

## Production planning & control with MES



Co-funded by the  
Erasmus+ Programme  
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## Production planning & control with MES4

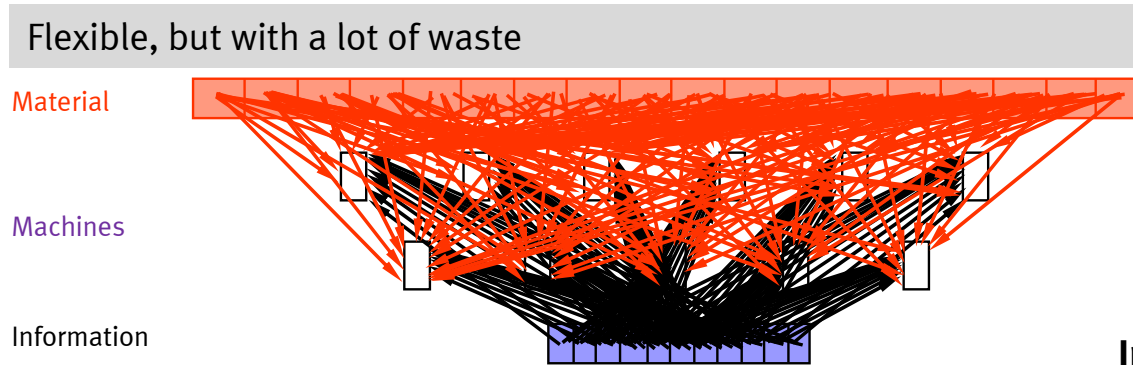
1 Basics, tasks and processes of production control

2 Basics and functions of Manufacturing Execution Systems (MES)

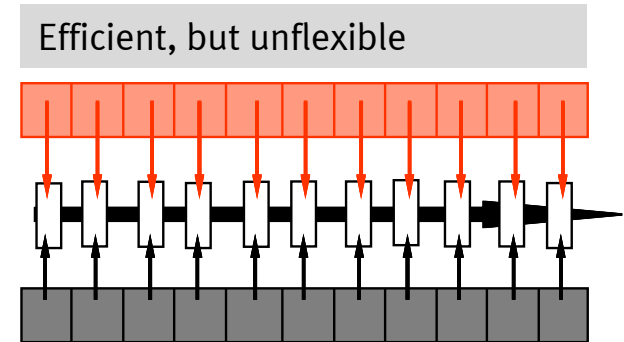
3 Structure and menu of MES 4

4 Creating new parts & work plans with MES4

## Tasks and processes of production control | From Industry 3.0 to Industry 4.0

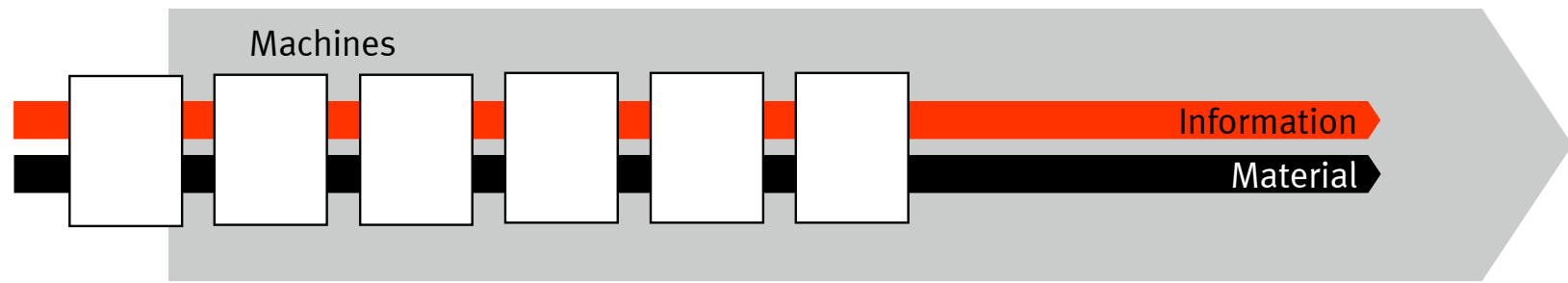


Industry 3.0



Industry 4.0

- Efficient processes with high flexibility.
- The material (product) is the information medium.
- Using intelligent machines, set-up times can be significantly reduced.
- The vision is One Piece Flow: Short cycle times and high number of variants.

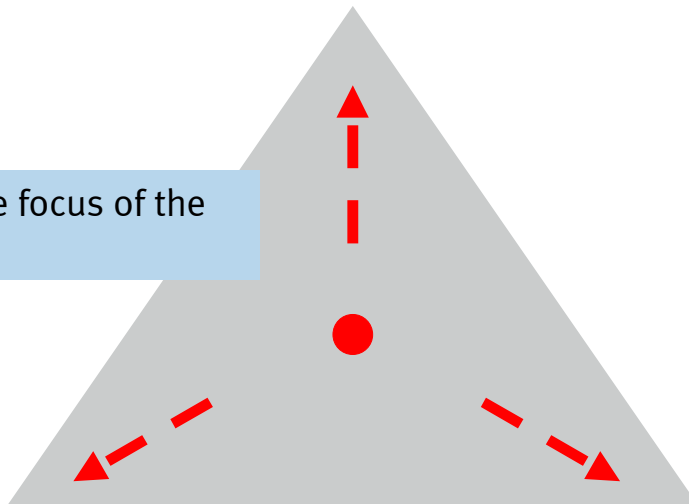


→ Target: Autonomous processes for lot size 1 at the costs of mass production

# Tasks and processes of production control | The dilemma of production control

On-time delivery(target -> 100%)

