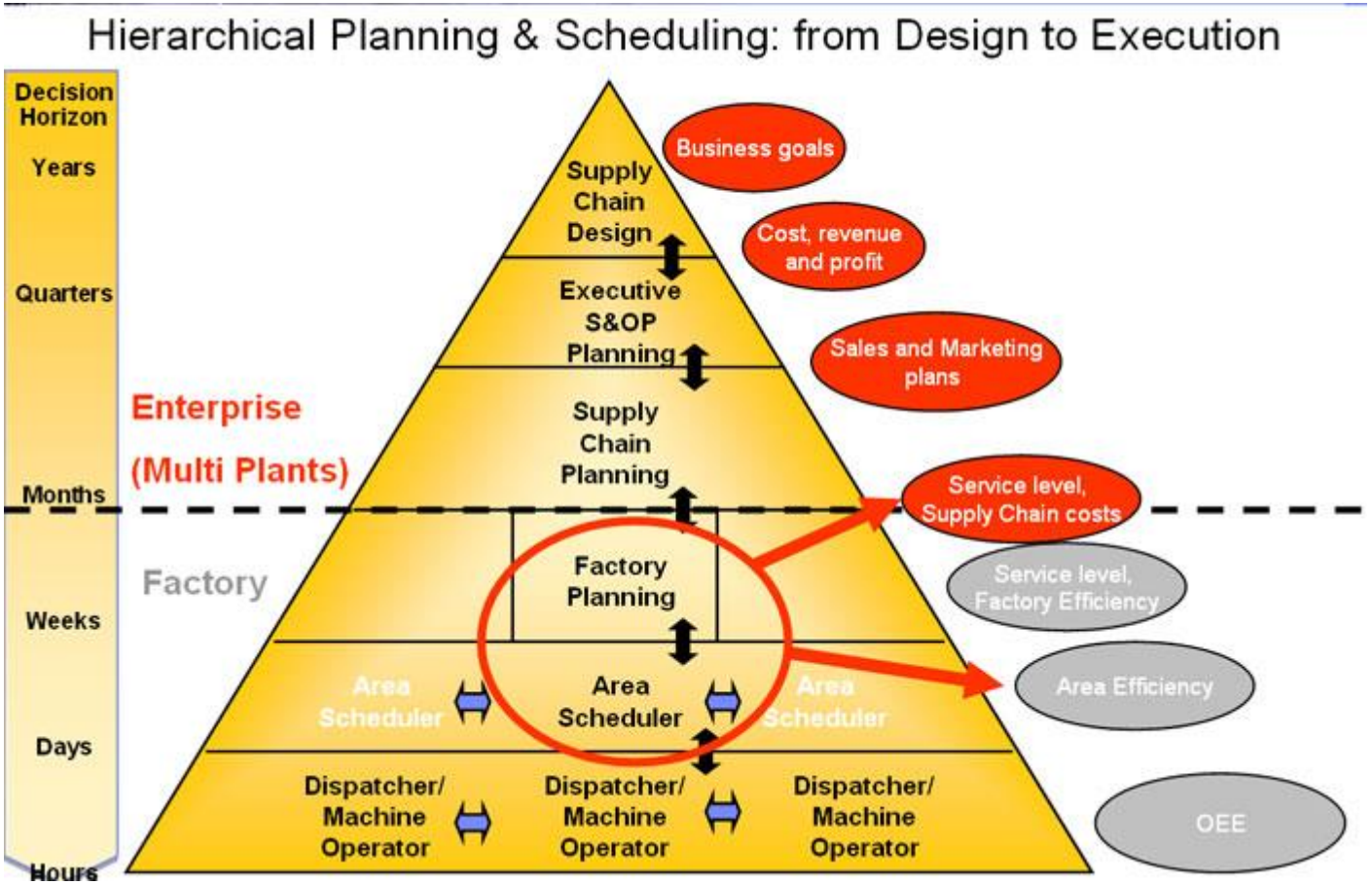
