Logisticians' training course according to ELA standards – Senior Level (ESLog)

MODULE E :

DEMAND, PRODUCTION AND DITRIBUTION REQUIREMENTS PLANNING

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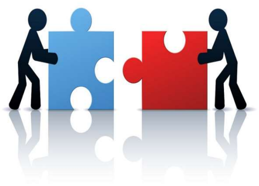

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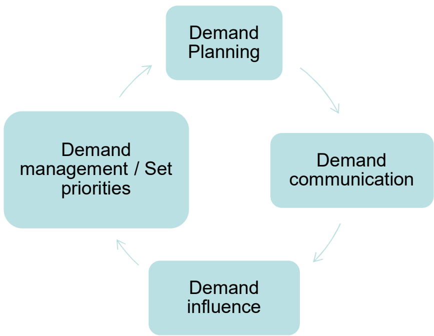
6.3.05.01 Improving the demand management process.

Demand management process

The demand management process is the procedure that aims to balance customer needs and supplier's capabilities, using specialized Information Technology Systems (IT systems) and trained staff. That is a process that aims to **equalize demand with supply!**



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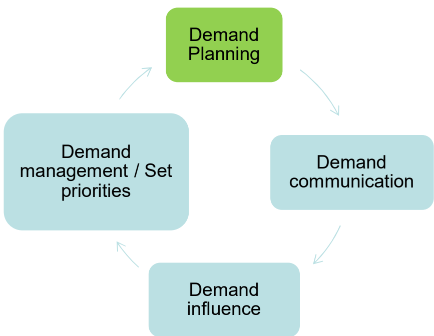
Demand Planning

Demand planning doesn't have to do only with the forecast. The forecast is the starting point. It is an action plan based on the logic of the "Demand Plan" and includes assumptions, promotional actions, plans to introduce new products and pricing policies.
The usual planning time period is 24 months with regular monthly reviews.



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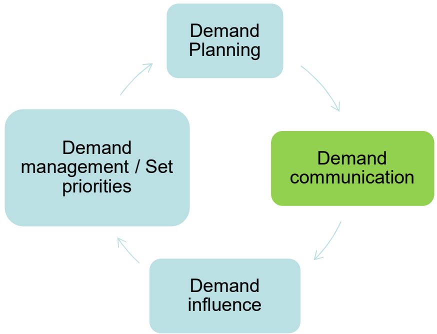
6.3.05.01 Improving the demand management process.

Demand communication

Implementation of a structured process communication.
Communication to stakeholders
must be done the quickest possible
to avoid any surprises.
It must be structured to
Ensure that is done correctly. Must be
focused and should be adapted to
stakeholders.



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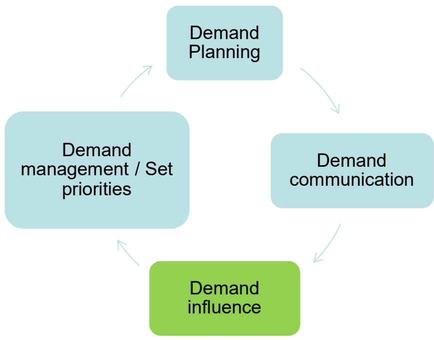
Demand influence
The impact of demand is
the effort to balance the
supply with demand. Describes
the actions of marketing and
sales in order to convince customers to
supply the company's products
on the most profitable moment in terms of
availability. The purpose of the influence
of demand is to support business
company goals and manage abnormal
demand.



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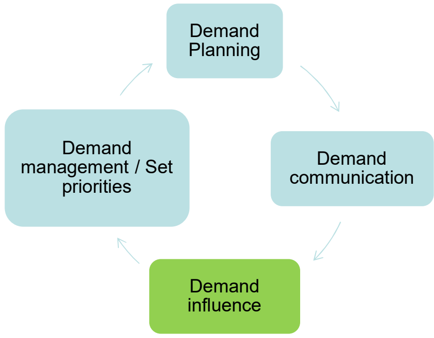
Demand influence

Examples of actions in demand influence:

- Beware of the most profitable product mix.
- Strategic pricing.
- Product distribution.
- Promotion of products.



