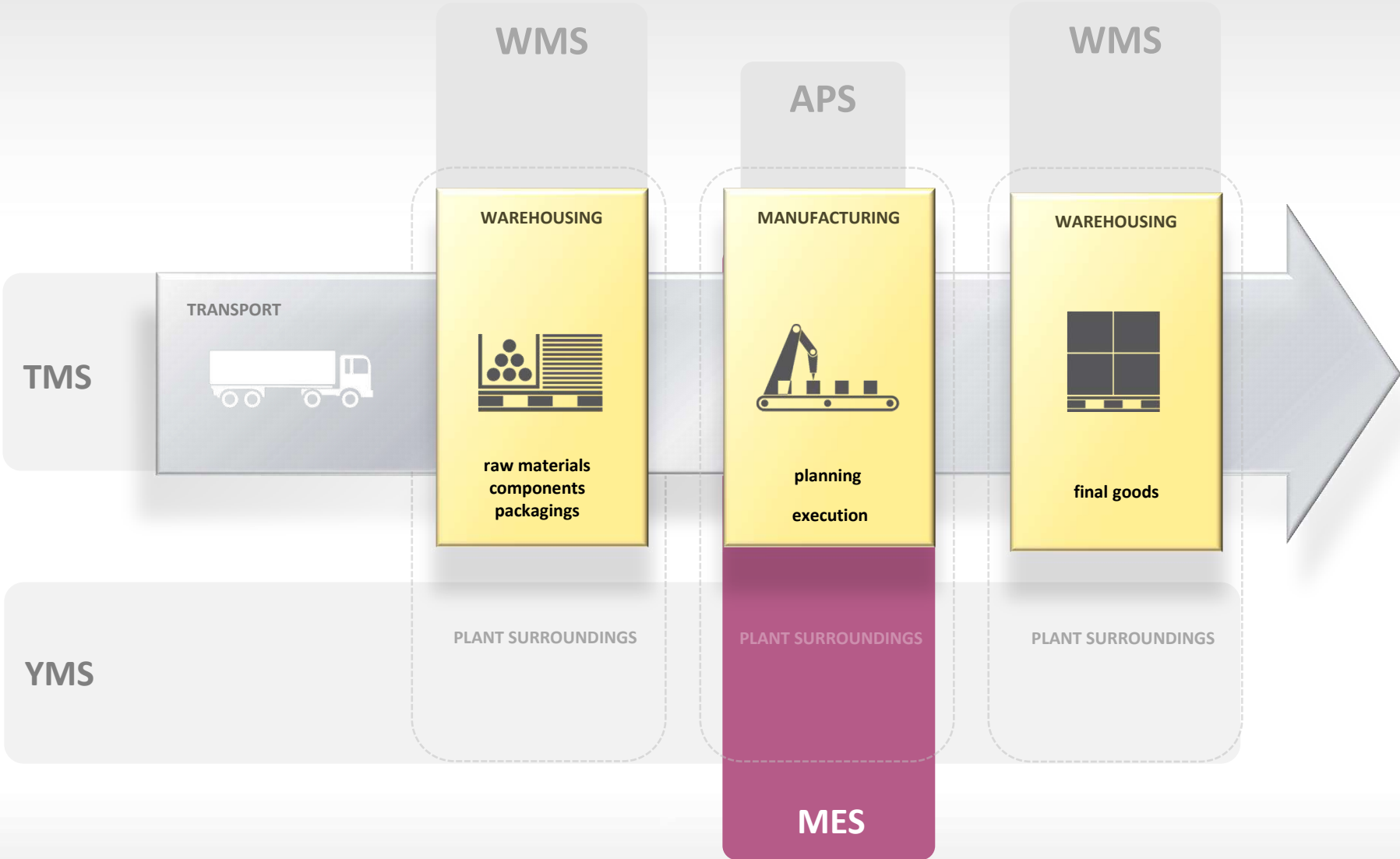


# QGUAR MES - one of our many SCE systems



# General QGUAR MES flow chart (divided into main processes)

## MES

### ADM

#### System administration

- Defining the manufacturing plant (machines, lines, cost centres etc.)
- Basic data.

### WIP

#### Work in Progress

- Defining the production orders
- Defining the method of performing an order (production operations)
- Performing production orders
- Order progress

### LP

#### Logistics of Production

- Production stations supply
- Storage of raw materials and intermediate products on the production floor
- Tracing the product movement during production.

### GEN

#### MM – product management

- BOM – Bill of Materials
- Traceability
- Management of serial numbers and batch numbers
- Substitutes

### LM

#### MW – Machine work

- Connecting machines
- Gathering data about machine work
- Gathering data about materials' work
- Calculating KPI indicators
- Alert module

### QM

#### Quality management

- Definition of quality management
- Support of sampling and sample testing
- Tracing the quality status during production
- Control lists
- Support of Six Sigma, 5S, Poka-Yoke, etc.

### TPM

#### Total Productive Maintenance

- Tool management
- Maintenance of repairs and inspections
- Failure handling

## Qguar MES

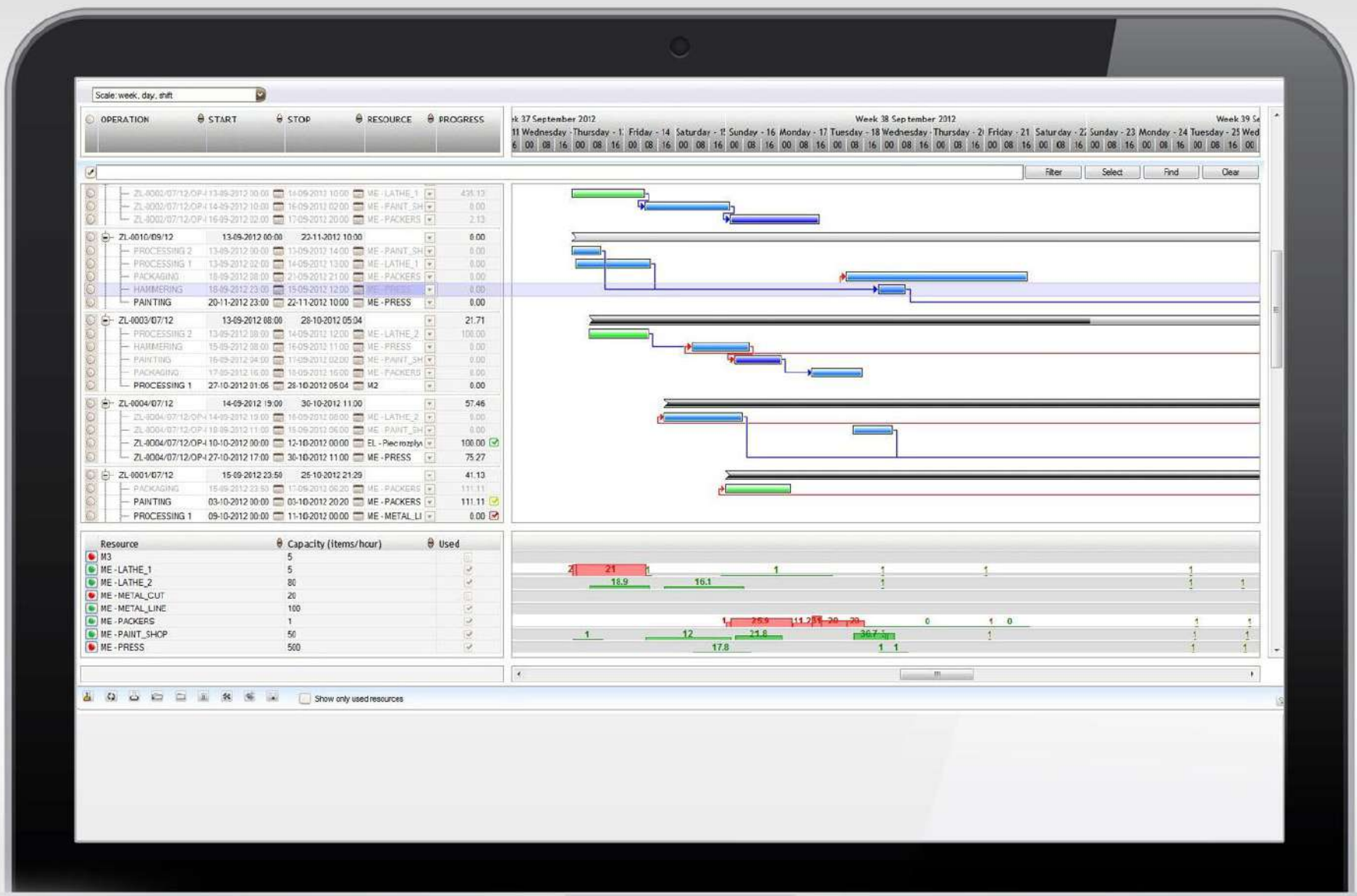
**a specialised, modern and efficient tool for logistics support, charge management, local stocks and quality of manufactured items.**

## MES - Manufacturing Execution System

system of product process supervision which replaces all non-standard applications and provides many additional functionalities. Moreover, it supports information flow on the production floor by integrating company systems.

MES system is a next evolutionary stage for production companies who implemented the ERP system.

