

# Market Driven Systems (FRTN20)

## Exercise 4 - Solutions

### Manufacturing Operation Systems (MOS) and Key Performance Indicators (KPI)

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#### 1.

- a. Suppose you work for a company that struggles with a decrease in profit. The costs related to production is therefore of importance. Five KPIs that are related to the cost of producing a product are e.g:
  - Cycle Time: the total time it take to make a product (from the beginning to the end of your product-making-process). The shorter the better.
  - Throughput: Quantity produced per unit . The higher the better.
  - Quality rate: The quality rate is the relationship between the quantities produced and the total quantity used. The higher the better.
  - Rework-ratio: how many products needs to be reworked. The fewer the better.
  - Downtime: how much time the production is not producing. The less the better.
- b. A KPI, Key Perfomance Indicator, is a performance measure. It is used to help an organization define and evaluate how successful it is. The KPI has a numercal value and it is possible to follow the changes of the value.
- c. The five KPIs:
  - Cycle Time: This is mostly related to time.
  - Throughput: this is mostly related to time
  - Quality rate: this is related to quality
  - Rework ratio: this is related to cost
  - Downtime: this is related to time

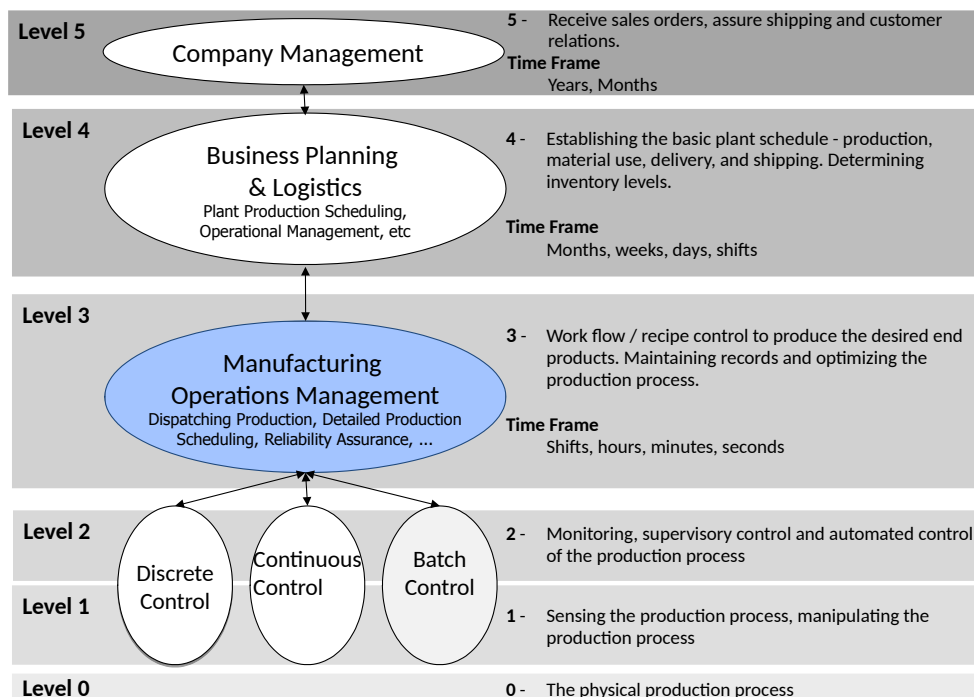
#### 2.

- a.
  - Higher output: an increase in the product volume being produced
  - Utility cost: the cost of the utilities e.g., cooling water, electricity, steam etc
  - Better yield: an increase in the ratio products produced/raw material used.
  - Fewer unwanted byproducts: a decrease of the number of byproducts (not main product) being produced.
  - Less labor: the number of labor hours being used in production
  - Better quality: an increase of the quality
- b. None of them are listed in ISO 22400-2, but the *Better quality* is similar to *Quality ratio*.
- c. The objective of ISO 22400 is to define KPI for manufacturing Operations.

3. The ISA95 standard is a standard in several parts. Part 1 and Part 2 deals with how level 4 systems (Business and logistics systems, ERP) and level 3 systems (MES systems) can be integrated. It deals with WHAT information should be sent between level 3 and 4. The standard lists 4 categories of information that should be sent; product definition, production capability, production schedule, and production performance. In addition, information about the resources should also be sent, i.e., personnel, material, process segments and equipment.

Our company consists of several sites. The sites all have different MES systems but the company has one ERP system, it is therefore of interest to standardize how ERP systems should be connected to the MES systems.

4. Manufacturing Operation Management is those activities of a manufacturing facility that coordinate the personnel, equipment, material, and energy in the conversion of raw materials and/or parts into products. Manufacturing operations management includes activities that may be performed by physical equipment, human effort, and information systems. Manufacturing Operations is defined as level 3. Business and logistics system is defined as level 4 and process control systems is defined as level 2, see figure below.



5. The four manufacturing operations categories are
  - Production operations: ...
  - Maintenance operations: ...
  - Quality test operations: ...
  - Inventory operations: ...

6. The eight activities in the activity model for production operations are:
  - Product definition management: Details about the product
  - Production resource management: Raw materials management
  - Detailed Production scheduling: Scheduling the production orders
  - Production dispatching: Deciding which equipment to use for which order
  - Production execution: Supervision of PLC
  - Production data collection: Log important production values, for example temperatures
  - Production tracking: Tracking the status of the orders
  - Production performance analysis: KPIs for the production
  
7.
  - a.
    - control improvement: less variance, better reference following
    - process improvement: simpler recipe
    - economical improvement: cheaper raw materials
  - b. See Krister Forsman's example.