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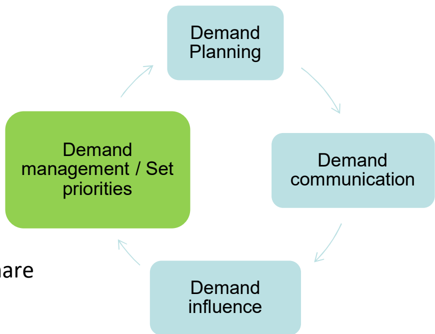
Demand management / Set priorities

To properly manage the abnormal demand should:

1. To give the right for management and demand prioritization options to the right people in the company.
2. Share the order with the warehouses or with the resellers in cases of Product shortages so that everyone gets a share from the total.



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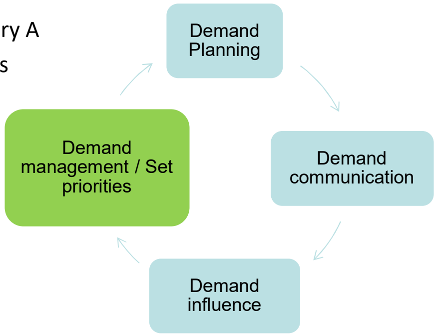
Abnormal demand management

3. Prioritize production of products in category A
 in order to meet the needs of these products
4. To satisfy any large,
non-recurring orders
in case they could affect the
regular orders.



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6.3.05.02 Implementing collaborative forecasting.

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6.3.05.02 Implementing collaborative forecasting.

CPFR Model

(Collaborative Planning, Forecasting and Replenishment)

CPFR model is a framework of collaborative planning, order execution forecasts and stock replenishment, which aims a holistic approach to supply chain management.

It combines the knowledge of business partners at all designing levels and meeting customer demand, using common indicators, common language and corporate agreements to improve efficiency for the benefit of all participants.

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CPFR Model

(Collaborative Planning, Forecasting and Replenishment)

The basic principle of the CPFR model is that all participants in the supply chain develop a commonly accepted, synchronized forecast.

Anyone involved in a CPFR collaborative design process - **supplier, manufacturer, distributor, reseller** - can view and change the forecast elements to improve the process.

Basically, the CPFR model puts an end to the guesswork.

This means that all participants share all the knowledge, data and information they have with all their details, the assumptions and the commitments that exist.

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The above diagram shows the relationship of the three key players in the four phases:

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CPFR Model
(Collaborative Planning, Forecasting and Replenishment)

- The core of the model represents the **consumer,**
- The middle ring the **reseller** (buyer) and
- The external ring the **manufacturer** (seller).

The consumer determines the demand for goods and services while the reseller is the supplier of these ones. The manufacturer supplies the sales channels (stores) with the products, depending on the demand caused through the supply chain by the end user, ie the consumer.

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The phases of the most updated CPFR model:

Strategy & planning

Establishes the basic rules for the collaborative relationship such as business objectives, purpose of cooperation, role definition, responsibilities, control points and escalation procedures.

Supply & Demand Management

It consists of sales forecasting, order planning / forecasting, stocks and lead times.

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The phases of the most updated CPFR model:

Implementation

It includes the creation of an order, ie the conversion of the forecast into real demand and the satisfaction of the order, ie the process of production, transport and delivery and storage of products for the supply of consumers.

Analysis

It includes the management of exceptions and the evaluation of performance. Exception management is the active monitoring of the design and operations for the out-of-the-ordinary conditions, while performance appraisal is the assessment of the achievement of business objectives to reveal hidden trends or to develop alternative strategies.

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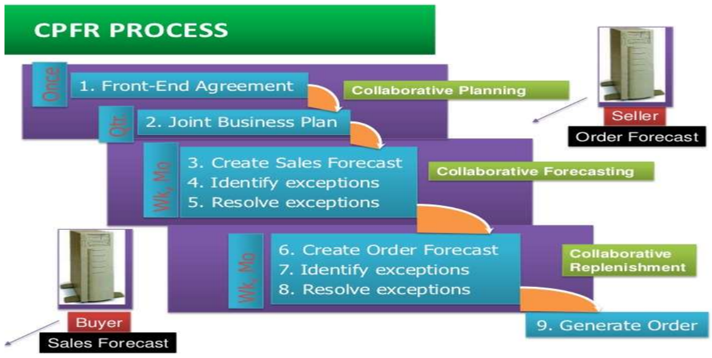
Steps of the CPFR model
(Voluntary Interindustry Commercial Standard, 1998)



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Steps of the CPFR model (VICS, 1998)

Phase I: Collaborative Design
This phase is related to human resources, processes and building trust.

