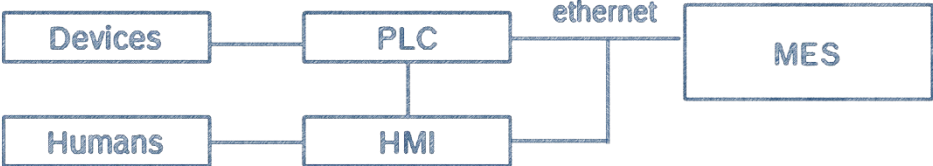


# FLEXIBLE MANUFACTURING CONCEPT BASED ON INDUSTRY 4.0



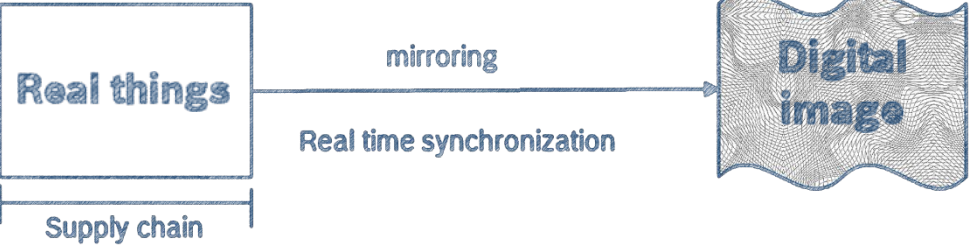
# Flexible manufacturing concept

## Cyber physical system



Flexible and modular architecture  
optimizing production related process

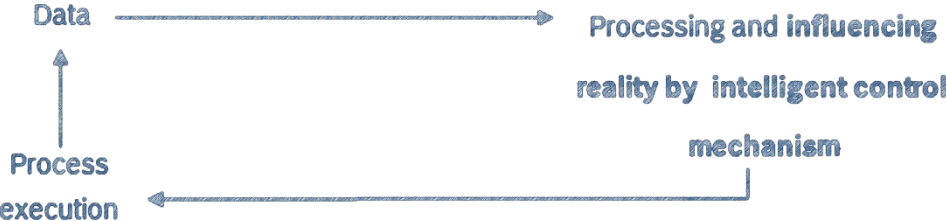
### Reality



VERTICAL INTEGRATION

REAL TIME

HORIZONTAL INTEGRATION



# Flexible manufacturing concept

## What do we want to achieve?

A production concept for  
high mix – low volume product portfolio  
which enables:



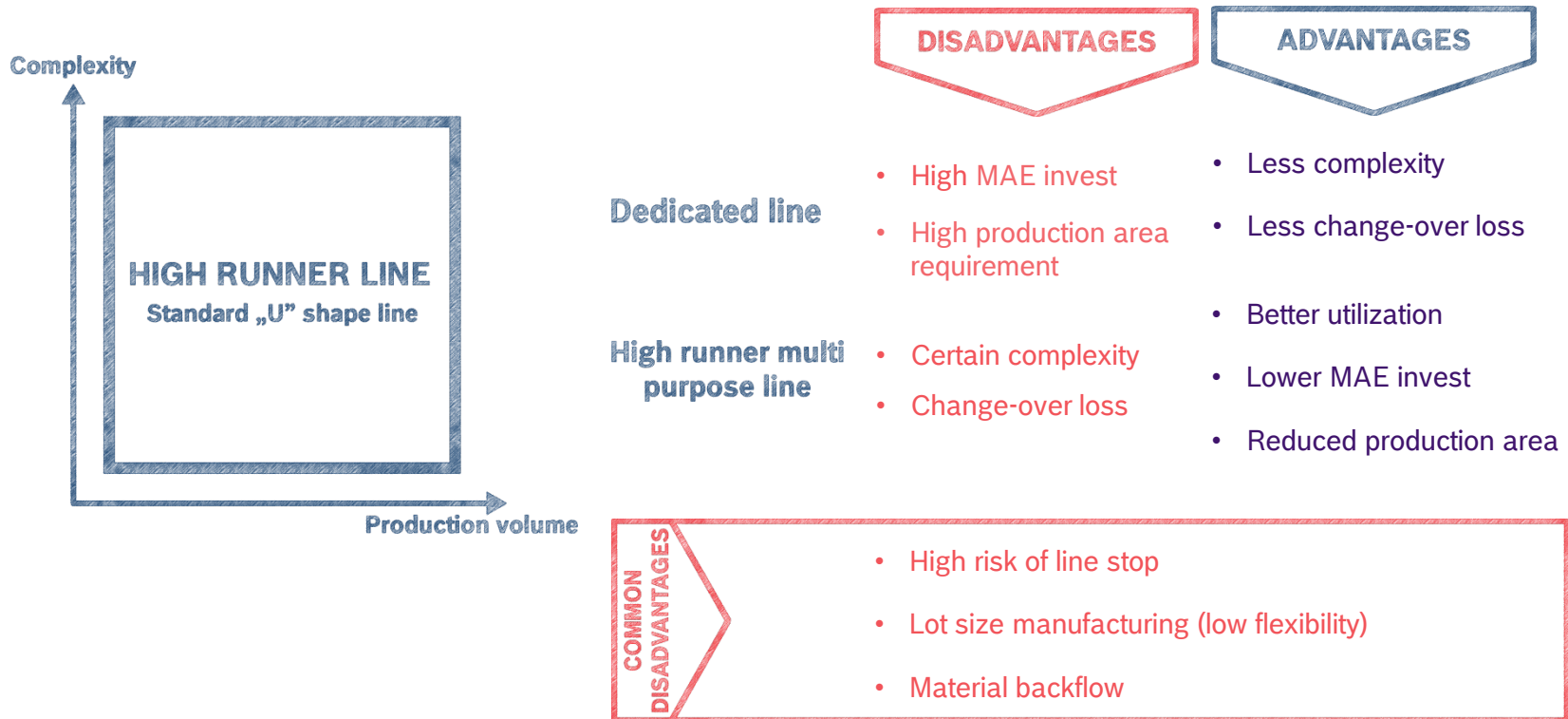
High flexibility -> responsiveness to customer demand