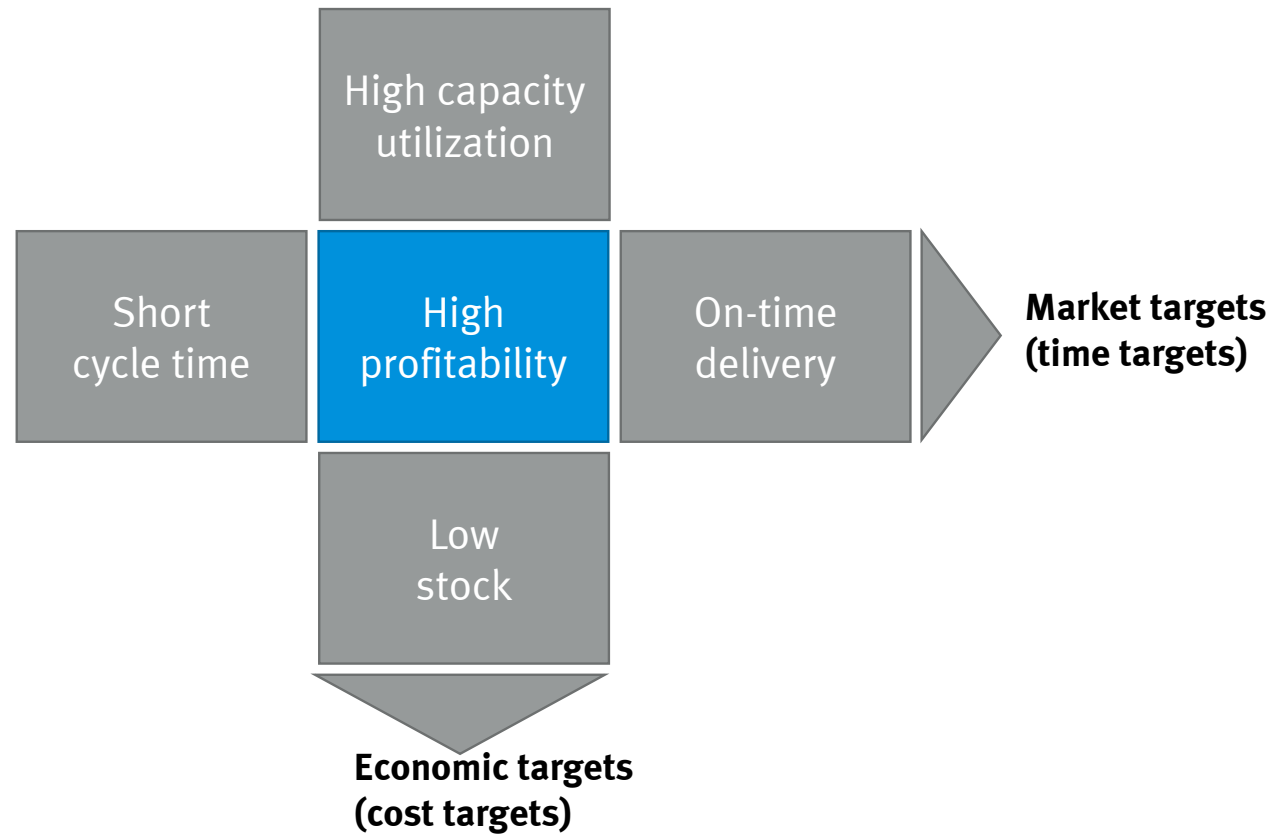
Where is the focus of the company?



Low stock (target -> 0)

High degree of capacity utilization (target -> 100%)