1. Development of the front-end agreement
Partners need to define their relationships and identify what processes they need to change in order to achieve strong collaboration. This means that you must:
- create and update joint documents determining the terms of the agreement.
- Define and measure specific KPIs.
- Ensure that everyone has access to the information at the same time.

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Steps of the CPFR model (VICS, 1998)

2. Creating a joint business plan

The basic agreement is valid for as long as the cooperating companies exist. Obviously, a large amount of information should be exchanged between the collaborators.

- Who will be informed and why?
- When, where and at what depth?

To answer these questions, a joint business plan is created. The "warning points" should be defined and those responsible should act in these cases and the time frame they should act. Specific benchmarks and KPIs need to be defined to evaluate the effectiveness of the joint project.

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Steps of the CPFR model (VICS, 1998)

Phase II: Collaborative Forecasts

In Phase II, **sales forecasts** are made collaboratively by a company, which are then used to determine **order forecasts.**

Exceptions are also identified and resolved at the level of sales forecasts.

This creates a unique collaborative sales forecast that can capture the complexity of the business environment.

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Steps of the CPFR model (VICS, 1998)

3. **Create sales forecast**

Collaborative forecasting is the "heart" of a successful implementation of the CPFR model.

Businesses, using demand forecasting software, can develop multilevel models, which may include product hierarchies, geographies, channels, and specific customers.

They can also take into account variables (causal variables) such as pricing, promotions and opening new stores.

Finally, historical data can be combined with "almost" real-time variables in sales channels, so that we have the most accurate forecasts.

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Steps of the CPFR model (VICS, 1998)

4. **Identify exceptions to sales forecasts.**
5. **Resolving the exceptions.**

Exceptions are easily identified, and the details of the exceptions are communicated.

Each of the actors (partner, supplier and customer), learns, as a member of the collaborative process, the exceptions in real time.

The final prediction that resolves the exceptions is the combination of the most accurate and up-to-date information available.

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Steps of the CPFR model (VICS, 1998)

Phase III: Collaborative Stock Replenishment

6. Create order forecast

In order for ordering forecasting, to support joint sales forecasting is based on:

- In Point Of Sales (POS) data,
- In the information causes of changes (causal information), and
- In stock strategies

Actual volume data capture inventory targets by product and warehouse. Order forecasting allows manufacturers to adjust their production to demand while minimizing safety stock.

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Steps of the CPFR model (VICS, 1998)

7. Identify exceptions to order forecasts

The cases that are outside the limits of the order prediction set by the partners are defined. As a result, we have a list of exceptions that are defined using the criteria established in the front-end agreement.

8. Resolving the exceptions

It is the investigation of exceptions in order forecasting by the method of researching the data and using the results to change the order forecasts. Once again, the rules set out in the original agreement define how these exceptions are handled.

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Steps of the CPFR model (VICS, 1998)

9. Order creation

The final step in the CPFR model is the creation of the order and the commitment for a correct delivery. The key to maintain a relationship of trust with our partners and customers is to deliver what we have promised. Applications such as "Order promising", or "tagging" of products or raw materials and the scheduling of the production and the transportation ensure that the product is ready when needed.

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Challenges in the CPFR model

The collaborative design-forecast-replacement (CPFR) model may seem **simple**, but its **real implementation is difficult.**

Since it involves working with different business partners, there are differences in the way of thinking between them and some understanding and adoption of the rules by everyone is required.

Changes in existing processes are needed, and an effort to look at things from a broad multi-corporate perspective

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Challenges in the CPFR model

The challenges when implementing the CPFR model that the companies may face are:

- Selection of partners in the CPFR model.
- Adoption by the Senior Management.
- Confidentiality.
- Change of culture and way of thinking.