# Qguar MES – sample screen



## ✓ **Flexibility**

easy adjustment to the client's needs, easy modelling of production processes

## ✓ **Module structure**

possible implementation of single modules

## ✓ **Changes can be easily introduced**

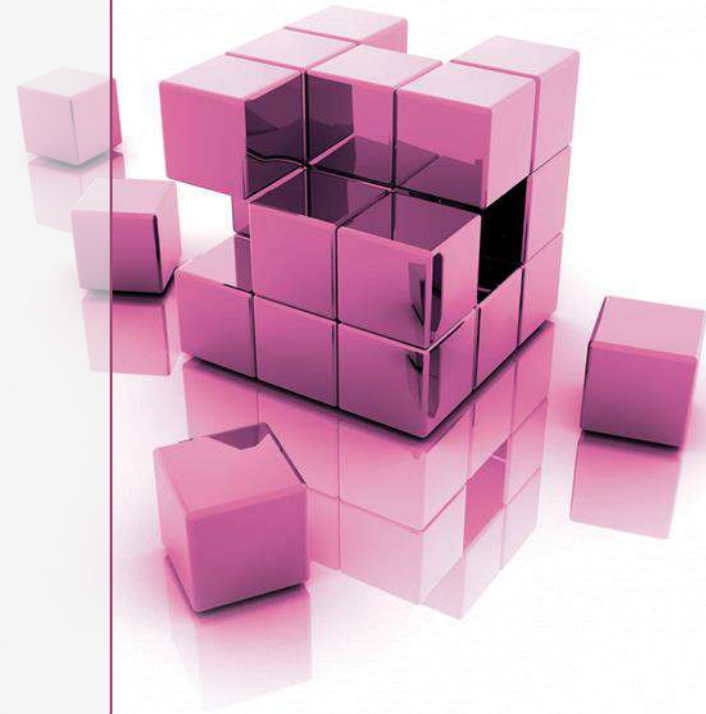
process modification

## ✓ **Standard notation (BPMN)**

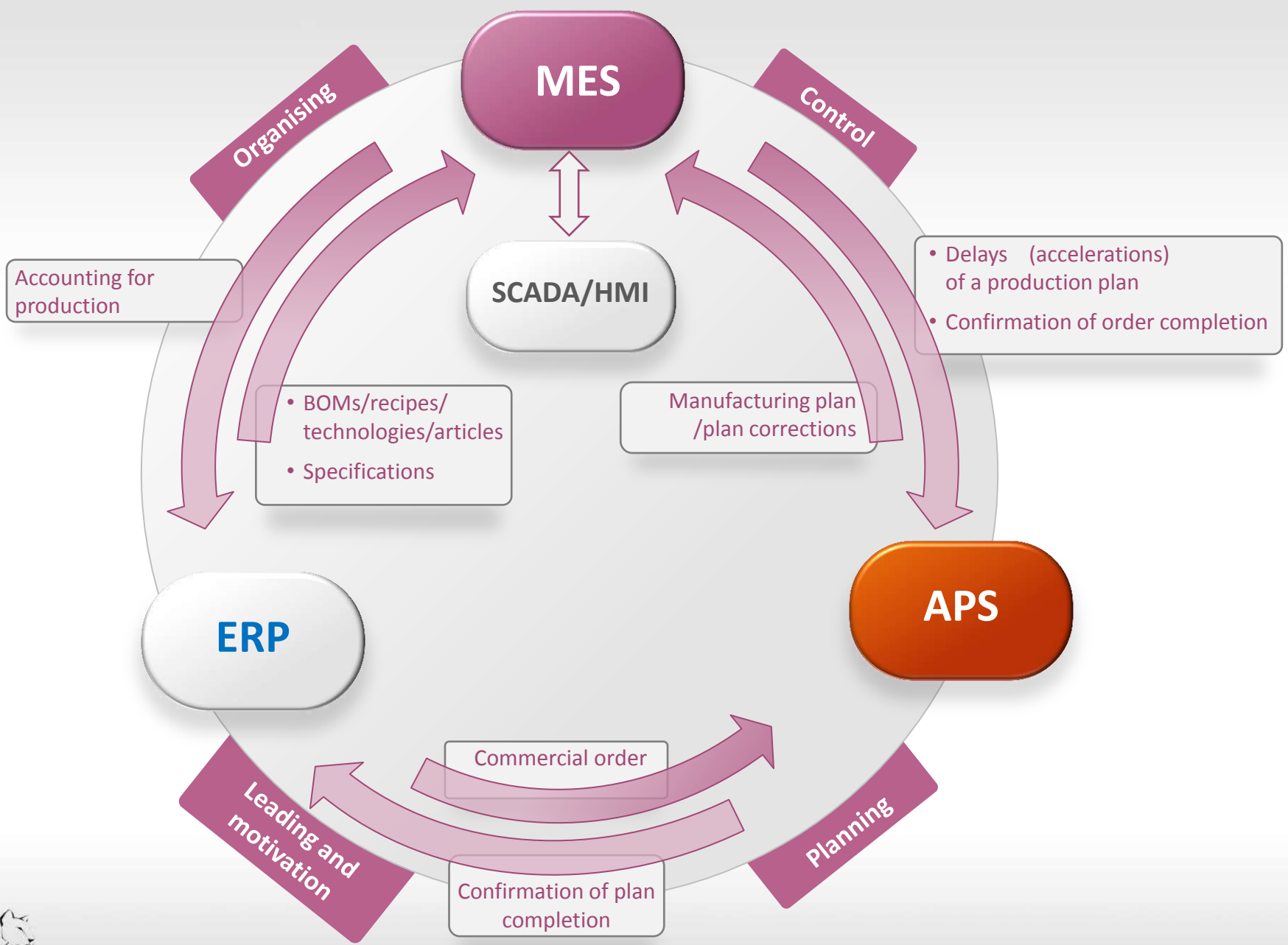
## ✓ **Three layer structure**

no need to install workstations, remote access

## ✓ **Friendly user's interface**



# MES in a manufacturing company





## Static data

- ✓ Basic data
- ✓ Standard objects
- ✓ Screens for management of standard objects

## Variable data

- ✓ Defining manufacturing processes
- ✓ Defining simple screens for operators

## RESOURCES

### ALERTS

Objects called from the system as a result of certain events (machine stop, stop of order performance).

Enable information flow between employees.

### EMPLOYEES

People performing and reporting tasks assigned from the system.

Employees may be connected into employee groups (brigades for instance), employee shifts – according to the work time (e.g. morning shift).

Employees can be defined with abilities (for instance welder, turner).

### MACHINES

Machines and/or workstations where production takes place.

Machines can be grouped according to their type (machine tools, welding units etc.)

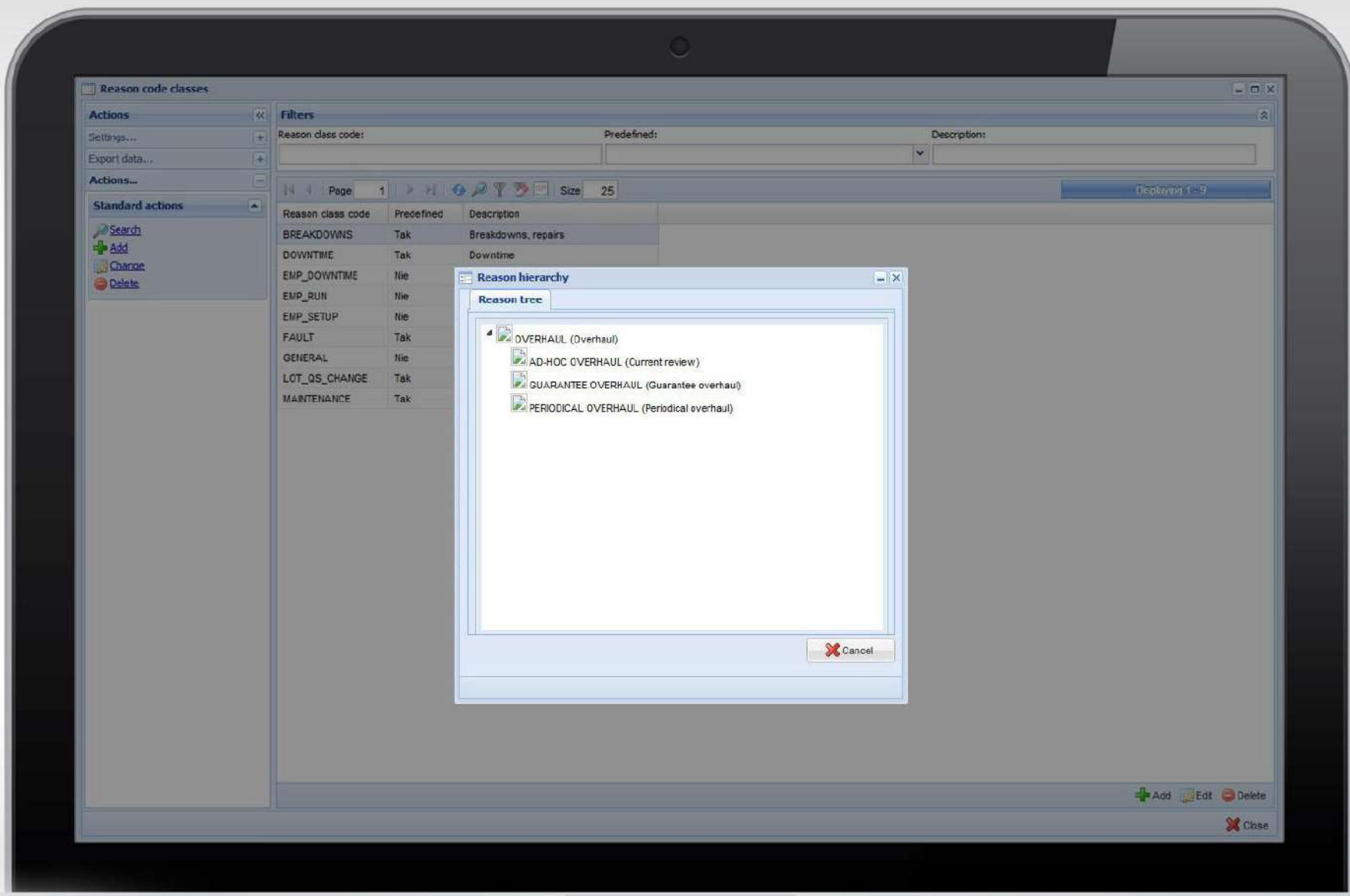
Machines can be connected into production lines.

### REASON CODES

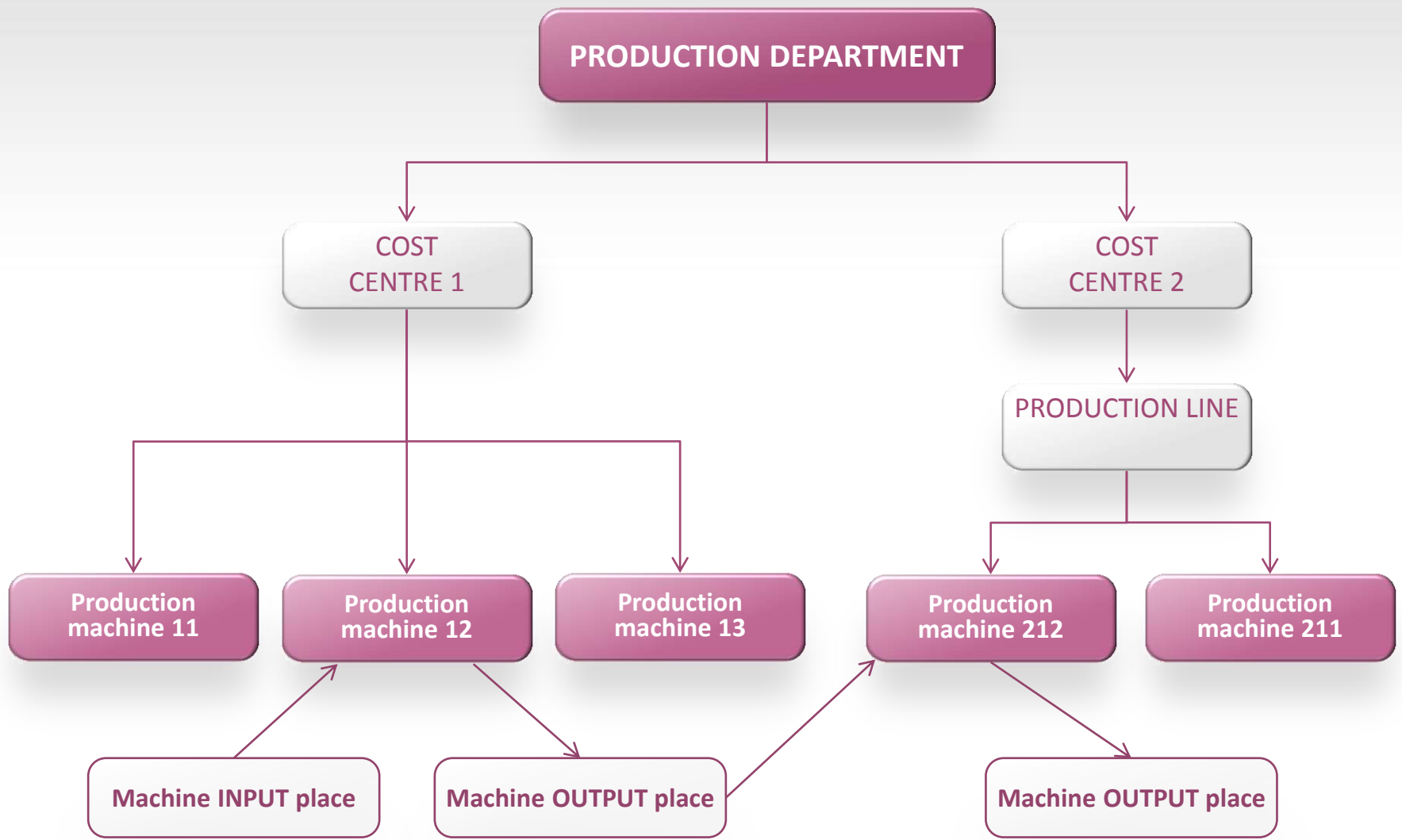
Objects which make it possible to describe events which take place during production.