Low cost-> competitiveness

# Flexible manufacturing concept

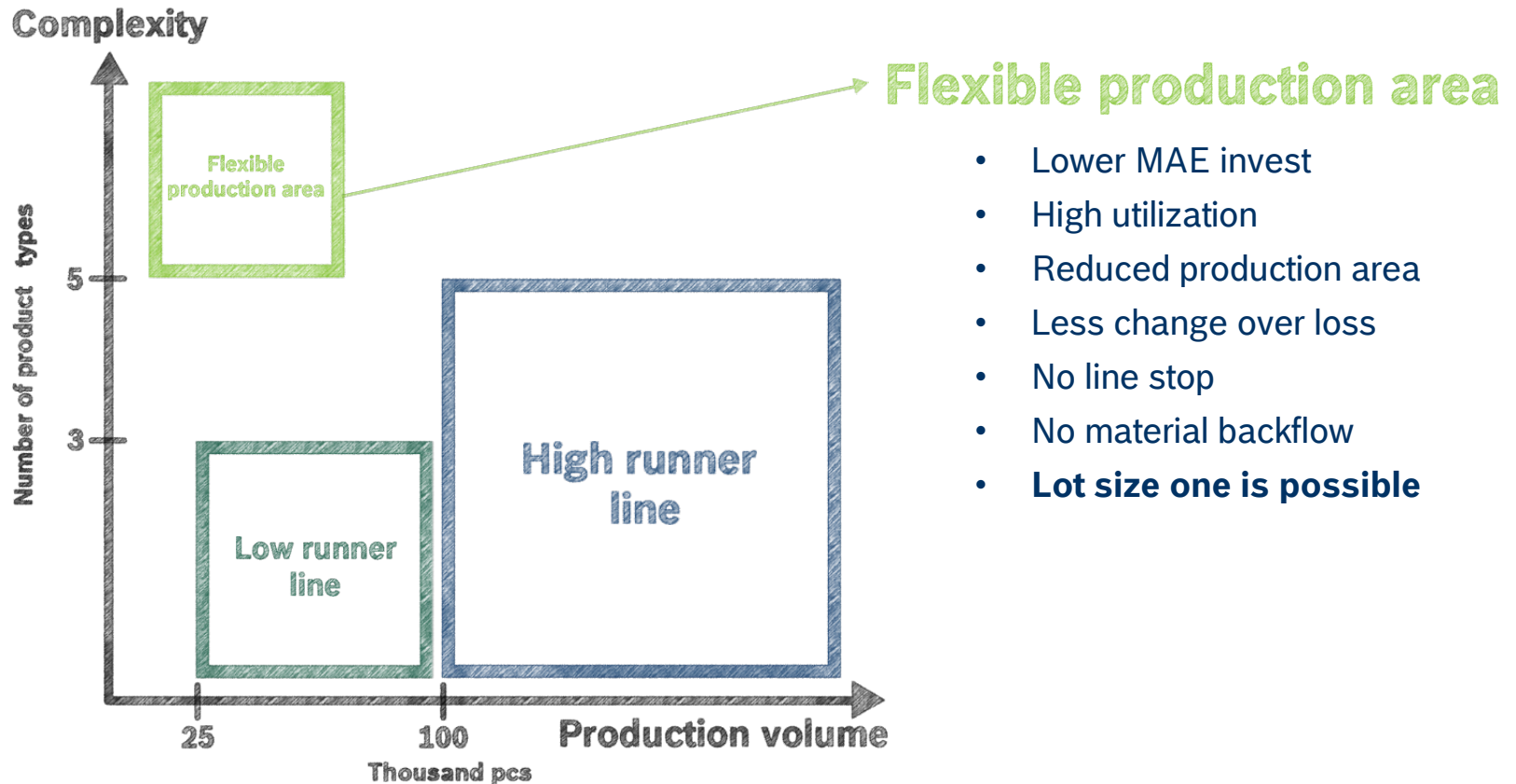
## Background



**How can we eliminate all of these losses?**

# Flexible manufacturing concept

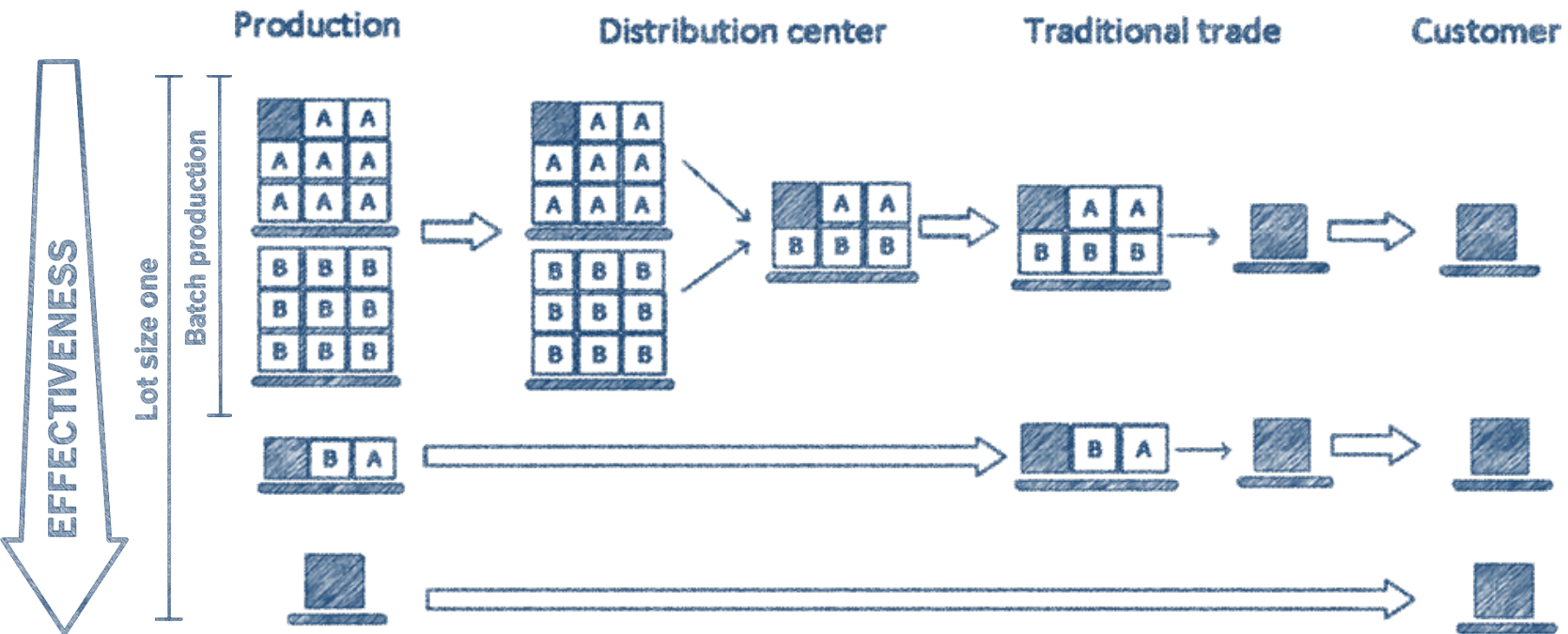
## New concept



- Lower MAE invest
- High utilization
- Reduced production area
- Less change over loss
- No line stop
- No material backflow
- **Lot size one is possible**

# Flexible manufacturing concept

## Simplifying supply chain



- Stock reduction
- Lead time reduction
- Less handling steps
- Lower transportation and storage cost
- Better availability and service level

# Flexible manufacturing concept

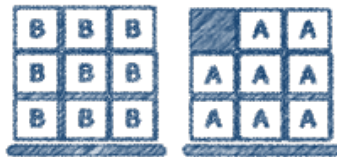
## Comparison of the approaches

### LOT SIZE MANUFACTURING

Production planning  
Leveling ( 2 weeks)  
Raw material stock control

**! Focus on: forecast accuracy**

Safety stock on finished good side

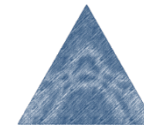


### LOT SIZE ONE PRODUCTION

Defined raw material stock with  
frequent material supply  
Min/max stock control