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Advantages of the CPFR model

1. **Improved customer service due to better technical forecasts.**

The most reliable forecasts allow the execution of customer orders from the entire supply chain, in a more efficient way and therefore allow the company to plan the production capacity accordingly. The chances of stock-outs are reduced, which improves the execution of orders and that in turn increases revenue, deliveries and the level of customer service.

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Advantages of the CPFR model

2. Reduced stocks for higher profits

Accurate demand forecasts reduce stock-outs and provide better knowledge of production needs.

Safety stocks due to well-designed production can be reduced, resulting in reduced inventory costs, reduced storage needs and reduced number of potentially defective or even devalued products.

In addition, there is an improved flow of raw materials and release of resources that can be used in other areas of production than being tied to the inventory.

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Advantages of the CPFR model

3. Improved ROI (Return on Investment) in Technology investments

The necessary investments in technological equipment for the implementation of the CPFR model give an advantage to the participants due to the reduction of indirect (overhead) costs that is achieved through the elimination of various inefficient practices such as:

- Non-automated processes,
- Connection of different data processing systems between the partners and
- Search for information from different sources / systems.

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Advantages of the CPFR model

4. Improved relationships between business partners

Business partners understand better the work of others by exchanging information and establishing direct communication regularly, thus creating a win-win situation for all partners.

5. Cost reduction

This is happening when production is equal to agreed demand forecasts. Costs are reduced when we minimize production and preparation times, repetitive actions and changes / deviations. There is also more efficient use of production potential as design information is more reliable.

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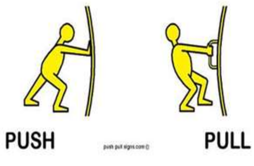

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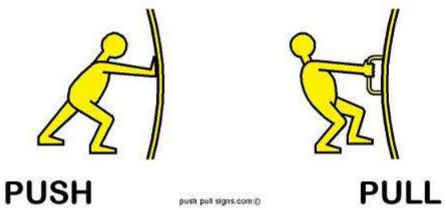
Designing Push vs Pull



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Push Design System
Based on Forecasts

It is a production planning system based on the sales forecasts of the final products. From the moment the products are produced and assembled, they are "pushed" to the next level regardless of whether it is necessary (existing order) or not.

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MRP System

The term MRP is used to describe systems called Materials requirements planning (MRPI) and Manufacturing resource planning (MRPII). **It is a classic push design technique.**

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MRPI vs MRPII vs ERP

The term **MRP** I is used for material requirements planning systems and has to do with having the **right amount of raw materials** at the right time to support production that is designed based on demand forecasts.

The term **MRP II** is used for manufacturing resource planning systems and expresses what MRP I does but also **adds production planning** and monitoring tools.

A third-generation system called **ERP** (enterprise resource planning) integrates **all parts of the business, not just the construction and procurement departments.**

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MRPI

MRP I was developed in the 1970s to help construction companies manage better the supply of raw material to support production.

MRP I systems "transform" the master production schedule (MPS) into needs at the level of components and raw materials, by separating the product that is to be manufactured into independent parts / components whose quantities are in the list of materials (Bill of materials) available for the manufacture of this product.

In this way the procurement department knows when to procure these components based on the lead time of each component registered in the MRP I system.

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MRPII

MRPII (Manufacturing Resource Planning) goes several steps beyond MRPI.

The MRPI stops at the point of the receipt of the raw materials.

MRPII includes the entire MRPI range and in addition the entire route from manufacture to the point of loading where the product is packaged and shipped to the final customer.

This path includes production planning, mechanical capacity equipment planning, demand forecasting and analysis data as well as quality monitoring tools. MRPII also has tools for monitoring productivity and employee participation and attention.

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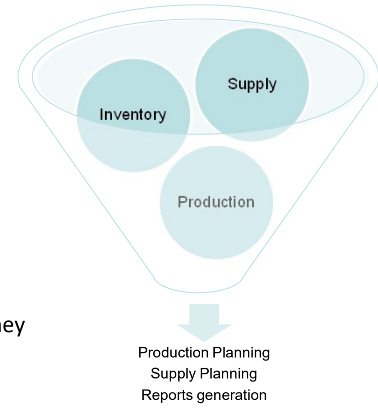
MRP System

MRP is a standard push-system.
A computer-based system for the supply, production and inventory control that minimize inventory while ensuring a sufficient number of materials for the production process or otherwise constructs production programs based on sales forecasts of finished products. Since the intermediate products will be produced, they are promoted to the next level whether necessary or not.