Reason codes can be grouped according to their class. Hierarchy of codes is possible. Reason codes at the same time may be superior to one set of codes and subordinate to the main code.

# Reason codes – sample screen



# Organisational structure of the Qguar MES system production floor



# Production lines – sample screen

The screenshot displays a software interface for managing production lines. The main window, titled "Production lines", has a "Lines tree" tab. It features a table with the following data:

Production line no	Description
MANUAL	
ELECTRONICS	
LINAPAPER	Line for sheets production
ME - METAL_LINE	Metal production line
EL - Electronics production line	Electronics production line

Below the table is a "Machines in line" section with "Up" and "Down" buttons and a table with columns "Machine no." and "Is line?".

An overlaid "Production lines" dialog box shows a "Lines tree" view:

- EL - Electronics production line
  - EL - S30
  - EL - SMD P50
  - EL - RK320
  - EL - Manual assembling station
- LINAPAPER
- ME - METAL\_LINE

Both the main window and the dialog box have a "Cancel" button at the bottom right.

# LP

## LP - LOGISTICS OF PRODUCTION

- ✓ Supply of a production line with raw materials and components
- ✓ Tracing all the warehouse movements at the production floor
- ✓ Information about location of raw materials and intermediate products on the production floor
- ✓ Support of "lean manufacturing" philosophy

## Calculating demand

On the basis of the BOM for the order and warehouse data, the system calculates the demand for raw materials / materials needed to complete each operation.

## Supply of production machines

When the operation starts to be performed on a certain working station, the system delivers materials to the storage place assigned to this place. The system delivers materials in instalments according to the definition of a place assigned to the machine. When the amount on the place reaches minimum value, it delivers an instalment of materials until the place amount reaches maximum filled space.

First it delivers products which is located on the production floor, then (when it is not enough) it obtains products from the raw material warehouse.

## Raw material consumption

The products are consumed from the place allotted to the machine when the operation is performed. Consumption may take place in two ways:

**theoretically** – on the basis of the BOM (the operator informs that the given number of products was produced which, (according to BOM) means that the given amount of raw materials was consumed.

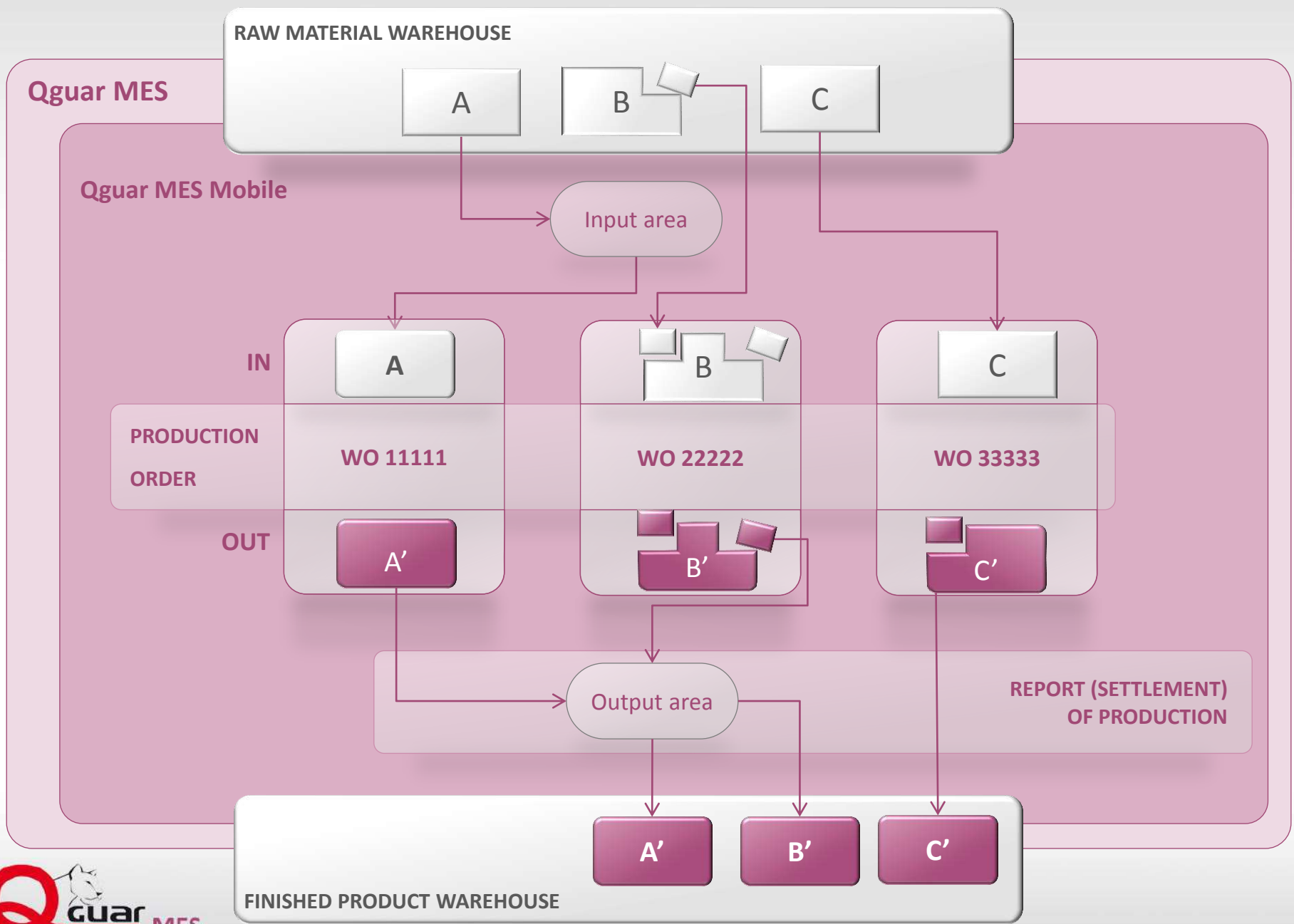
**reporting** – operator reports the amount of used raw materials.

Additionally, one can use the theoretical method and after the operation is completed, receive a report the amount of raw material which currently remains at the place by the machine.

## Acceptance of finished product

In the moment the production operator files a report, a new carrier appears in the system (for a finished product) which is stored at the machine output. The system may generate a logistics label for the finished product, and next, the carrier, depending on the configuration, may be automatically moved to the ready product warehouse.

# Logistics of Production – from raw material to the finished product





# WIP

## WIP – Work-In-Process Monitoring

- ✓ Management of production orders
- ✓ Gathering information about the work performed for the order
- ✓ Monitoring completion of production orders
- ✓ Scheduling tasks on machines
- ✓ Management of production processes

## Order

Production order for a particular product usually comes from a superior system.

Contains information about which product has to be produced and at what deadline.

## Generating an operational production order

Based on the imported order and routes (technologies) an operational order is generated, which contains all the production steps (operations) necessary to complete the order.

## Completing production

Operational order is carried out. Specific operations are performed and data gathering from production floor takes place, including:

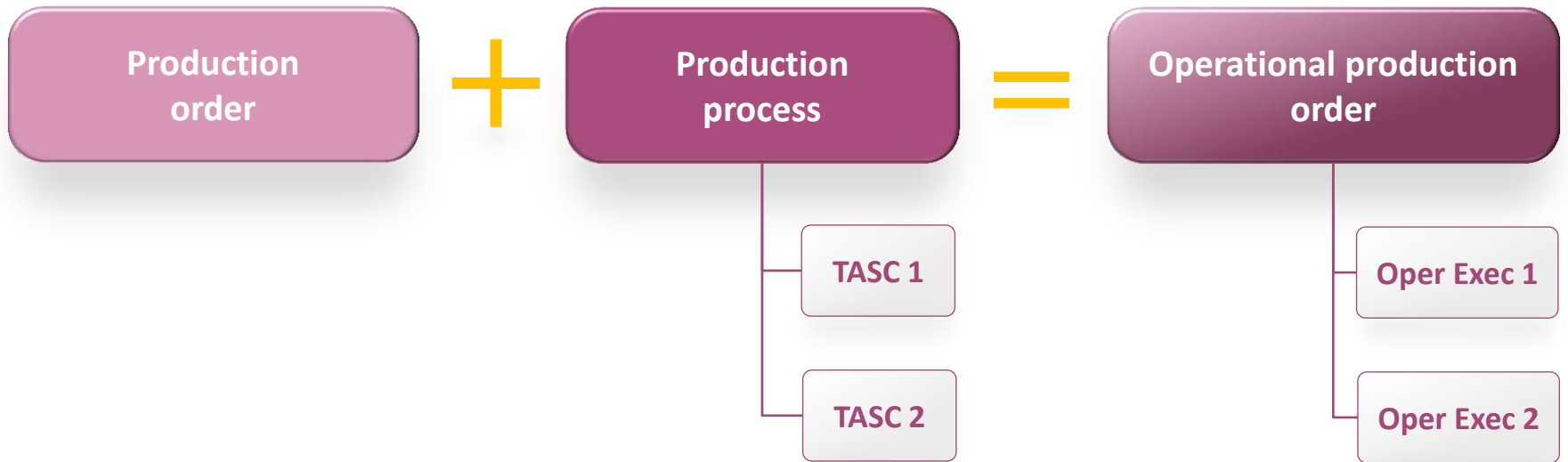
- time: spent on production, downtime etc.
- quantity: produced good, produced bad, used up etc.
- who carried out the production and much more data specific for the production in question.