## Tasks and processes of production control | Conflict between economic and market targets



## Tasks and processes of production control | Challenges

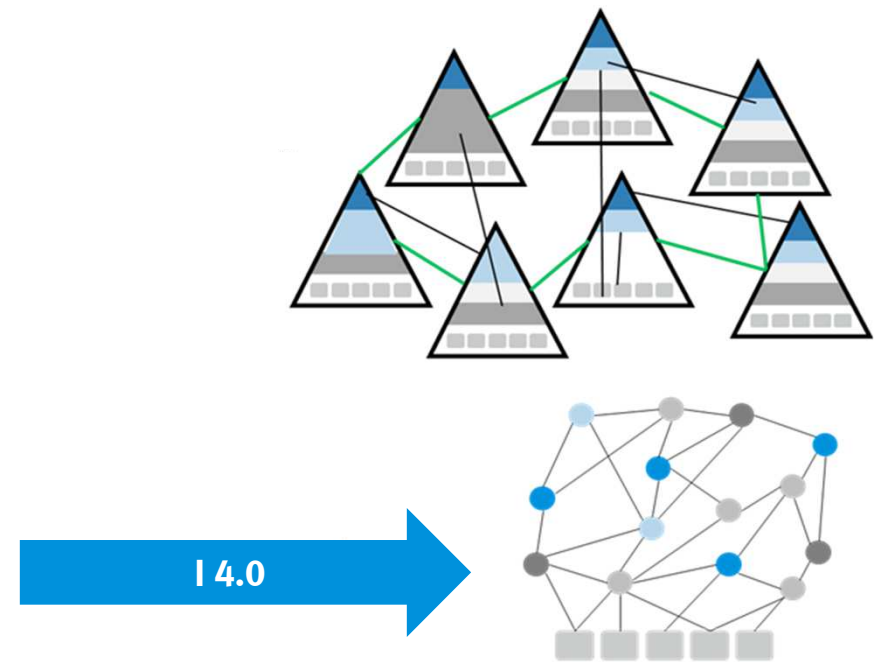
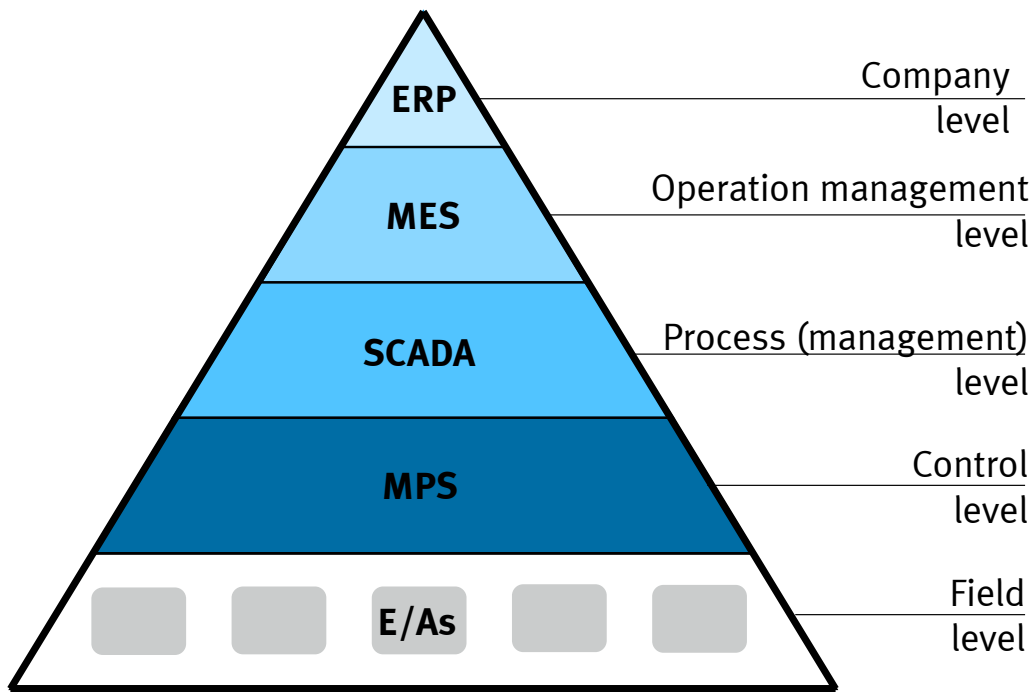
- ✗ Forecast versus actual consumption
- ✗ Planning versus Murphy
- ✗ Quality problems (Complaints / Rework)
- ✗ Stock is too high
- ✗ Stock is too low
- ✗ Urgent orders
- ✗ Wrong component to be processed on the machine
- ✗ Synchronization of preceding processes
- ✗ Discussion about lot size / Collecting orders
- ✗ Increasingly shorter delivery times with more and more variants
- ✗ Highly flexible production with low production costs

## Module 4

### Production planning & control with MES4

- 1 Basics, tasks and processes of production control
- 2 Basics and functions of Manufacturing Execution Systems (MES)
- 3 Structure and menu of MES 4
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## Basics and functions of MES | Integrating MES into the automation pyramid



## Basics of production control | Differences MES & ERP

### Enterprise Resource Planning (ERP)

Complex and slow

Planning & optimizations of business processes

Mid- to long term (days to months)

Predominantly core data are used

Cross-company index numbers

### Manufacturing Execution System (MES)

Quick and flexible

Planning & optimization of production (shopfloor)