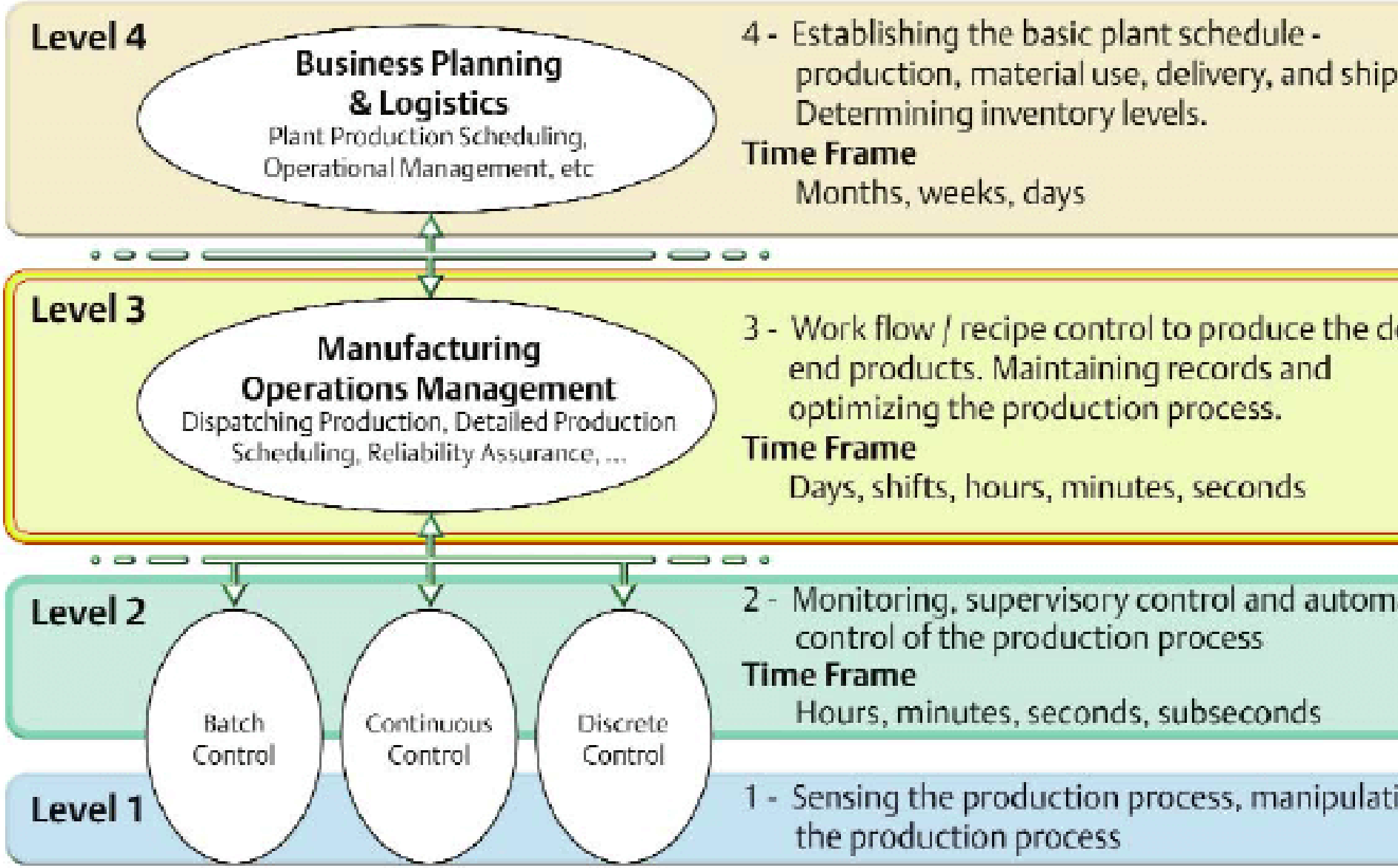
MRP, MRPII, ERP systems