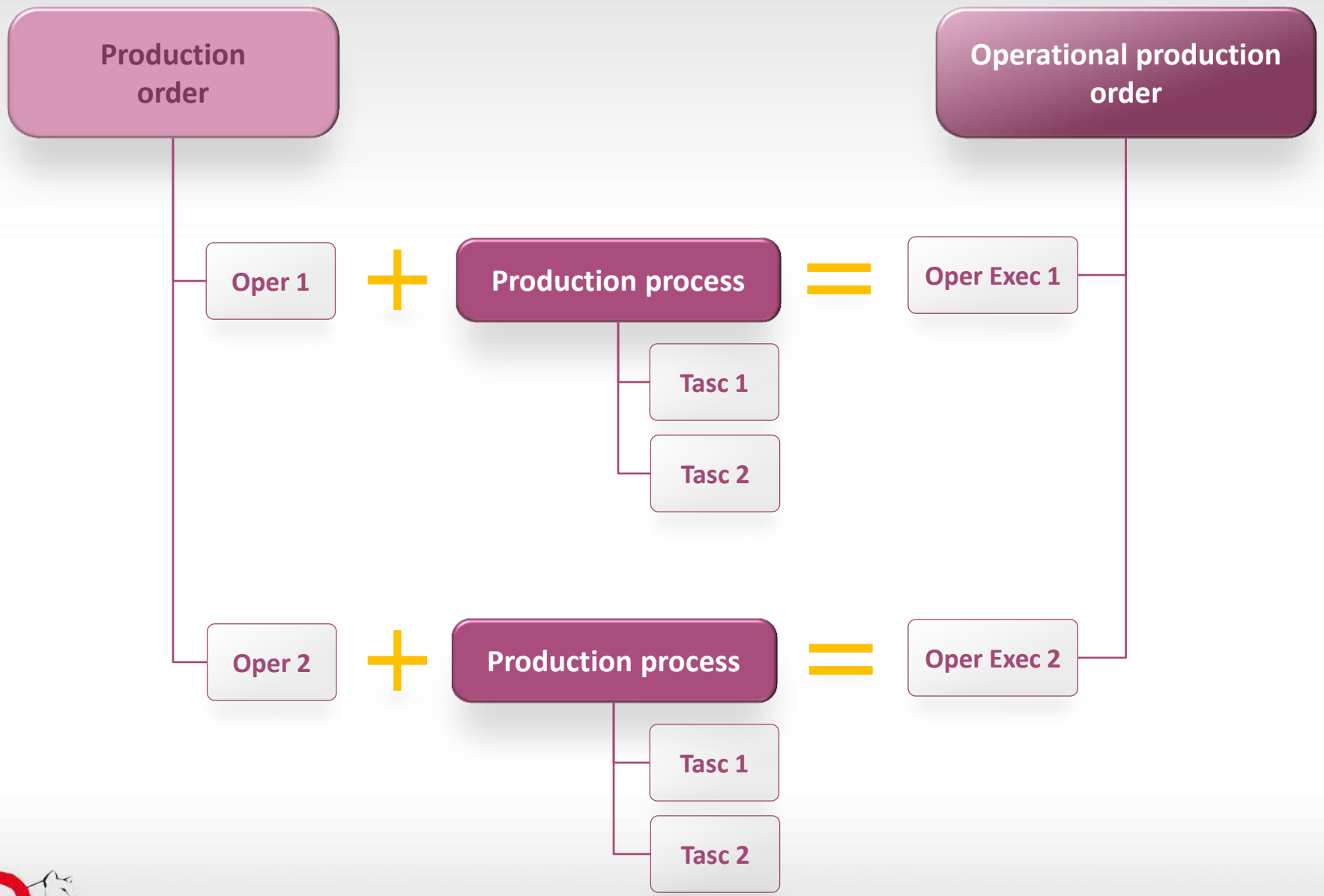
## Accounting for production

On the basis of the gathered data accounts for the production:

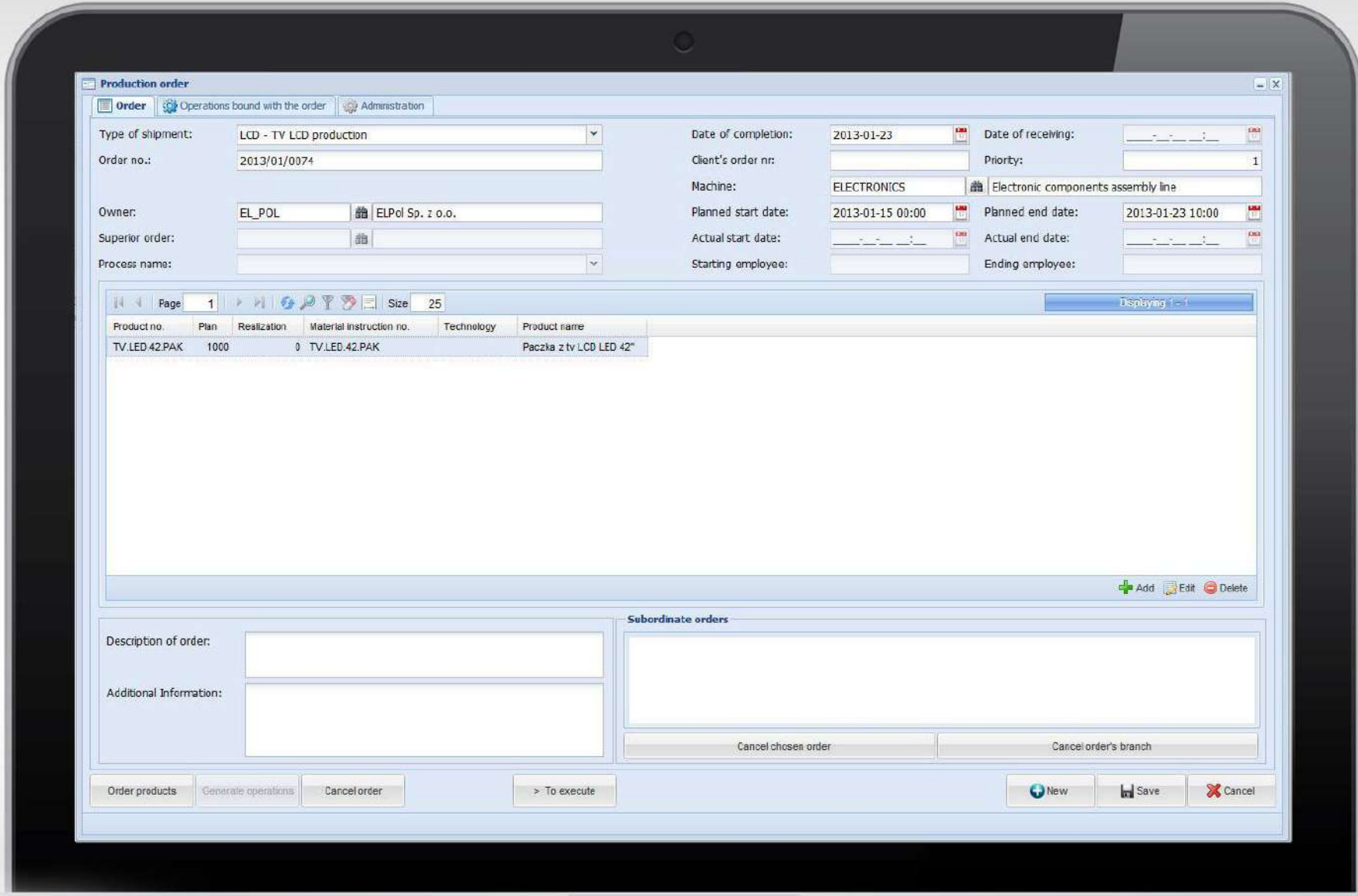
Calculates the production costs:

- materials used
- machine costs
- employee costs
- other specific costs for a given production (mould wear for instance)
- settlement may be sent to the superior system