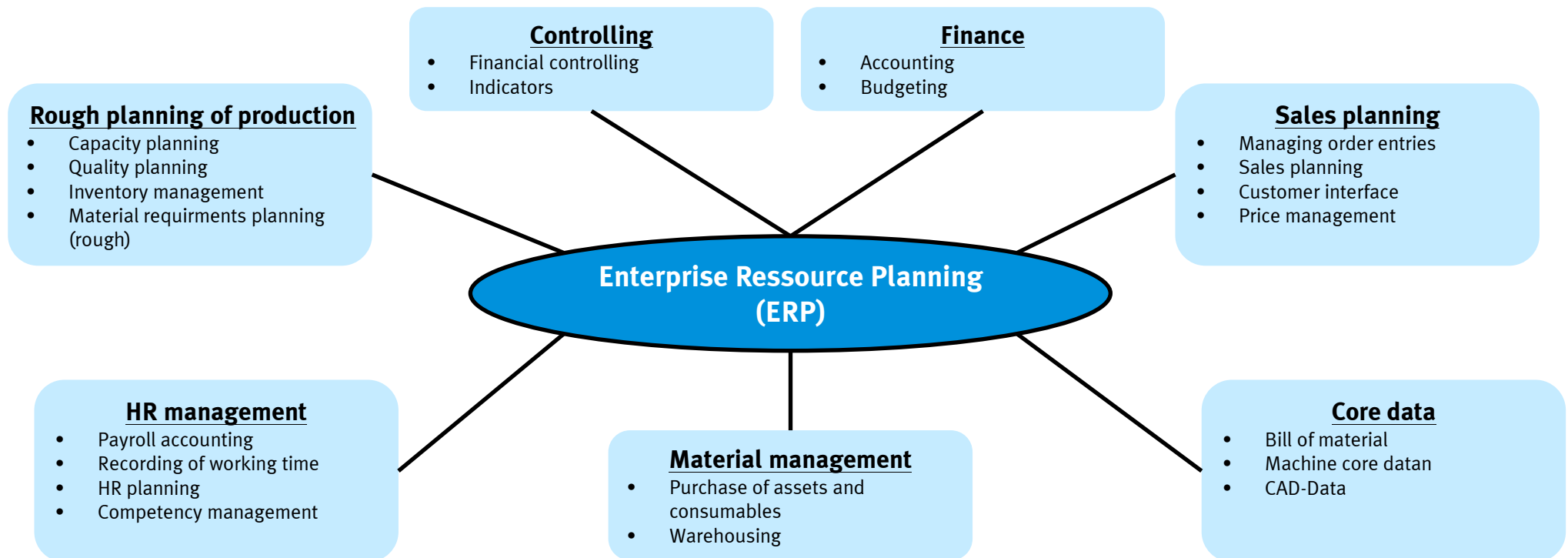
Short term (minutes to hours)

Predominantly motion data are used

Department- and system specific index numbers

**ERP is the basis & MES facilitates an efficient implementation of the rough planning**

## Basics of production control | Tasks of ERP



## Basics and functions of MES | MES tasks

### MES – definition VDI 5600

- Order management
- Detailed planning and detailed control
- Management of production equipment
- Material management
- HR management
- Data collecting
- Performance analysis
- Quality management
- Information management

### Festo MES4

- Order management
- Detailed planning and detailed control
- Management of production equipment
- Material management
- ~~HR management~~
- Data collecting
- Performance analysis
- Quality management
- Information management

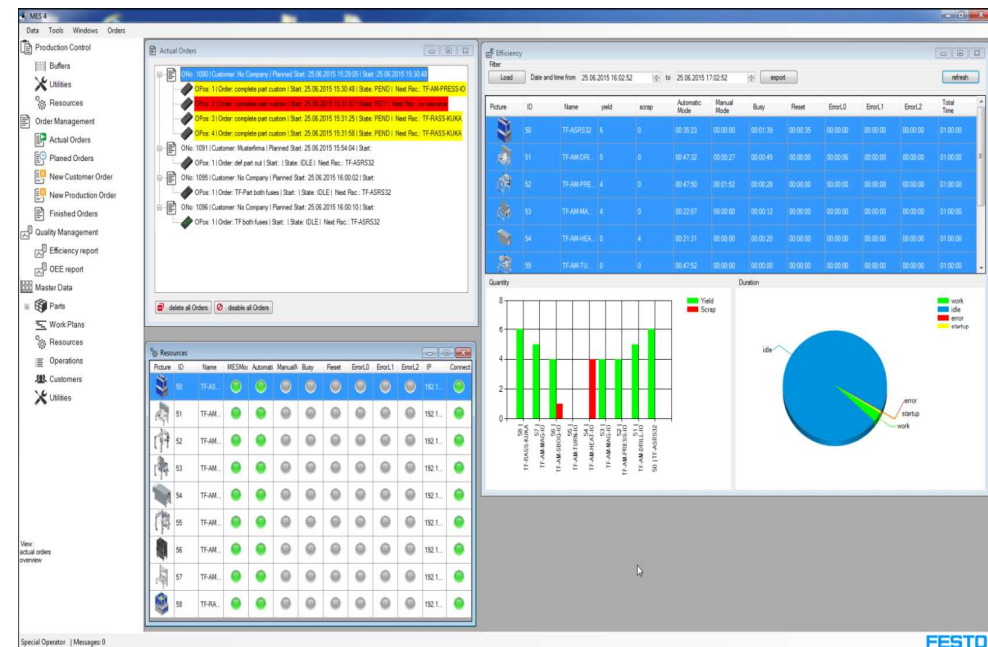


MES4 can accomplish almost all typical tasks of a classical MES, yet in a reduced scope!

