the Car of the Third Millennium (MyCar)“

Methodology Description (High Level)

Environmental Optimization Tool

Volvo technology corpoı

Methodology Description (High Level)

… How can assembly processes be improved based on environmental optimization?

Introduction

- Align the environmental and economic aspects in the production processes by a mapping strategy
  - Value stream mapping (VSM)
  - Life Cycle Assessment (LCA)

Methodology criteria

- Simple and easy to understand from the user's point of view
- Give a good visualisation of the existing environmental shortcomings
- Be used as a generalized and powerful tool in future projects

Methodology description

- Computer-based tool
- Goals achieved with computer-based tool
  - Keep LCA data within the Model
  - Keep Data Sheets within the Model
  - Generate Data Sheets
  - Compare and version control Models

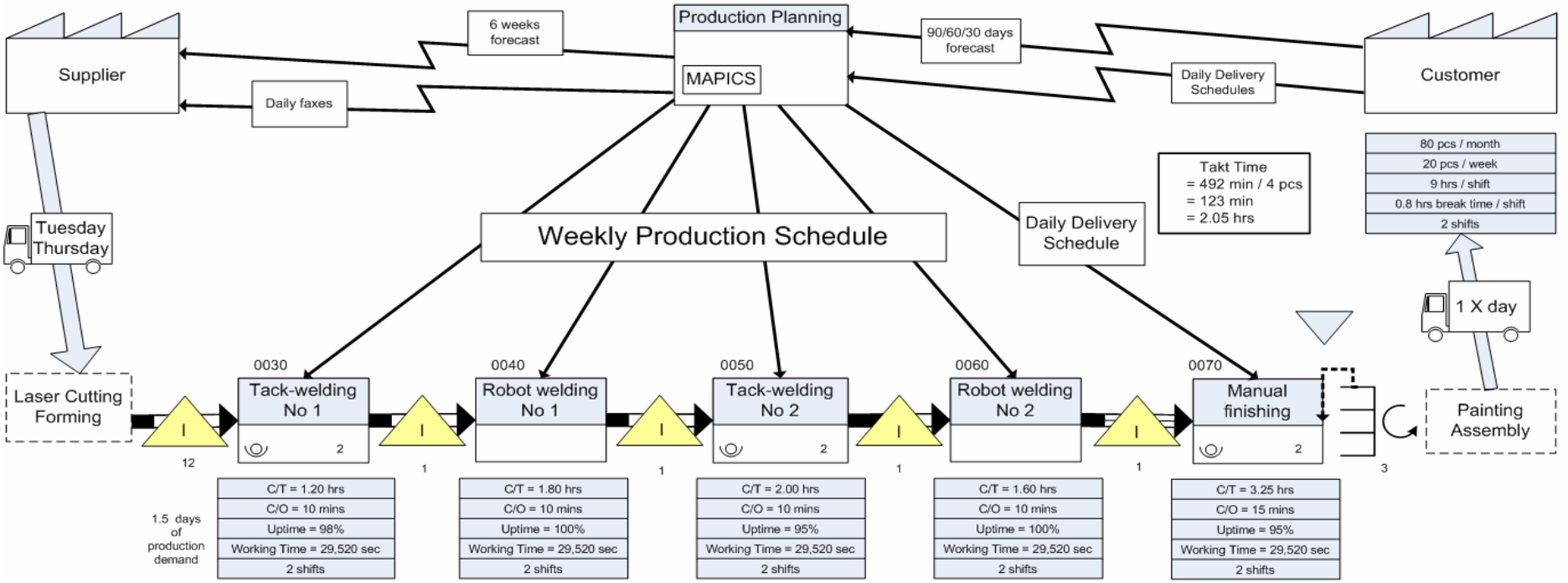
What can be evaluated

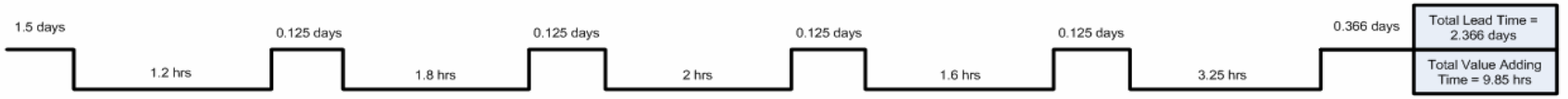
- Resources use
  - Value Adding (VA)
  - Necessary but Non-value Adding (NNVA)
  - Non-value Adding (NVA)
- CO_2 emissions and EPS value