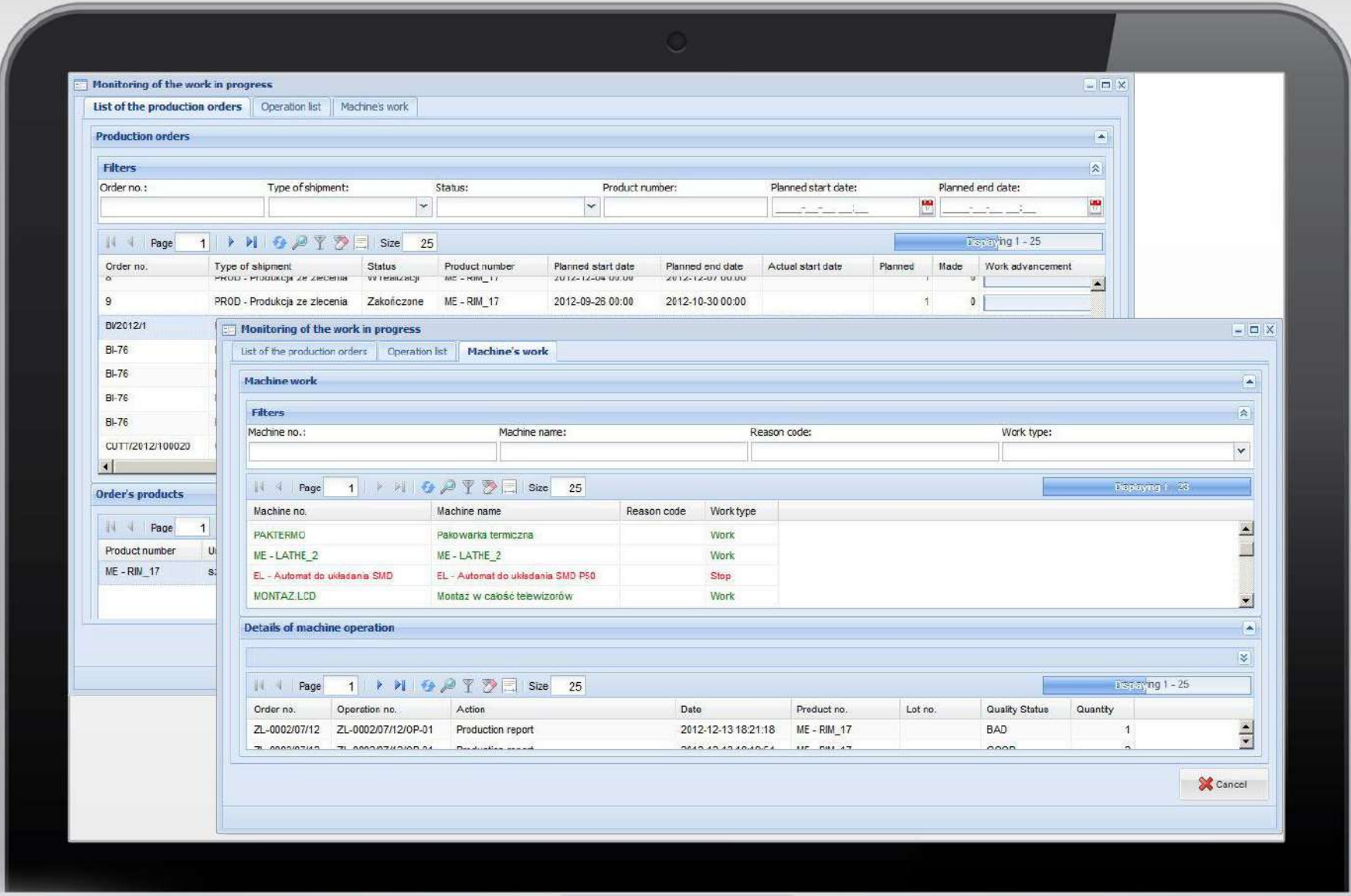




# Production order – sample screen



# Production in progress – sample screen



# Product management (MM) – genealogy – sample screen

**Genealogy**

**Product selection**

Product:  Batch:  Date from: 2012-11-01 00:00 Date to: 2012-11-02 00:00  
Machine: VALMET Employee:  Ser. no.:  Show genealogy Print report

**Genealogy down**

- TP.500.1020 FB+, Produkcja: 1169 j.p. [Nr partii: 775766-80-577-A]
- TP.500.1000 FB+, Produkcja: 1146 j.p. [Nr partii: 775766-80-577-B]
- TP.500.0600 FB+, Produkcja: 693 j.p. [Nr partii: 775766-80-579-A]
  - 707 x TP.500.2150 FB+ [Nr partii: 775766-80-579]
- TP.500.0740 FB+, Produkcja: 853 j.p. [Nr partii: 775766-80-579-B]
  - 870 x TP.500.2150 FB+ [Nr partii: 775766-80-579]

Produced quantity: 853  
Quantity used for:  
Quality status: Good

Production - summary data	Consumption - summary data
<b>Machines</b> VALMET	<b>Machines</b> PEMCO1
<b>Dates</b> 2012.11.01	<b>Dates</b> 2012.11.05
<b>Employees</b> TKAROLCZAK	<b>Employees</b> WKMIECIAK

**Genealogy up**

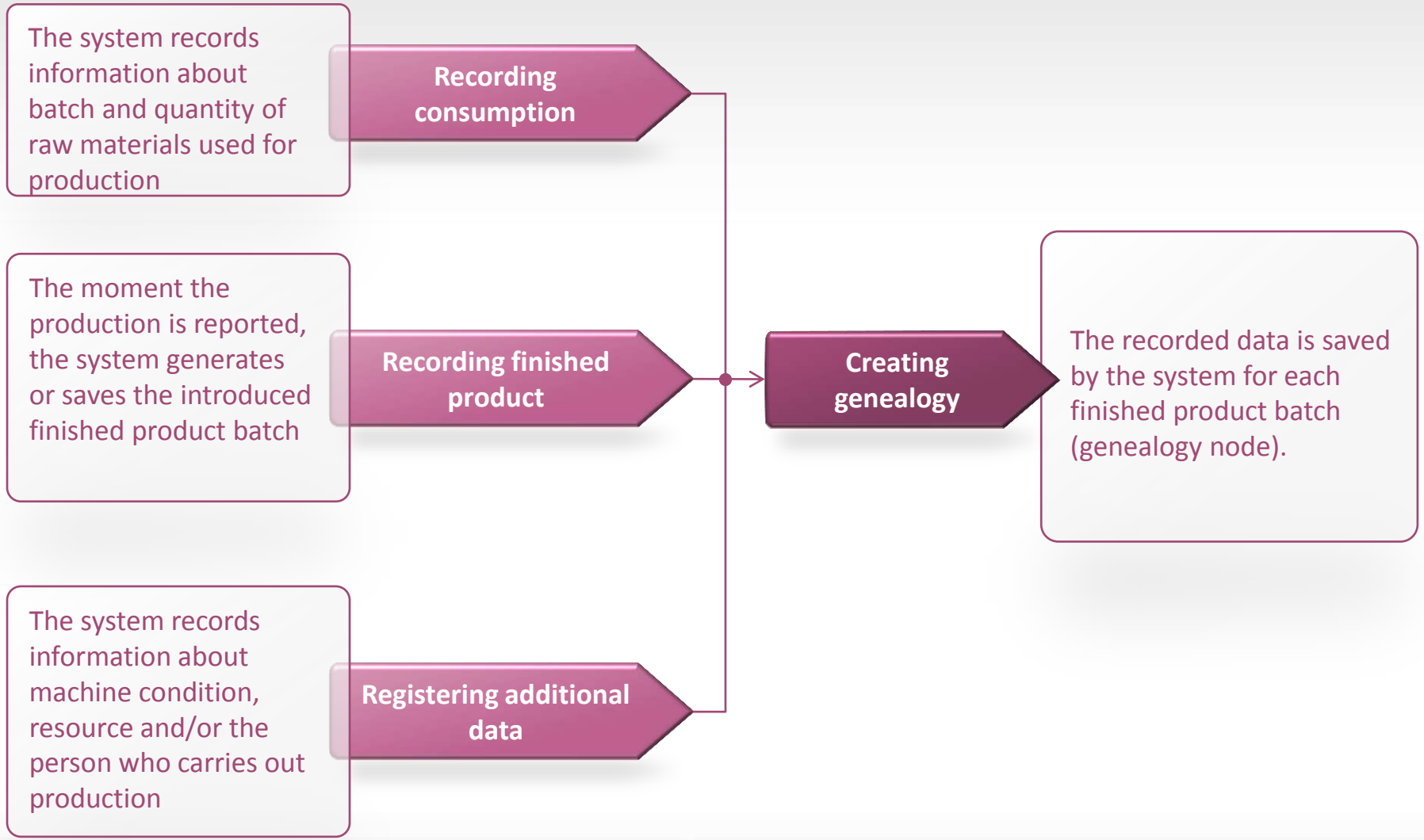
- TP.180.2300 QLN [Nr partii: 460729-4]
- TP.200.1930 OTN [Nr partii: 088669-02-191R-B]
- TP.210.2020 QLN [Nr partii: 460739-2]
  - 1813 elem. na 1781xTP.210.0965 QLN [Nr partii: 460739-2-A]
  - 1965 elem. na 1930xTP.210.1047 QLN [Nr partii: 460739-2-B]
- TP.210.2300 QLN [Nr partii: 458966-4]

Produced quantity: 1781  
Quantity used for: 1813  
Quality status: Good

Production - summary data	Consumption - summary data
<b>Machines</b> VALMET	<b>Machines</b> PEMCO2
<b>Dates</b> 2012.11.01	<b>Dates</b> 2012.11.05
<b>Employees</b> TKAROLCZAK	<b>Employees</b> KDZIALDOWSKI

Cancel

# Process of creating a genealogy/ traceability of a product





- ✓ Managing BOMs – Bills of Materials
- ✓ Gathering information about genealogy of the finished product
- ✓ Data storage about the history of particular batches
- ✓ Management of serial numbers and batch numbers
- ✓ Substitutes

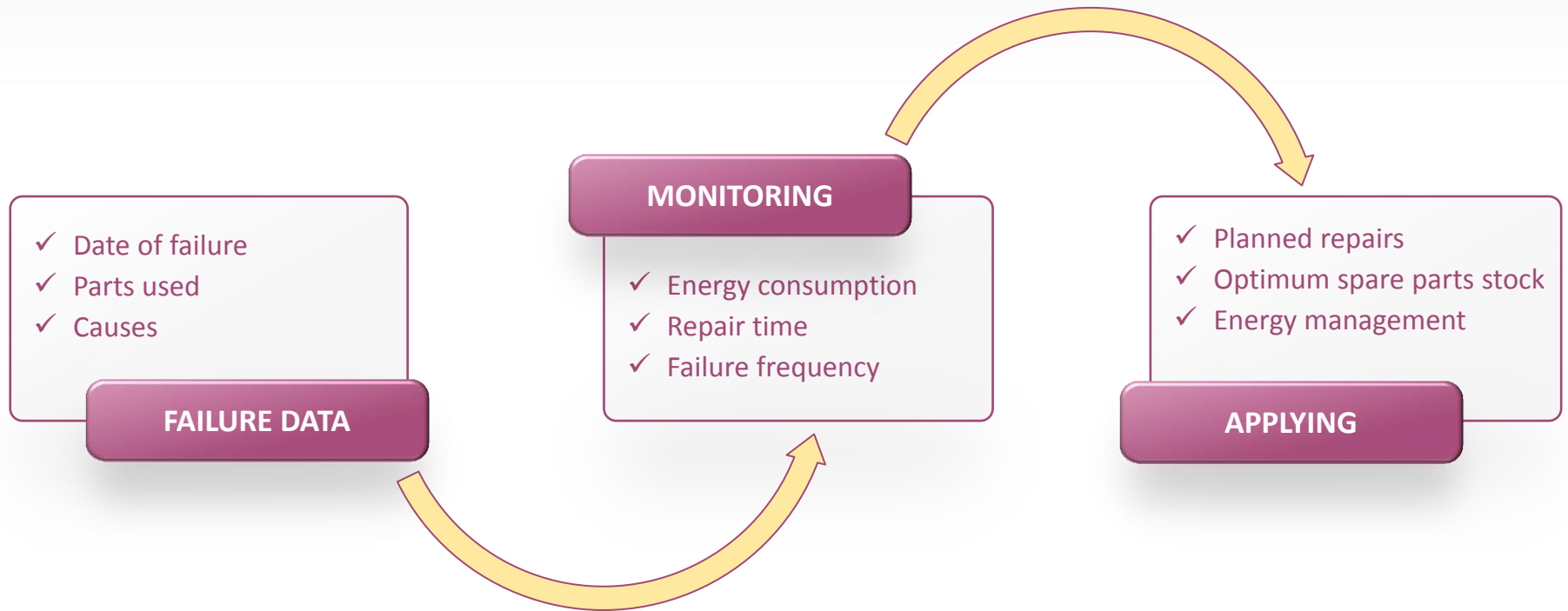
The screenshot displays a software interface for product management, divided into several sections:

- Genealogy (Top):** Includes a "Product selection" area with fields for Product, Batch, Date from (2012-11-01 00:00), Date to (2012-11-02 00:00), Machine (VALMET), Employee, and Ser. no. Buttons for "Show genealogy" and "Print report" are present.
- Genealogy down (Left):** A tree view showing production history for TP.500.1020 FB+, TP.500.1000 FB+, TP.500.0600 FB+, TP.500.0740 FB+, and 870 x TP.500.2150 FB+.
- Genealogy up (Right):** A tree view showing production history for TP.180.2300 QLN and TP.200.1930 OTN.
- Material instructions (BOM) (Center):** A detailed view for "TV.LED.42.PAK" with fields for Material instruction no., Instruction name (Zapakowany TV LCD LED 42"), Product (Paczka z tv LCD LED 42"), Shelf life from/to, and Type of material (Product).
- Production - summary data (Bottom Left):** A table with columns for Machines (VALMET), Dates (2012.11.01), and Employees (TKAROLCZAK).
- Product tree (Bottom Right):** A hierarchical view of the BOM for TV.LED.42.PAK, listing materials like INSTR.TV.LED, KABLE.TV.LED, KART.TV.LED, PILOT.TV.LED, TV.LED.42, EKРАН.TV.LED.42, and OBUД.TV.LED.42.