# Industry 4.0: Software

## MES4 - Features

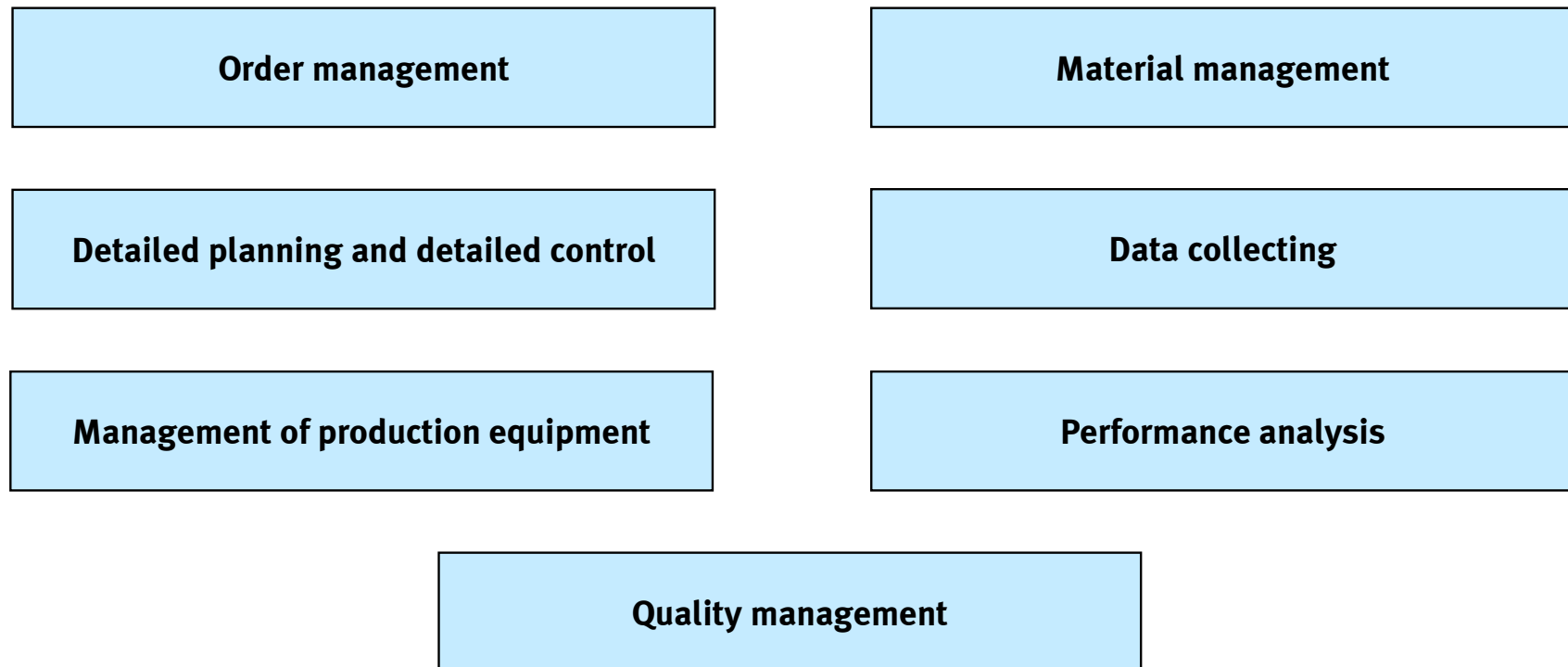
- Order and material management over database (ACCESS over ODBC)
- easy communication between PLC and MES over TCP/IP (PLC-Library) (roundtrip < 30ms) more functions addable
- No „main PLC“! Each PLC communicates directly with the MES (easy to understand) no redundant data management
- each station can get each information at every time from the MES
- create and manage buffers in MES (buffer zones are possible)
- Box –management and -configuration in MES (Templates for boxes)
- Traceability of each order position
- easy OEE- end efficiency -report
- easy customer management
- Overview of each station
- calculate transport routes to a station dynamically during runtime
- defined users with different rights
- Connection to SAP ME over OPC-UA



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## Structure and menu of MES 4 | Exercise – finding the functionalities according VDI guideline 5600



# Structure and menu of MES 4 | Explanation of the functionalities

The screenshot displays the MES 4 software interface with several key components:

- Main Menu:** Data, Tools, Windows, Orders, Help.
- Production Control:** Buffers, Utilities, Resources.
- Order Management:** Current Orders, Planned Orders, New Customer Order, New Production Order, Finished Orders.
- Quality Management:** Efficiency Report, OEE Report, SPC.
- Master Data:** Parts, Work Plans, Resources, Operations, Customers, Utilities.
- Utilities:** A tree view showing a hierarchy: box (20 | Pallet Box) -> center (31 | TF Center) -> pallet (25 | TF Pallet).
- Resources Table:**

BoxID	ONo	filed	Image	Resource
1	0	2/2		not defined
2	0	1/2		not defined
3	0	2/2		not defined
4	0	1/2		not defined
5	0	0/2		not defined
- Workplans:** A list of work plan items with descriptions such as "Deliver PCB Green", "Create part with no fuses", and "Transport Front Cover Black Row to ASRS".
- Part List:** A table listing parts with columns for Picture, ID, Name, MESMode, AutomaticMox, ManualMo, and a grid of status indicators.
 