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MRP = PUSH

Advantages	Disadvantages
Allows managers to plan and control in time(effective in cases with low demand volatility)	It can lead to high inventory levels
Requires good knowledge of production times and production flow.	It can generate large amounts of scrap before troubleshooting.
It can lead to economies of scale in supplies and production.	It requires consistency to maintain efficient production flows.
Allows the design and completion of complex products since the components are received only based on needs.	Requires the maintenance of large and complex databases.

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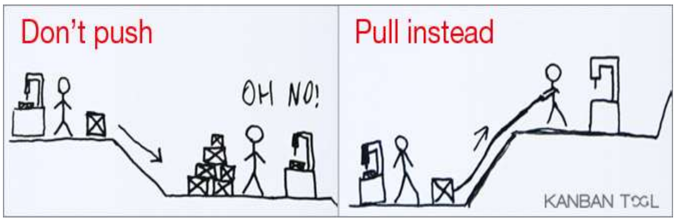
Pull Design System

Based on Real Demand



It is a production planning system where production at one level is implemented only when there is demand from the next level. This means that the unfinished products are "pulled" in the production system upon demand (order) or in other words based on demand.

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Kanban System.

We may find the Kanban system as a pull design technique:

- *In a production environment*: It is the system that supplies the production process with components and materials exactly when they are needed, so that these materials and components are used immediately.
- *In a commercial environment*: It is the system that starts the order satisfaction process at the very moment when the order is placed in order to deliver exactly what the customer has ordered.

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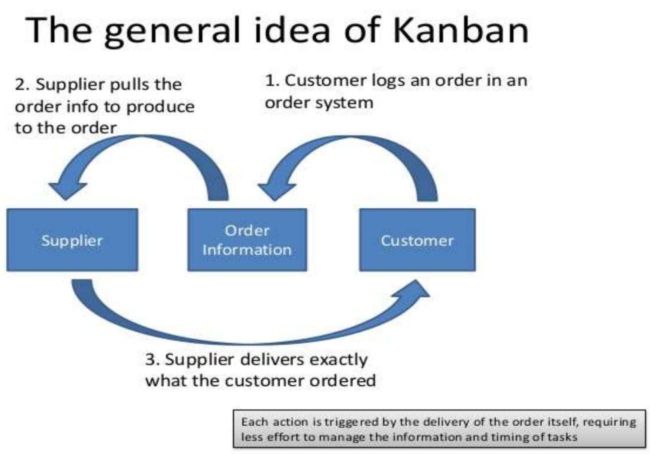

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Kanban System – Operating Principle

It is known as a key part of the Toyota Production System (TPS). Developed by Toyota Motor Company in the 1950s.

"Kanban" means "sign" in Japanese and the system was named likewise because it requires the use of signs ("Kanbans").

Kanban is basically a system of controlling and procuring materials and components just when they are needed in the production process so that those components and materials can be used immediately. But it is not related to inventory control system.

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Kanban System – Operating Principle

Kanban signs, are marked to the boxes (containers) that contain a certain amount of the specific component.

They indicate the need to move the boxes inside the production area or the movement from an external supplier to the production site.

There are two types of signs:

- "Move" label and
- "Production" label.

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Kanban System – Operating Principle

For the Kanban system to work effectively:

- Only one label should be placed in each container at any one time.
- The point of the usage should indicate the movement of components from the supply center.
- No processing of parts is permitted without the production label.
- You never move or produce anything other than what is specified on the label.
- Labels should be handled according to the FIFO principle.
- Finished products should be placed according to label indication.