# TPM

## TPM - TOTAL PRODUCTIVE MAINTENANCE

- ✓ Managing tools, forms, accessories
- ✓ Failure handling
- ✓ Management of repairs and inspection of machine park
- ✓ Defining machine structure



# Repair order – sample screen

**Repair and renovation orders**

Order data | Contractors and tools | Administration

**Main data**

Type of shipment:	Awaria	Machine:	M1	MIXER
Order no.:	A/QUANTUM/M1/70	Cost centre:	Ext1	Extruder 1
Order name:	Repair order A/QUANTUM/M1/70	Reason code:	Electric failure	
Reporting person:	MES55_STD			

**Performed by**

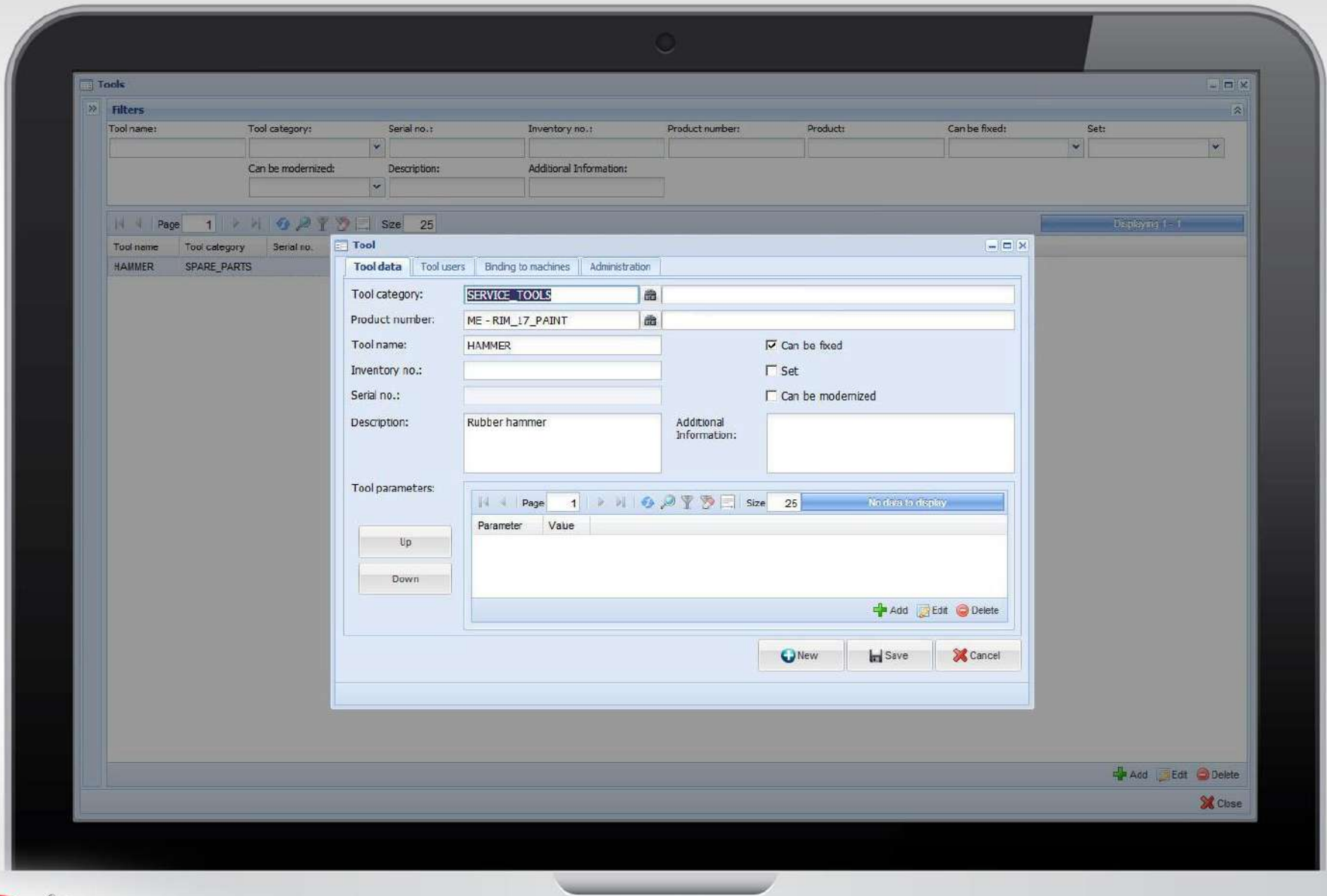
Executing serviceman:	MES55_STD	Submission date:	2012-11-27 18:14
Planned start date:	2012-11-27 18:14	Planned end date:	2012-11-27 20:14
Start date:		End date:	

**Descriptions**

Registration description:		Preliminary diagnose:	
---------------------------	--	-----------------------	--

Activate Start Finish New Save Cancel

# TPM – sample screen



# LM

## LM – MACHINE WORK

- ✓ Gathering information about reason codes for downtimes
- ✓ Gathering information from machines via an OPC server
- ✓ Tracing of order performance on a machine
- ✓ Calculating standard KPI – OEE
- ✓ Alert system

# Recording work time – sample screen

The screenshot displays a software interface for recording work time. The main window is titled "Order list" and features a "Filters" section with various input fields for order details. A "Work time registration" dialog box is open in the foreground, showing a date of "2013-01-15 15:52", a "Work type" of "Downtime", and a list of "Reason code" options such as "AD-HOC OVERHAUL", "AQC - After finishing quality control", and "MECHANICAL - Mechanical faults".

**Order list Filters:**

Order no.:	Name:	Type of shipment:	Order state:	Planned start date:	Planned end date:
Product no.:	Machine no.:	Owner:	Number of ship order:	Planned:	Planning sessions:
Actual start date:	Starting employee:	Actual end date:	Ending employee:	Date of receiving:	Date of completion:

**Work time registration Registration:**

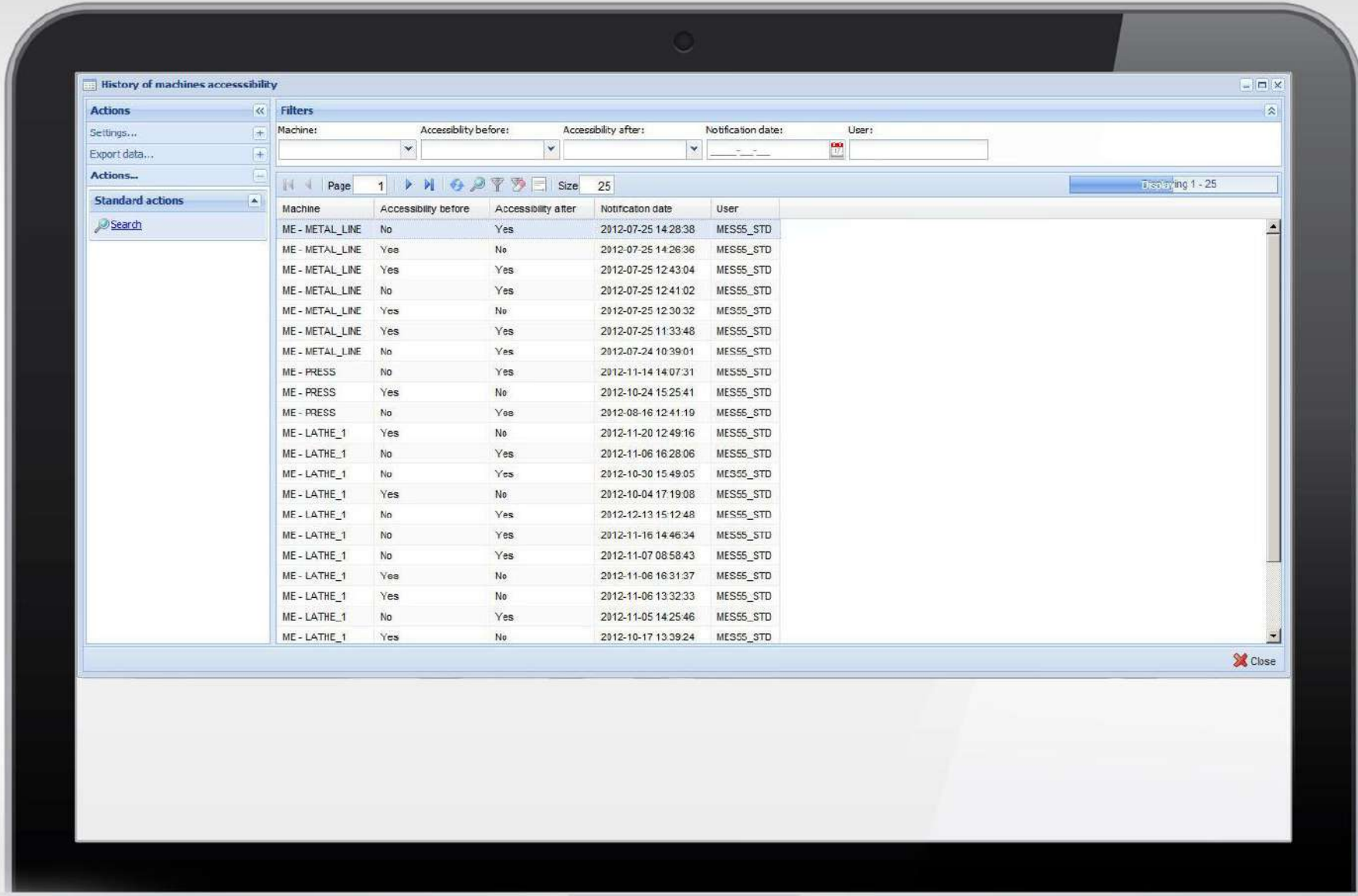
Registration time: 2013-01-15 15:52

Work type: Downtime

Reason code:

- AD-HOC OVERHAUL - Ad-hoc overhaul
- AQC - After finishing quality control
- BROKEN\_COMPONENT - Broken component
- CLEANING - Cleaning
- COMMUNICATION ERROR - Communication error
- COMPON\_NOT\_SOLDERED - Component not soldered
- CONSERVATION - Conservation
- DEVELOPMENT - Development
- DOWNTIME - Machine downtime
- ELECTRICAL - Electrical breakdowns
- GENERAL FAULT - General fault
- GENERAL RENOVATION - General renovation
- GUARANTEE OVERHAUL - Guarantee overhaul
- INVERTED\_COMPONENT - Inverted component
- MECHANICAL - Mechanical faults

# Machine information – sample screen





# Machine work – sample screen



# QM



## QM – QUALITY MANAGEMENT

- ✓ Supporting gathered sample tests
- ✓ Possibility to trace quality statuses from raw material to a finished product
- ✓ Algorithm for determining batch status on the basis of sample control
- ✓ Automatic and manual sampling
- ✓ Control lists
- ✓ Support of Six Sigma, 5S, Poka-Yoke, etc.