Picture	ID	Name	MESMode	AutomaticMox	ManualMo	Grid
	1	ASRS32	Red	Grey	Blue	172.21.5.1
	2	DMHB	Red	Grey	Blue	172.21.6.1
	3	AM-LABELI...	Red	Grey	Blue	172.21.7.1
	4	AM-TURN-I...	Red	Grey	Blue	172.21.8.1
	5	R-CNC-MII...	Red	Grey	Blue	172.21.9.1
	6	BRANCH-A...	Red	Grey	Blue	172.21.10.1
	7	AM-DRILL-...	Red	Grey	Blue	172.21.11.1
	8	RASS	Red	Grey	Blue	172.21.12.1
	9	AM-SBOQ-IO	Red	Grey	Blue	
	10	AM-MAN-1	Red	Grey	Blue	
	11	AM-ORI-C...	Red	Grey	Blue	
	12	AM-MAG-IO	Red	Grey	Blue	
- Part Details:** A window showing a list of parts for "production part" and a 3D model of a tray with components.

## Module 4

### 4 Production planning & control with MES4

4.1 Basics, tasks and processes of production control

4.2 Basics and functions of Manufacturing Execution Systems (MES)

4.3 Structure and menu of MES 4

4.4 Creating new parts & work plans with MES4

# Creating new parts & work plans with MES4 | Exercise

## Aufgabenstellung

MES 4

Data Tools Windows

Production Control

6 Order Management

Quality Management

Master Data

**Exemplary sequence**

1. Taking out
2. Turning
3. Heating
4. Inserting

5

Production Control

Buffers

Utilities

Resources

2

3

Master Data

Parts

Work Plans

Resources

Operations

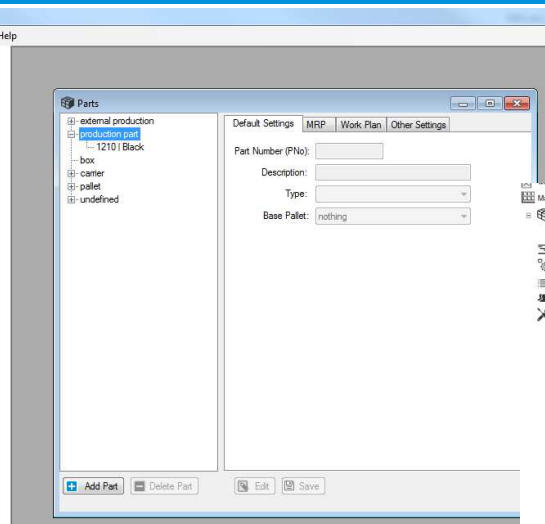
Customers

Utilities

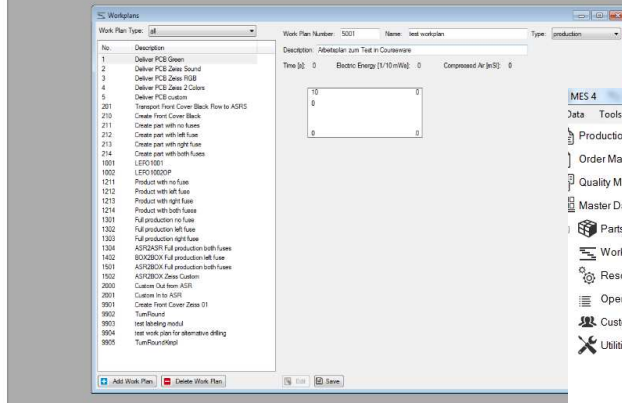
1. Defining a sequence
2. Preparing a new component
3. Preparing a routing card
4. Linking the component with the routing
5. Filling the stock
6. Starting the production order

# Using MES 4 | Generating new product entries and work plans

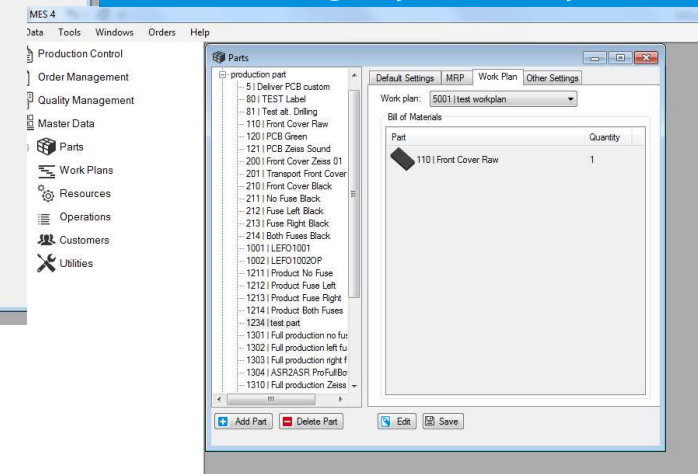
## 1. Generating a new product entry



## 2. Generating a new work plan



## 3. Wedding of product & plan



# Using MES 4 | Starting and planning orders

### Starting & planning production orders

Order (No): 1293  
Start Date and Time: 01.06.2017 09:19:44

new position  
Part: 1234 | test part  
Quantity: 2

### Starting & planning customer orders

Order (No): 1294  
Start Date and Time: 02.06.2017 13:10:14

new position  
Part: 5678 | test customer part  
Quantity: 1

Description	Parameter	Value	Picture
insert a defined part on stopper 1	Part number	25	
heating Part	temperature	30	
heating Part	time [s]	5	
Store part from stopper 2	Part number	110	