**! Focus on: local for local**

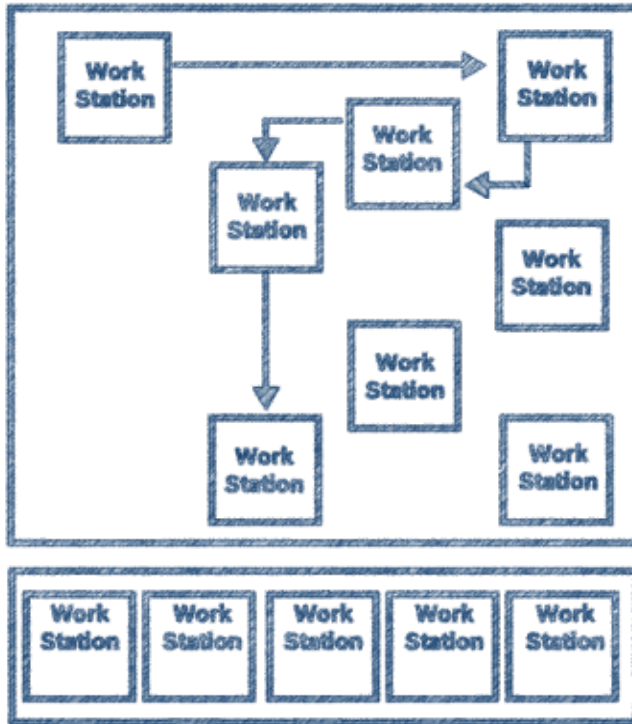
Safety stock on material side



# Flexible manufacturing concept

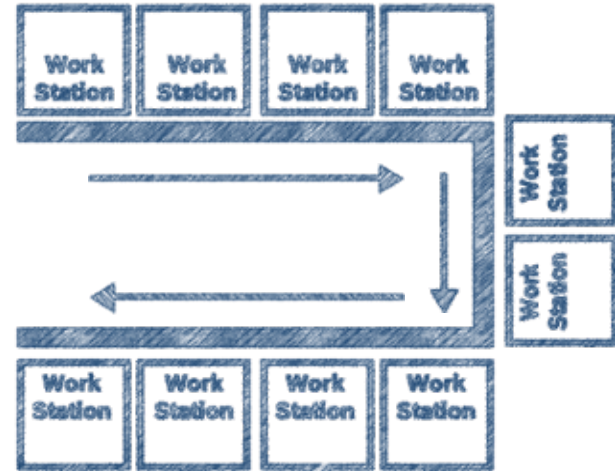
## Flexible production area and the conventional production lines

Flexible Production Area

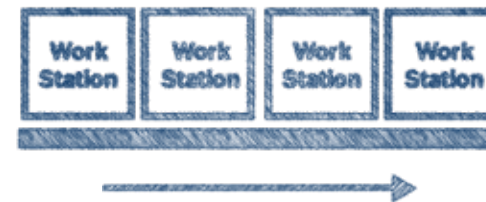


RTC - Reserved Technical Capacity  
(contains redundant critical workstations)