# Quality management – sample screen

**Quality control type** [Quality control parameters] [Administration]

**Quality control**

Quality control type no.:

Name:

Quality status:

Instructions:

Lot locked for the period of check

Quality status during check:

Automatic test result

Automatic change of quality status

Quality status for the incorrect test:

Desc.:

**Samples**

Samples taken by machine

Sample unit:

Sample size:

Sample storage period:

Sample number mask:

Special characters: \*M — machine, \*D — date, \*S — change, \*W — warehouse,  
\*X — number from sequence.  
Example: TEST\*D-\*X which means TEST-2011.05.27-9576

Sampling frequency:

Scope of drawing sampling step  
 to:

**Sampling plan**

Page 1

Quantity of produced articles
100
200
300
400
500

# BPMN

## BPMN

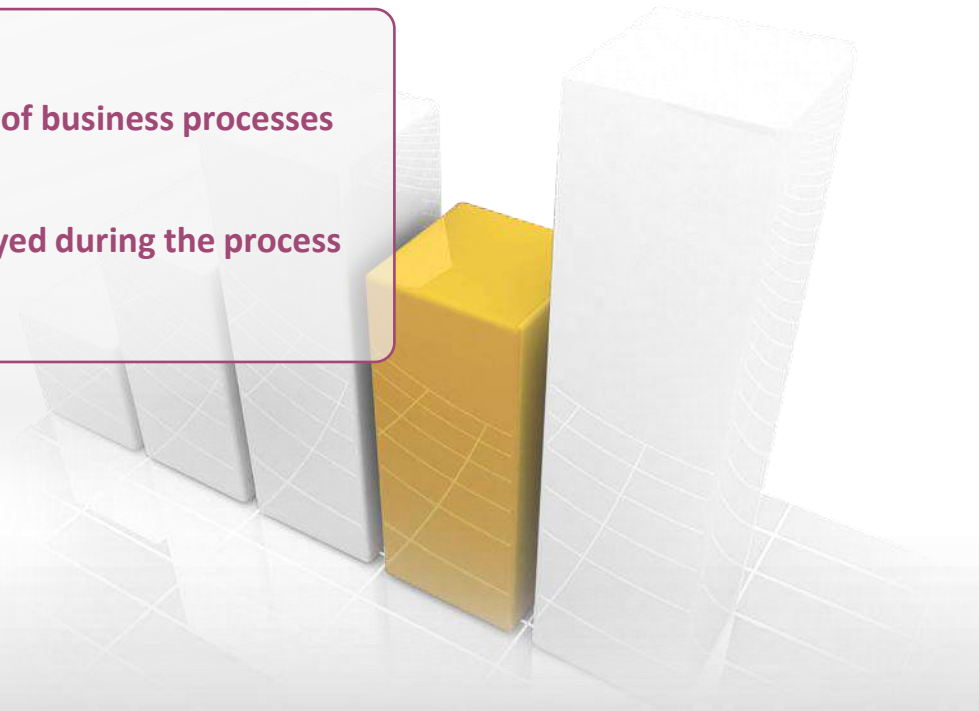
Business Process Modelling Notation

## Business Process Modelling Notation (BPMN):

- ✓ Graphical notation for describing processes.
- ✓ Enables graphical representation of business processes which take place in the company.

## Q - BPMN

- ✓ Software which enables graphical representation of business processes which take place during production at the plant.
- ✓ Also enables creation of screens which are displayed during the process performance.

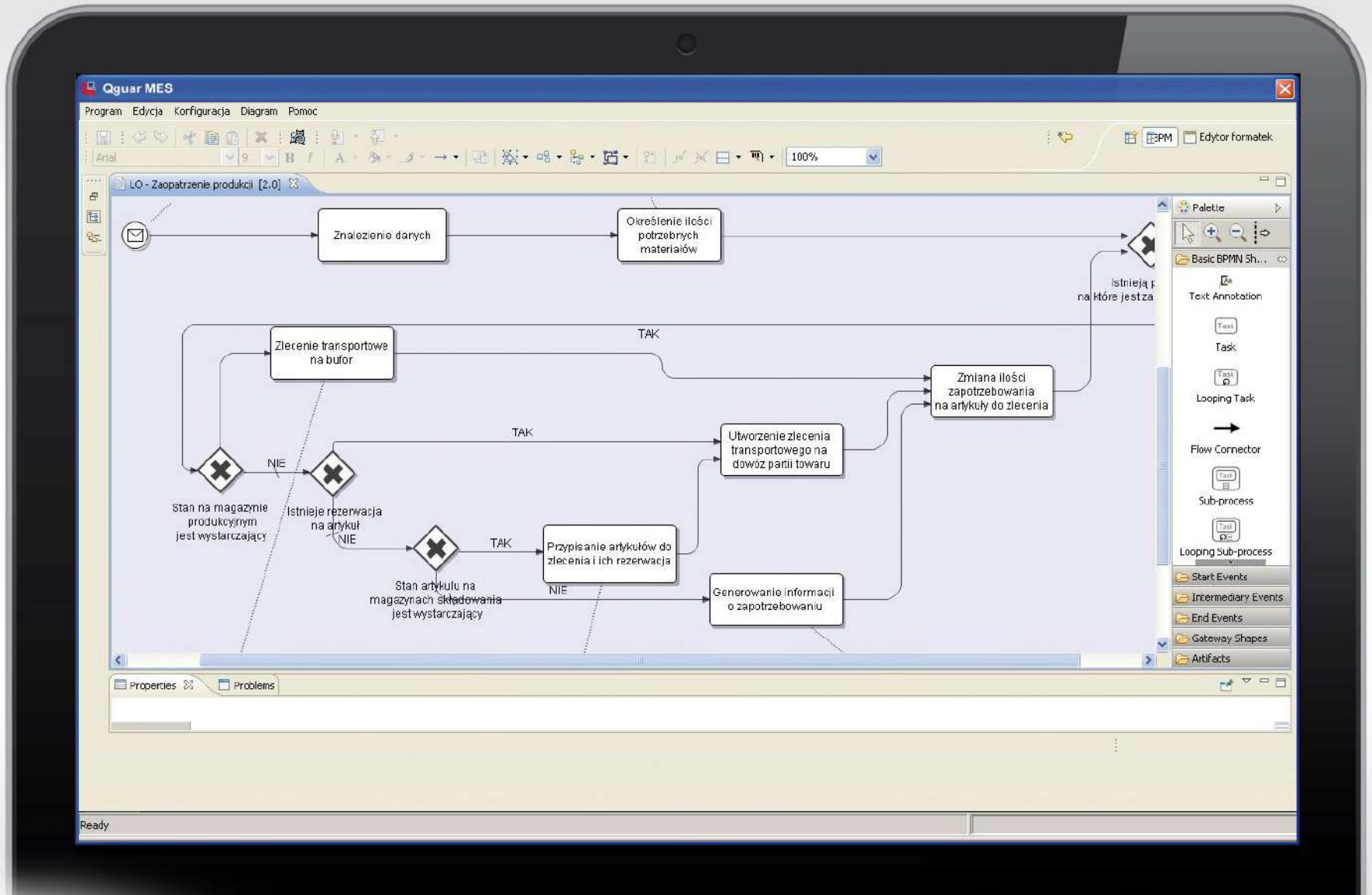


- ✓ **Configuration of the course of business processes**
- ✓ **Uniqueness**
- ✓ **Access to the inner definition structure - additional user-defined functions may be written**
- ✓ **Can be used for describing processes for MES, WMS and ERP software classes.**
- ✓ **Established open standard**
- ✓ **Supported by the largest IT companies**
- ✓ **Promotion of BPMN on the world markets**