View actual orders overview

## **5 Process optimization with MES4**

**1 Basics of Lean Management & Industry 4.0**

**2 Basics of Value stream analyses and -design**

## Bottom Up | From value add and waste...

### Value add:

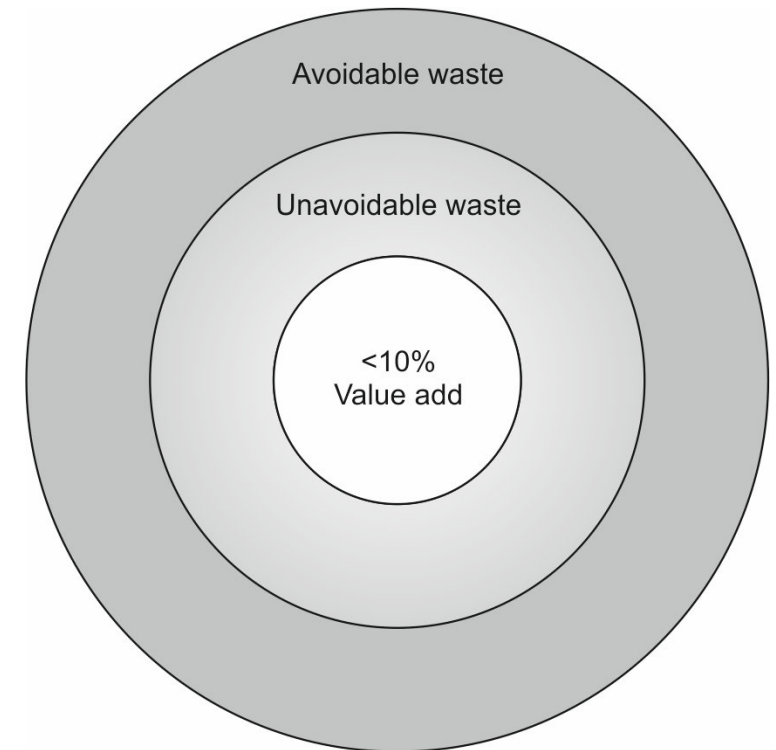
Value added is that part of an activity for a product or a service for which the customer is actually willing to pay.

### Unavoidable Waste:

All activities which are strongly necessary to enable value add but without an own part of value add.

### Waste:

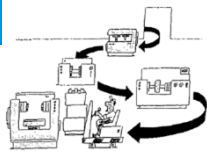
Work that does not result in a benefit for the company or the employees, but which circumstances dictate has to be done.



# Seven kinds of waste | Overview

## 1. Transport

Any kind of transport is waste because it doesn't add value.



*Is there a shorter way or is it possible to avoid the transport completely?*

## 2. Inventory

Inventories are products that do not pull in sales yet.



*Problems often and only become visible, after inventory has been reduced!*

## 3. Movement

Searching for material, tools, documents, etc are unnecessary movements.



*Could the order or layout be improved so that the important things are instantly within one's reach?*

## 4. Waiting

Waiting means not being able to keep on working because of waiting for something.



*Waiting is easy to detect. The process has to be reorganized so that no waiting occurs.*

## 5. Overproduction

Overproduction means to produce too much or too early.



*Only produce, what is needed, when it is needed; in the required quantity!*

## 6. Overprocessing

Often we work more exact as the customer demands.



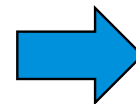
*Is there an easier and faster way to reliably solve the task?*

## 7. Scrap & rework

Waste caused by scrap and rework has to be avoided under all circumstances.



*Quality from the beginning! – Customers only pay for good quality, not for faulty parts.*