ISA95: Enterprise-Control System Integration 1: Models and Terminology; ANSI/ISA95.00.01– 2000

MRP

Material requirements planning (MRP) is a production planning, scheduling, and inventory control system used to manage manufacturing processes. Most MRP systems are software-based, but it is possible to conduct MRP by hand as well.

An MRP system is intended to simultaneously meet three objectives:

- Ensure materials are available for production and products are available for delivery to customers.
- Maintain the lowest possible material and product levels in store
- Plan manufacturing activities, delivery schedules and purchasing activities.

MRP II

Manufacturing resource planning (MRP II) is defined as a method for the effective planning of all resources of a manufacturing company. Ideally, it addresses operational planning in units, financial planning, and has a simulation capability to answer "what-if" questions and extension of closed-loop MRP.

This is not exclusively a software function, but the management of people skills, requiring a dedication to database accuracy, and sufficient computer resources. It is a total company management concept for using human and company resources more productively.

ERP

Enterprise resource planning (ERP) is the integrated management of core business processes, often in real-time and mediated by software and technology.

ERP is usually referred to as a category of business-management software — typically a suite of integrated applications—that an organization can use to collect, store, manage and interpret data from these many business activities.

SAP ERP is enterprise resource planning software developed by the German company SAP SE. SAP ERP incorporates the key business functions of an organization.

Logistics and logistic system

Logistics is generally the detailed organization and implementation of a complex operation.

In a general business sense, logistics is the management of the flow of things between the point of origin and the point of consumption in order to meet requirements of customers or corporations.

The resources managed in logistics can include physical items such as food, materials, animals, equipment, and liquids; as well as abstract items, such as time and information.

The logistics of physical items usually involves the integration of information flow, materials handling, production, packaging, inventory, transportation, warehousing, and often security.

Logistics systems classification

Usually based on the definition of demand vs production and distribution
Extreme cases are :

- **“su commessa”** (***pull, make-to-order, MTO***): products are produced when ordered.

- **“su base magazzino”** (***push, make-to-stock, MTS***): demand prediction on order to anticipate the production.

Decisional structure

Strategic: referred to the infrastructure of the logistics, and it requires huge investments

Examples: optimal location of logistics centres, design of the delivery network.

Tactical: usually referred to available resources and usually based on forecast (annual, seasonal, weekly)

Examples: to assign demand to logistics nodes, to assign vehicles to logistic nodes, to define how to manage resources.

Operational: weekly/daily work definition defining required personnel and resources (done by MES if present)

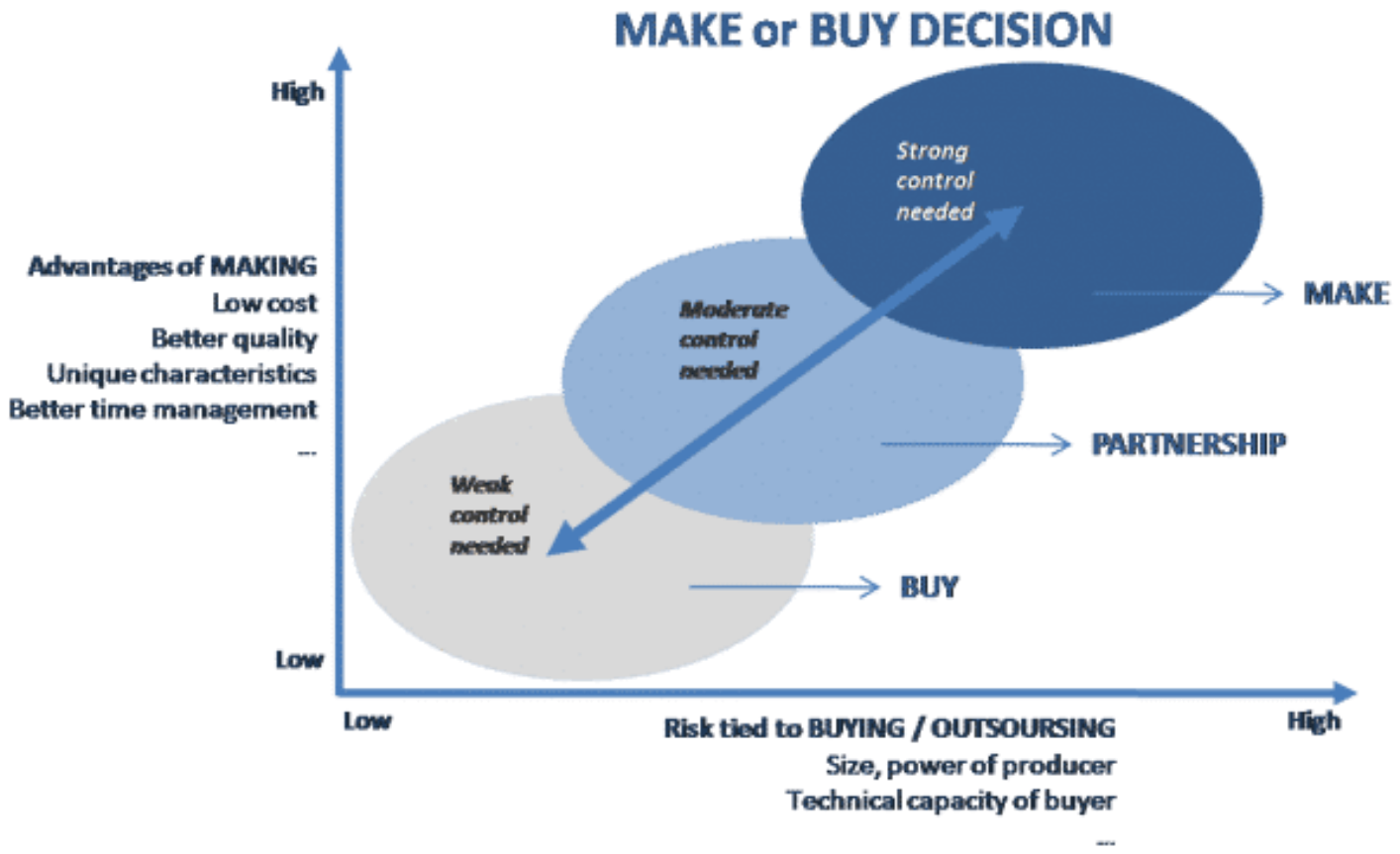
Examples: to feed distribution centres, to deliver final rpoducts to customers, to reallocate vehicles to distribution centres