High Runner Line



Low Runner Line

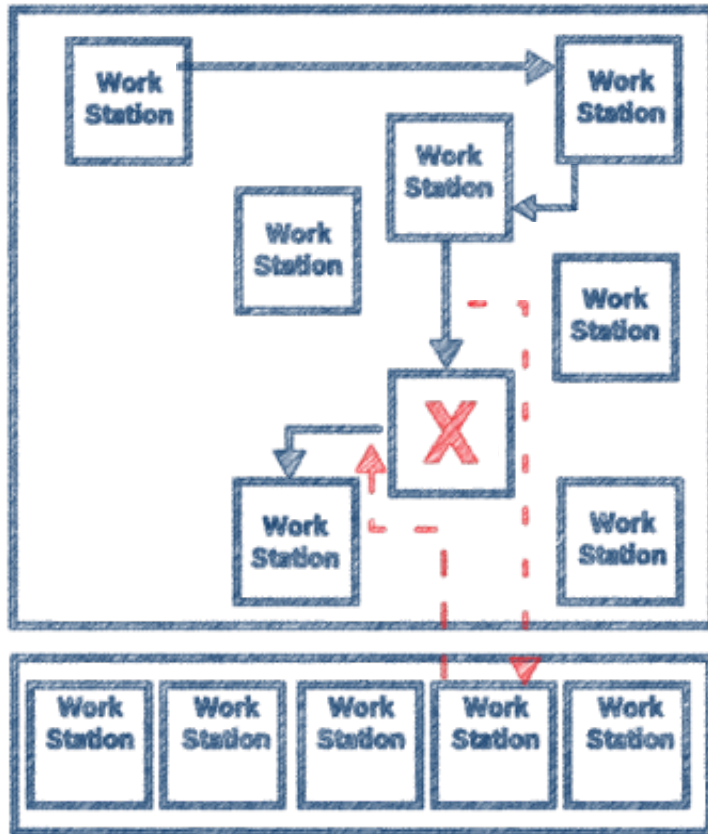


RTC



# Flexible manufacturing concept

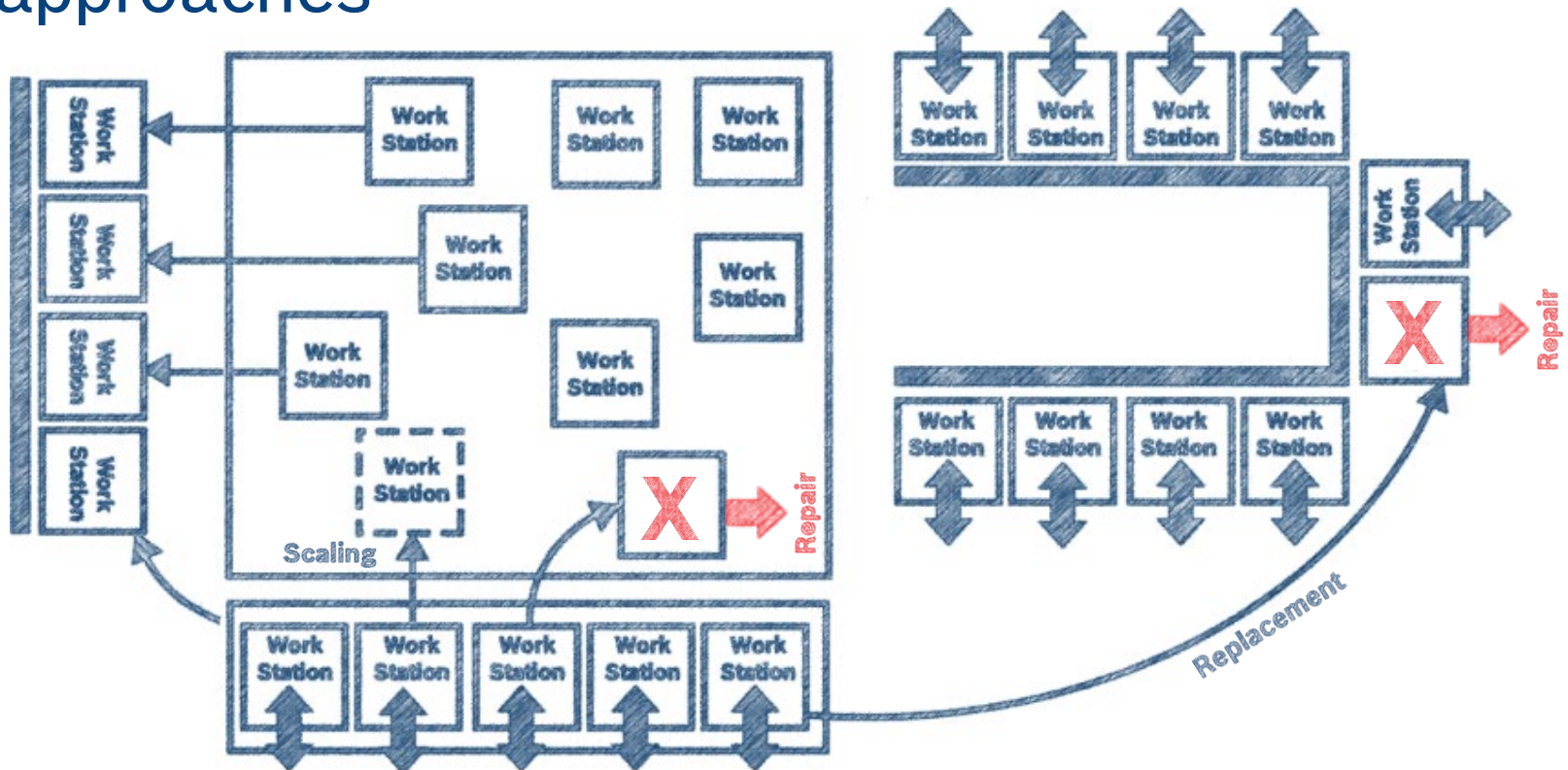
## Flexible Production Area



- Production process is defined via routing
- Plug and Play workstations
- Flexible layout with automated indoor positioning
- Resource optimized routing in case of process disturbances (e.g. using workstations from Reserved Technical Capacity)
- Automated change over
- Audiovisual instructions for the worker
- Online process monitoring
- Online training status management
- No material stored on the line
- No material backflow
- High utilization
- Reduced production area
- High flexibility
- Lot size one is possible