**Detect waste, problems have to be visible!**

## Module 5

### 5 Process Optimization with MES4

1 Basics of Lean Management & Industry 4.0

2 Basics of value stream analyses and -design

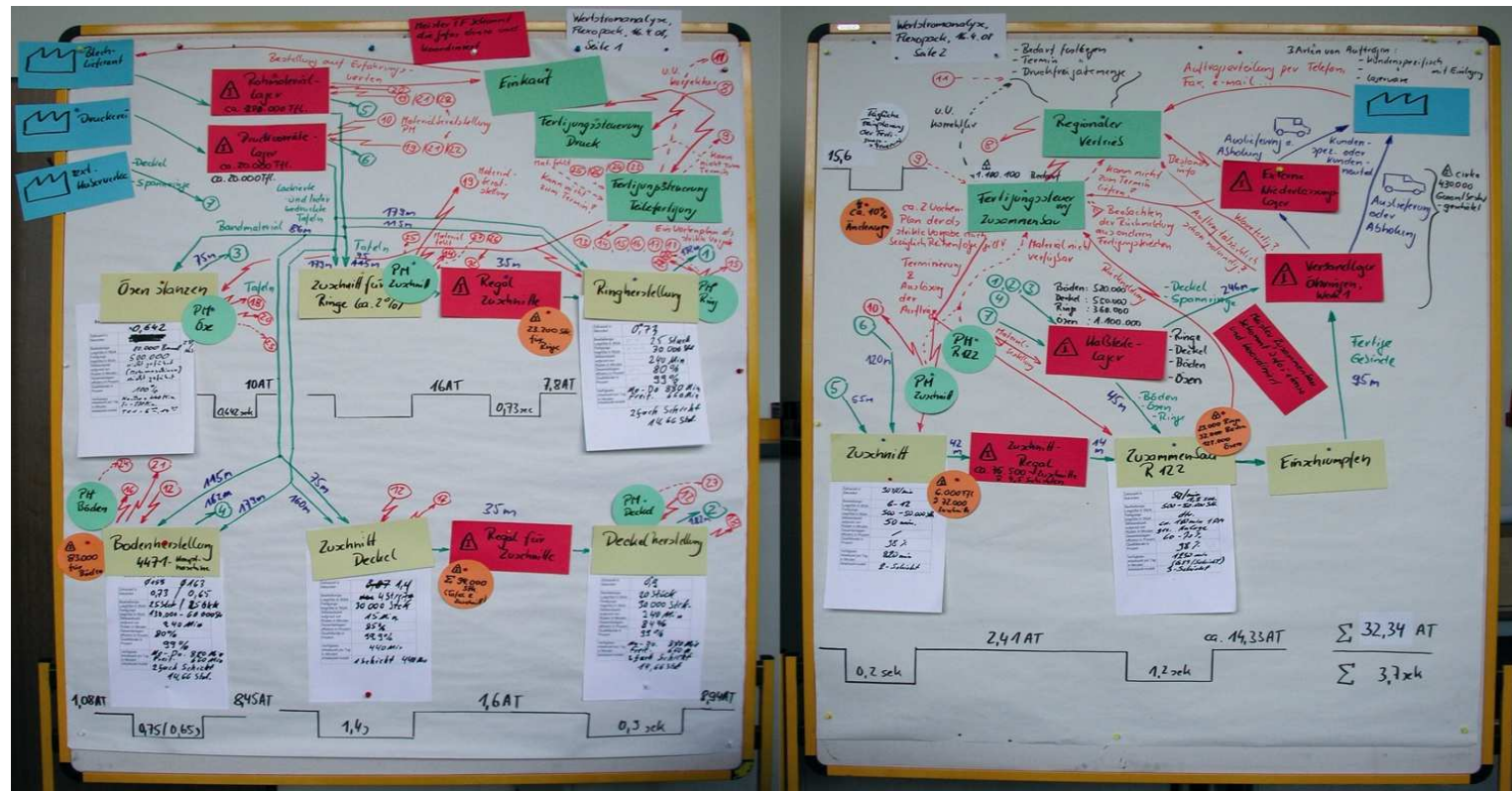
# Value stream mapping | Introduction

## 1. Value stream mapping

A tool for the identification of value streams in companies ...

## 2. Value stream design

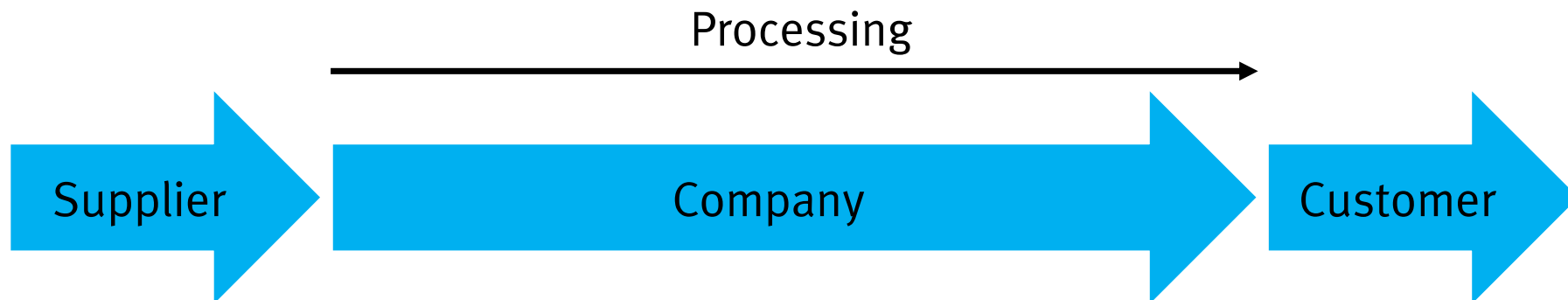
... to allow **substantial** improvement of the process.



## Value stream mapping | What is a value stream?

A value stream represents all activities (value-adding and non-value-adding) necessary to produce and market a product.

- The production workflow of a raw part/raw material until the finished product reaches the customer.
- Every company process or workflow.



# Value stream mapping | Steps to establish the current status

1. (Preparation)
2. Selection of the product and product family
3. Establishing customer data
4. Value stream mapping from job order to delivery (material flow)
5. Value stream mapping from customer order to job order (information flow)
6. Collecting data on the quality of process steps
7. Collecting data on distances, inventories and the timeline