Strategic-long term planning

- Involving the top level of the company;
- Requiring important investments on a long period
- Requiring modelling scenarios on long term in what-if approach
- Defining developing activities of the company;
- Deciding investments in infrastructures and to dimension the distribution «fleet»;
- To define services to be provided and prices.

Strategic-long term planning

Classic strategic problem **“make-or-buy decisional problem”.**



https://www.youtube.com/watch?v=WOknwNjI4t8

Make or Buy | Outsourcing

	Make	Buy
Variable Cost		
to make	$4	
to buy		$5
Plus fixed Costs	____	____

Tactical– medium term planning

- Involving high level of the company;
- Based on forecast in a «group by» way, so that decisions are partially subject to noise;
- examples: defining frequences and times of delivery, general assignments of vehicles to distribution centres.

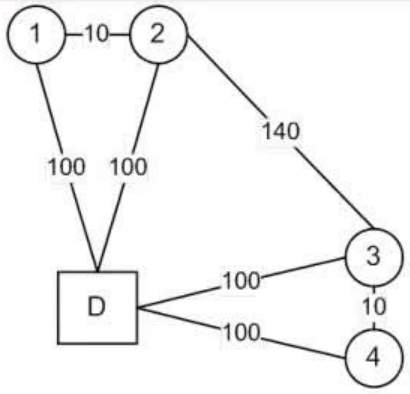
https://www.youtube.com/watch?v=A88uoWbxG2M

Operations– short term planning

- Involve local management;
- Daily planning of resources managing demand and noise;
- Detailed knowledge of personnel, vehicles, infrastructures, machines;
- Decide on scheduling of services, fleets, mainntenance, routing, dispatching… done by MES if available,

https://www.youtube.com/watch?v=oi3qnH-jRMk

Integrated Demand Forecasting and Routing



	Customer			
	1	2	3	4
Tank Capacity	5000	4000	2500	4000
Daily Usage	1000	3000	2000	1500

ORTEC

Methods

Mathematical programming

- Linear Programming (LP)
- Integer Linear Programming (IP)
- Non Linear Programming

Heuristic

- Good practise algorithm
- Local search or greedy algorithms
- Metaheuristic

Tools

Mathematical programming

- Excel (optimisation tools)
- Lingo
- Cplex
- Matlab

Heuristic

- Matlab