# Flexible manufacturing concept

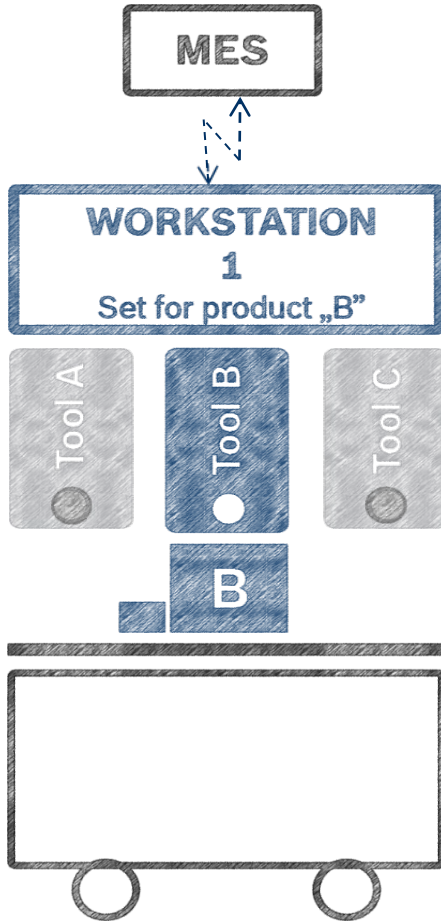
## Integration of the different production approaches



All workstations are compatible with every art of the production systems and can be replaced with each other. Temporary (reversible) and permanent scaling is possible.

# Flexible manufacturing concept

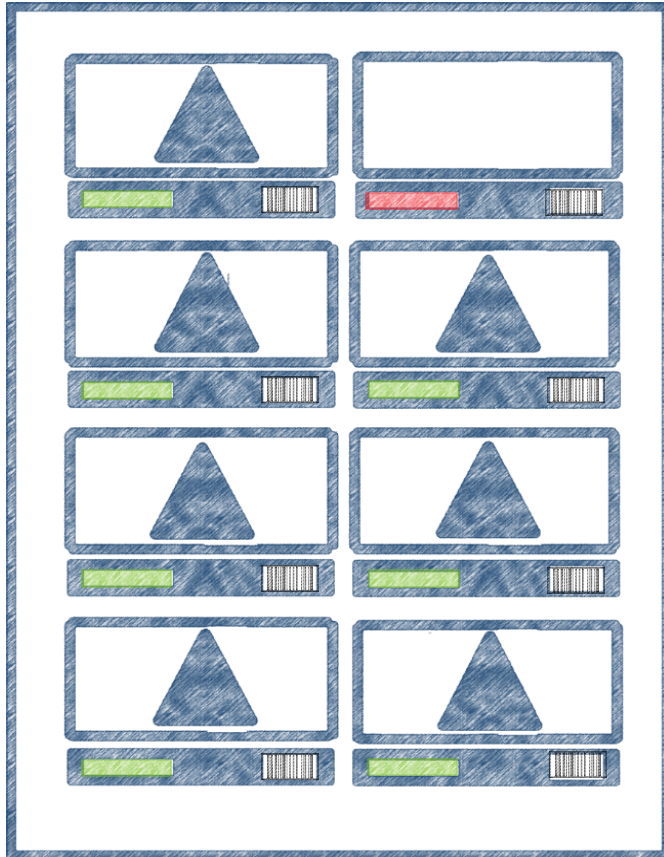
## Plug and Play workstation



- System compatible Plug and Play workstation
- System component of the Flexible Manufacturing Concept
- It is able to communicate with the MES system
- It is able to communicate with wireless devices
- Mobile workstation – can be moved to the point of use
- Able for automatic change over
- Automatic data transfer – process data, maintenance data
- It is able to read ID tags (e.g. RFID or DMC)

# Flexible manufacturing concept

## Smart supermarket



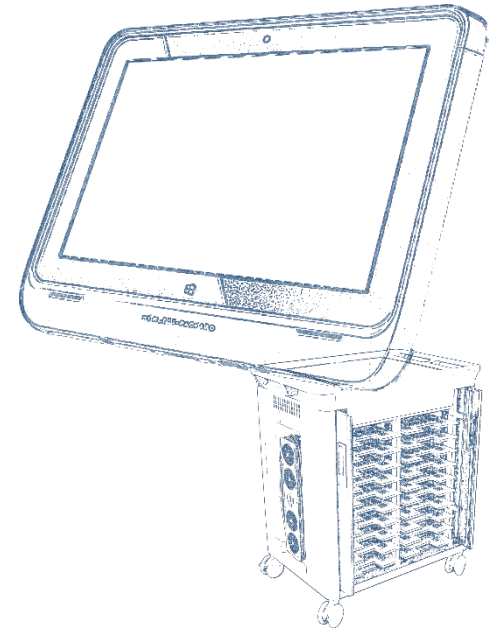
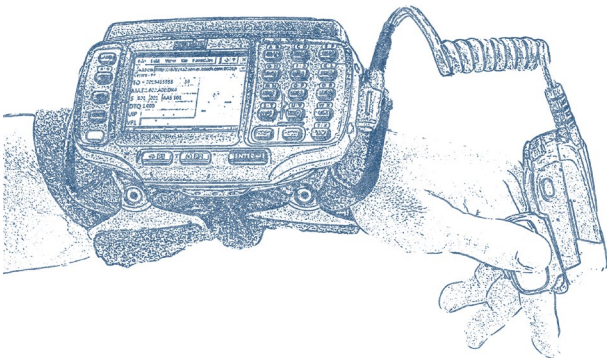
- Dedicated SM for each product type (with all of the components)
- Able to communicate with the system
- Picking order and SM size optimized layout
- Frequent material supply for refilling
- Min/max stock control (MRP)
- Physical stock control (Hardware)
- Automated reordering process
- Confirmation of picking part by part
- Quality checking of parts by parts
- Identified storage places (e.g. barcode) with material data