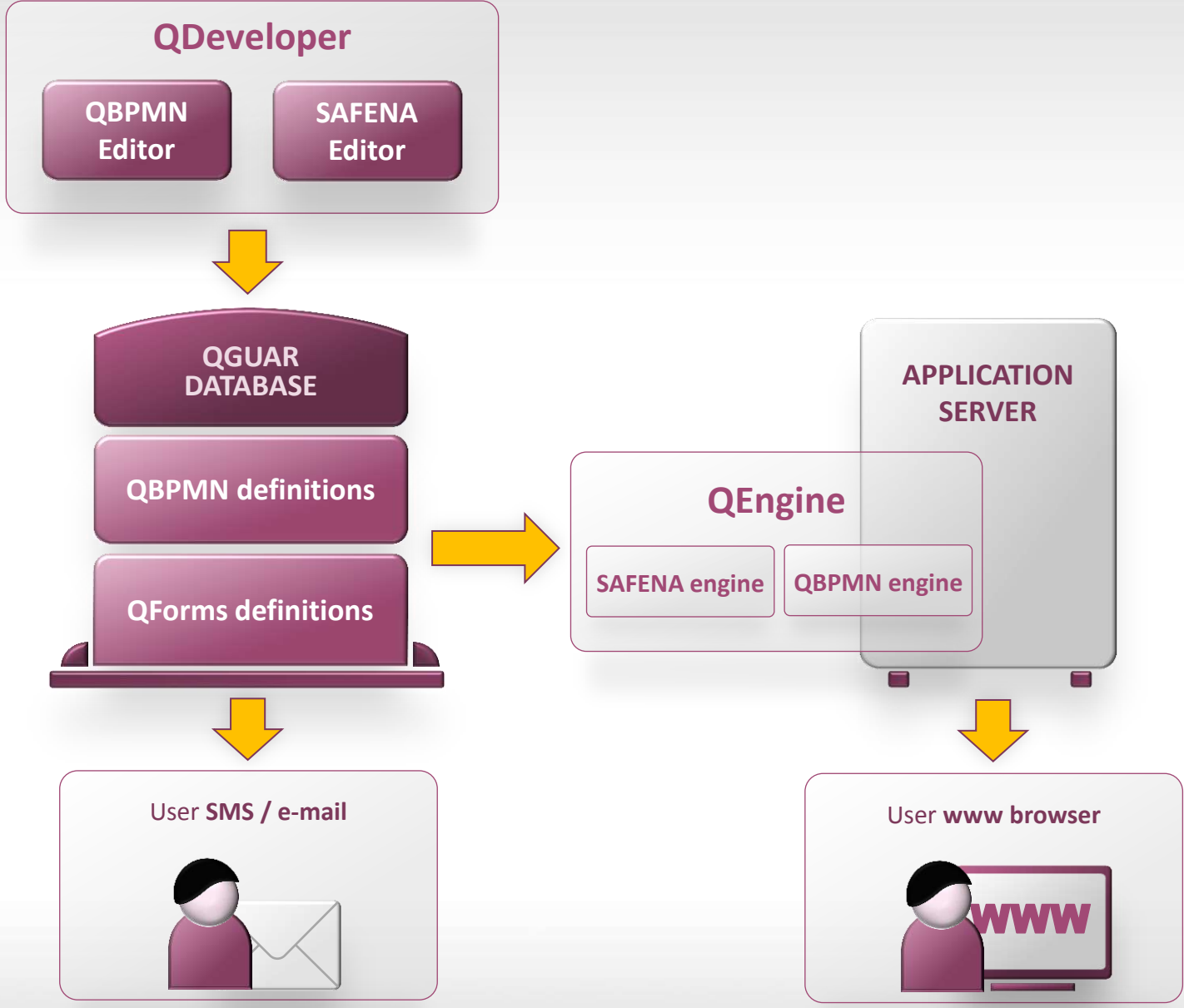
- ✓ Processes assigned to the production order (or operation) will serve as a routing; they will activate and be available to be performed as the status of an order or an operation changes.
- ✓ Processes of gathering information regarding the work performed on the finished product which are not directly connected to the order (servicing machine signals, for instance)
- ✓ Business processes which do not enhance the product value but they are necessary for the production flow to be easier, raw material delivery to the line, for instance
- ✓ Processes taking place automatically in the background on the basis of rules predefined during implementation, assigning machines to an operation, for instance

# Application Q Guar BPMN – sample screen

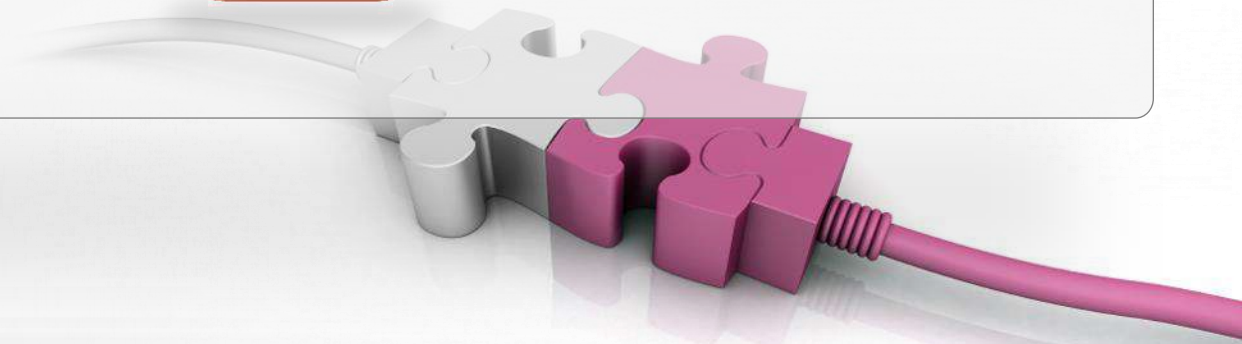
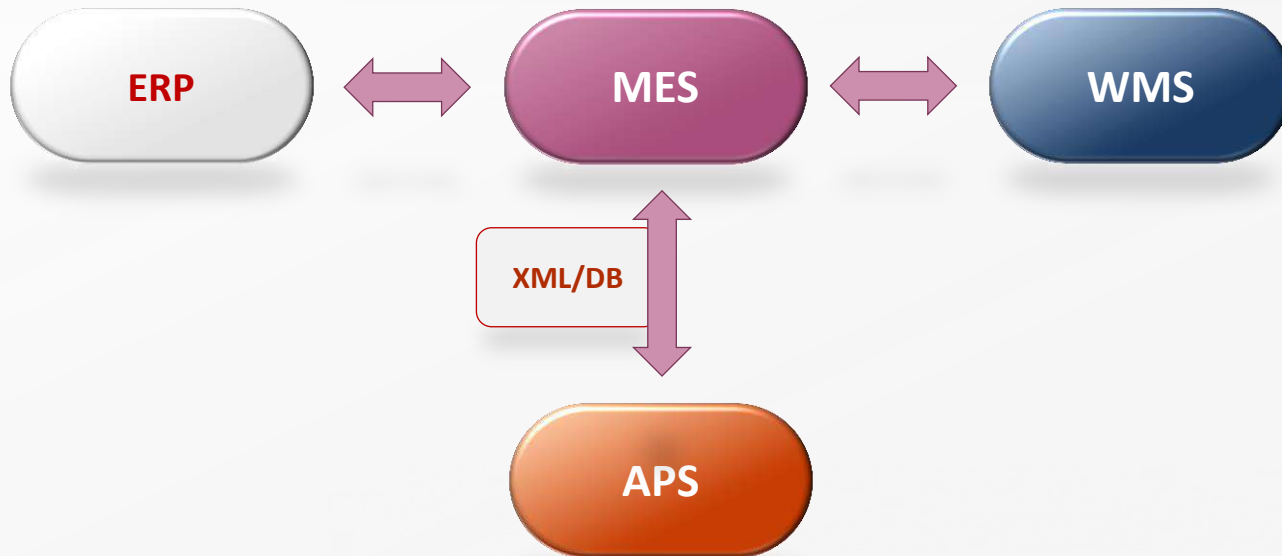




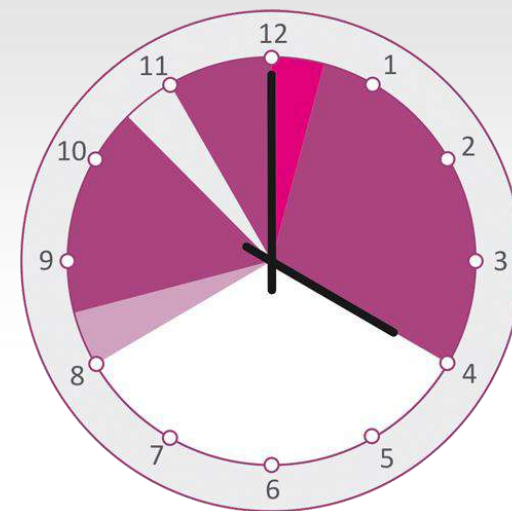
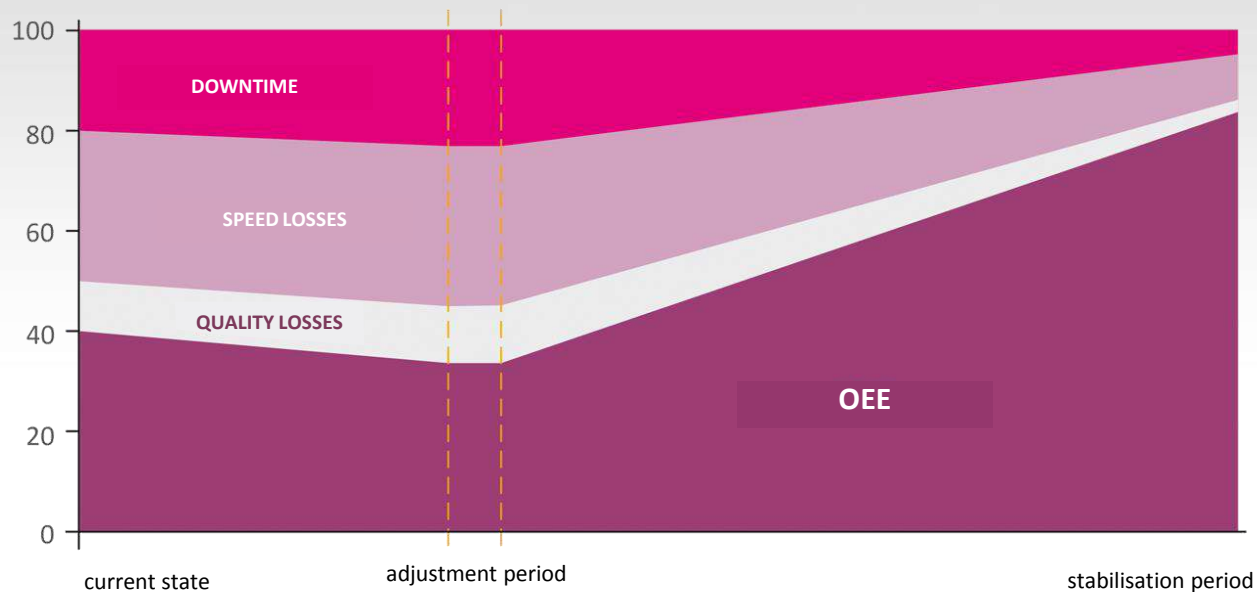
# Architecture of Qguar MES system



## Interface architecture



# Qguar MES - What do you get from deployment?



According to the report of **INDUSTRY DIRECTIONS Inc.**, an analytical and consulting group and an authority in logistics and manufacturing, the average changes of key indicators for manufacturing companies which implemented MES systems are:

OEE	Increase up to 84%
Own costs	Decreased by up to 34% *
Company profit	Increase up to 400% *
Energy consumption costs	Decreased by 57% *
Production capacity	Increased by 15%
Duration of a production cycle	Shortened by 37%

\* - data for 3 years

## Sample indicators ...



- ✓ OEE
- ✓ Material consumption
- ✓ Production reliability
- ✓ Proportion of orders within deadline and delayed orders
- ✓ Production time
- ✓ Technical efficiency
- ✓ Plan progress



- ✓ Shorter and fully controllable production cycle
- ✓ Monitoring of production in progress, machine work, resources
- ✓ Shorter information flow, real-time information
- ✓ Shorter planned and unplanned downtime, elimination of failures and damage
- ✓ Lower production costs
- ✓ Increased indicators (productivity, OEE etc.)
- ✓ Origin of produced defective products, prevention of defects, increased production quality.
- ✓ Comparison of plant work before and after Qguar MES was implemented...



**Thank you for your time**