Current State Value Stream Map for Body Shop at Volvo Construction Equipment, Braås

Item no 11194273 KORG A40E

Environmental Targets and Goals in 5 years:





Energy Use (kWh)	Cost (kr)
VA	3.07	2.89
NNVA	40.7	25.94
NVA	4.63	4.35

Energy Efficiency (%)	6.3
Cost Efficiency (%)	8.7

Material Use (g)	Cost (kr)
VA	0	0
NNVA	16.24	0.89
NVA	0	0

Material Use Efficiency (%)	0
Cost Efficiency (%)	0

Energy Use (kWh)	Cost (kr)
VA	28	26.32
NNVA	79.72	84.05
NVA	17.81	16.74

Energy Efficiency (%)	22.3
Cost Efficiency (%)	20.7

Material Use (g)	Cost (kr)
VA	0	0
NNVA	34.61	1.92
NVA	0	0

Material Use Efficiency (%)	0
Cost Efficiency (%)	0

Energy Use (kWh)	Cost (kr)
VA	7.32	6.88
NNVA	50.57	34.04
NVA	4.87	4.58

Energy Efficiency (%)	11.7
Cost Efficiency (%)	15.1

Material Use (g)	Cost (kr)
VA	0	0
NNVA	16.24	0.89
NVA	0	0

Material Use Efficiency (%)	0
Cost Efficiency (%)	0

Energy Use (kWh)	Cost (kr)
VA	28	26.32
NNVA	89.5	69.4
NVA	17.81	16.74

Energy Efficiency (%)	20.7
Cost Efficiency (%)	23.4

Material Use (g)	Cost (kr)
VA	0	0
NNVA	34.61	1.92
NVA	0	0

Material Use Efficiency (%)	0
Cost Efficiency (%)	0

Energy Use (kWh)	Cost (kr)
VA	3.05	2.87
NNVA	252.79	171.21
NVA	9.7	9.12

Energy Efficiency (%)	1.1
Cost Efficiency (%)	1.6

Material Use (g)	Cost (kr)
VA	0	0
NNVA	78.12	30
NVA	0	0

Material Use Efficiency (%)	0
Cost Efficiency (%)	0

Total Energy Use (kWh)	Total Cost (kr)
Total VA	69.44	65.28
Total NNVA	513.28	384.64
Total NVA	54.82	51.53

Total Energy Efficiency (%)	10.9
Total Cost Efficiency (%)	13.0

Total Material Use (g)	Total Cost (kr)
Total VA	0	0
Total NNVA	179.82	35.62
Total NVA	0	0

Total Material Use Efficiency (%)	0
Total Cost Efficiency (%)	0

Example of simplified input data

- Plant data (plant size, produced units/year, production time/year)
- KPI:s (heating, ventilation, lighting)
- Station data (station size, processes energy consumption etc)

Current State Value Stream Map for Body Shop at Volvo Construction Equipment, Bråås

MyCar

Environmental Targets and Goals in 5 years:

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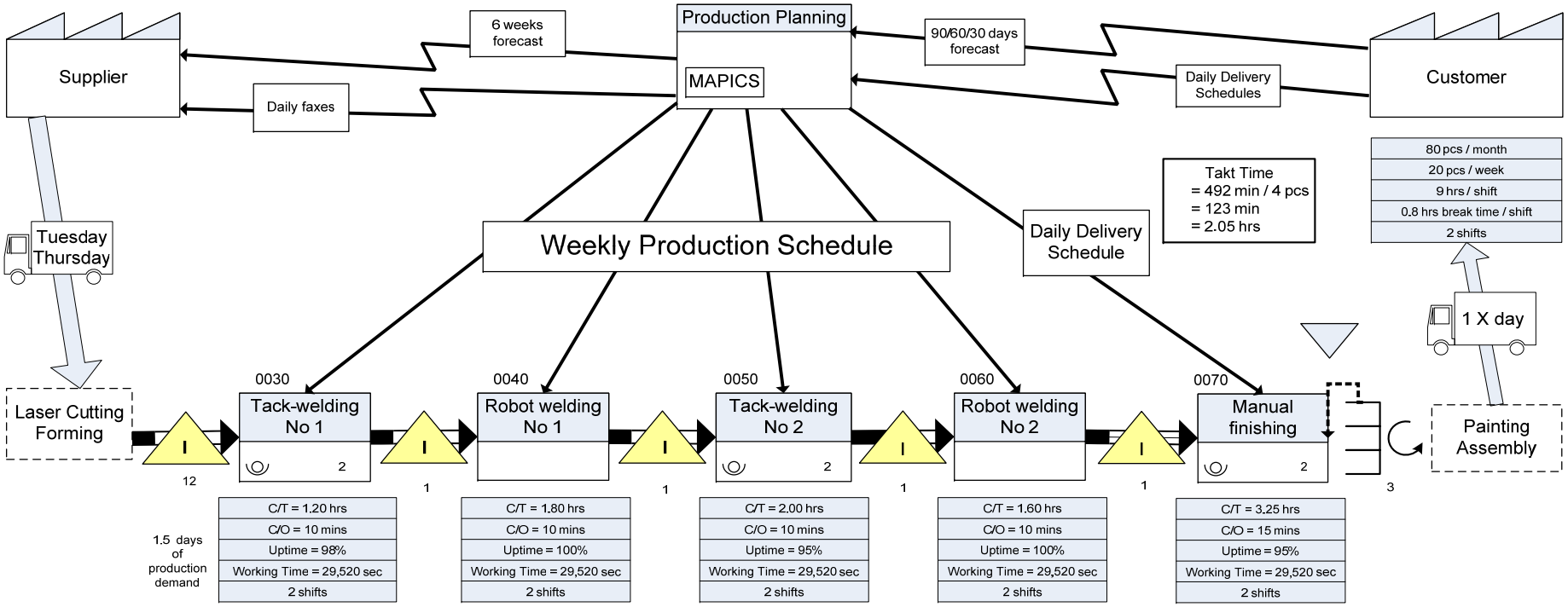

Unit: kWh/product

	Current State	Actions: Short-term	Actions: Long-term	Target on Future State
Station 1: Tack-welding 1				
District Heating	22		X	
Lighting	7,72		X	
Ventilation	6,7		X	
Cooling Pump (Idling)	4	X		
Crane (On)	2,94		X	
Station 2: Robot Welding 1				
Fan for Robot Cell (On)	27,6		X	
District Heating	24		X	
Welding Equipment (On)	24		X	
Lighting	18,63		X	
Fan for robot Cell (Idling)	14,4	X		
Station 3: Tack-welding 2				
District Heating	24,1		X	
Lighting	14,92		X	
Ventilation	7,4		X	
Welding Equipment (On)	7,32		X	
Cooling Pump (Idling)	3,76	X		
Station 4: Robot Welding 2				
Fan for Robot Cell (On)	27,6		X	
District Heating	26,3		X	
Lighting	25,42		X	
Welding Equipment (On)	24		X	
Fan for robot Cell (Idling)	14,4	X		
Station 5: Manual Fnishing				
District Heating	118,6		X	
Lighting	83,95		X	
Ventilation	36,4		X	
Crane (On)	9,08		X	
Grinding (Idling)	4,95	X		

Example of output data

- Suggestions
  - Short-term
    - Shut off the equipment when not used.
  - Long-term
    - Ventilation
      - Install heat exchangers
  - Others
    - Design new plant layout

Current idling energy consumption for producing one product	4 + 14.4 + 3.76 + 14.4 + 4.95 = 41.51 kWh
Production units/year	920 pcs
Cost of electricity/kWh	0.94 SEK
Total cost for idling energy consumption/year	35898 SEK

Conclusions

- VSM
  - Visualisation tool
  - Increase awareness of potential cost savings and environmental improvements
  - VA, NNVA and NVA resources use
  - Future improvement plans
- Computer-based tool
  - Serves as a database in the long-term perspective
  - Decision-making support