# Flexible manufacturing concept

## Portable devices

The main HMI to the MES is the tablet with two main functions:

- „GPS” mode
  - Guidance of the worker through the defined route in the flexible manufacturing area
- Instruction mode
  - Showing work instructions and important information for workers

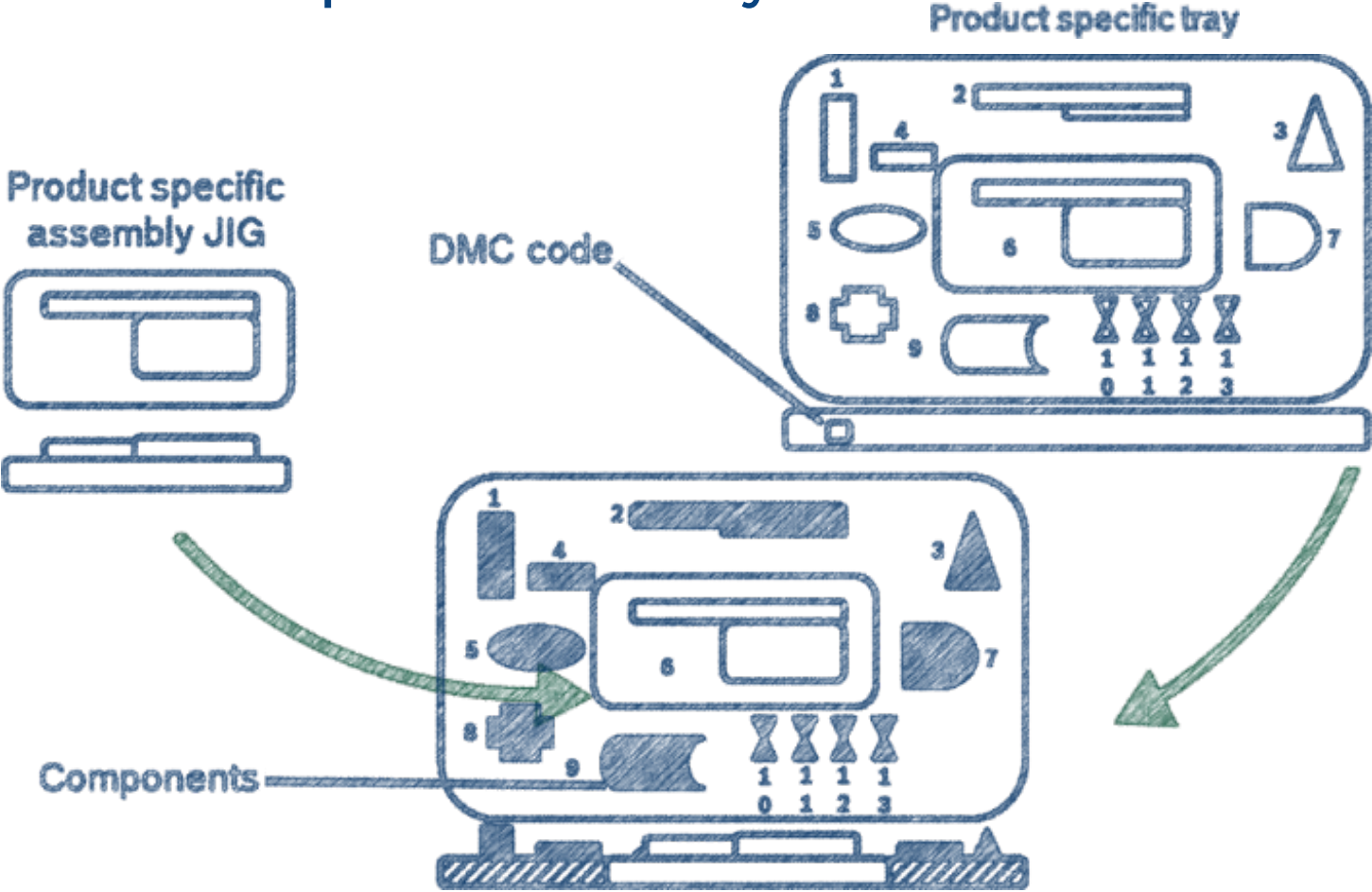


The main HMI to the ERP system is the portable device with scanner.

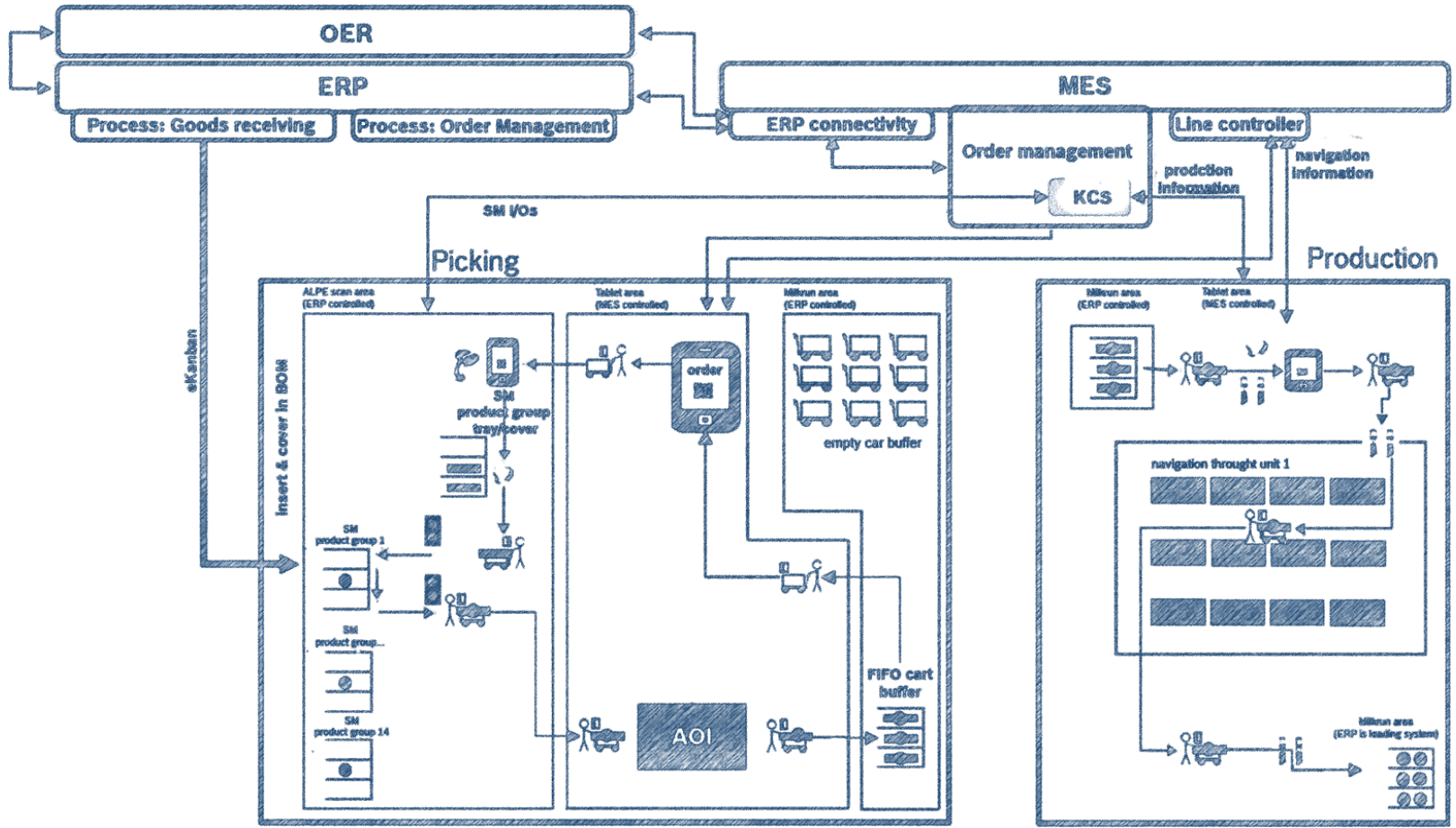
Data transfer (input/output) e.g. showing information for part set collection, confirmation of picking via scanning etc.

# Flexible manufacturing concept

## Part Set Preparation - Tray



# Flexible manufacturing concept Overview



# Flexible manufacturing concept

## Target

- Improvement of competitiveness by efficient management and control of production resources
- Economical production of small lot sizes „one piece flow”
- Intelligent machines, storage systems, operating resources which autonomously exchange information, provoke actions and control each other independently „Cyber Physical Systems”
- Make complexity in production controllable

**Expected result is depending on the project.**

**One example from an existing project:**

- MAE saving 70%
- Production area reduction 60%
- Production cost reduction 10%
- Supply chain cost reduction 15%



THANK  
YOU FOR  
YOUR  
ATTENTION!