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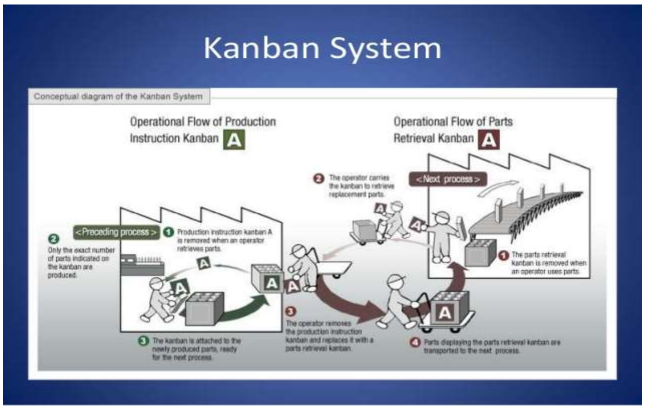
Kanban System – Operating Principle



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Kanban System – Advantages

It has all the advantages of the Pull systems.

In addition, because each Kanban label represents a fixed number of components manufactured or used in the production process, we can easily control the inventory that is under processing by the number of labels in the production site.

In addition to improving the cost of inventory holding, there are other benefits, such as improving:

- Quality and
- In the efficiency of the production area.

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KANBAN - JIT = PULL

Advantages	Disadvantages
Limited and known final stock. Effective for cases with high demand variability.	Each task is considered as 'High Stress' urgent order
Employees spend time and materials on what they really need.	There should be in place **balancing** and operational systems.
The quality **MUST** be of high level - each piece goes to a specific place - otherwise there is relevant briefing.	Every problem leads to dissatisfied customers (internal or external)

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Push - Pull design systems

The Push and Pull methods offer two completely different approaches to basic production design in the manufacturing environment. Each has advantages over the other, but neither seems to be enough on its own. Both have advantages and disadvantages, while the bottom line is that both methods can be useful in the same company.

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Hybrid Push – Pull

There are several industries that apply a hybrid push and pull model.

We could refer some examples of supply chains for raw materials and processed products, such as the wood, paper, meat processing, dairy, mineral and petroleum industries.

In the supply chains of processed products, we usually produce at the same time, a wide variety of finished products of high and low value, depending on the quality of the raw material.

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Hybrid Push – Pull

In these cases, the supply chain **operates according to the pull system (production and supply on demand) for high value finished products.**

However, the number and quantities of low value finished products produced are not based on real demand and often not even on demand forecast, but as by-products of the main product.

These are "promoted" by using the **push** system to the final consumer, in particular by using special prices to give the right motivation for their purchase.

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Hybrid Push – Pull

Raw materials can be "pushed" continuously into the supply chain either through the operation of specialized and complexed units (eg petrochemical plants) or through much simpler processes such as, cow milking twice a day.

What usually determines whether an industry **operates** with the **push or pull** model is:

- the economies of scale that can be achieved and
- the **uncertainty in demand.**

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Push - Pull designing systems

Differentiation factor	Push model	Pull model
Basic driving force (Prime business driver).	Maximize the use of available resources, raw materials or company's structure and organization with minimal costs.	High level of customer service through flexibility and responsibility to serve variable customer demand.
Supply chain strategy.	Implementation of strict procedures to meet demand. Emphasis on demand forecasting. Investigation of postponement possibility. Separation of parts for which a demand-based channel can be created (pull channel) and, if necessary, creation of alternative business units.	Operation that meets customer demand. Emphasizes in the basic principles of lean design (lean principles). That is, creating value for customers with minimal resources.
Total time period of ordering cycle(Lead times)	Long order satisfaction time period, while the main goal should be for them to be reduced.	Short period of time to satisfy the order.

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Push - Pull designing systems

Differentiation factor	Push model	Pull model
Pricing strategy	Price strategy is a key tool for balancing supply and demand.	The pricing strategy usually has no effect on short-term demand.
Manufacturing Strategy	Large production lines. Technical improvements should aim to reduce the economies of scale and help shift more towards to a pull model.	Small and flexible production lines.
Inventory	Usually, high. Emphasis on inventory level planning, implementation of security inventory policy and product categorization according to ABC. Maintain inventory as close to the customer as possible.	Usually low. Maintain inventory as far away from the customer as possible.

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Push - Pull designing systems

Differentiation factor	Push model	Pull model
Third party relationships.	Relationships with suppliers are usually the most important. Establish cooperative relationships with customers to minimize false predictions.	Customer relations are the most important. The importance of relationships with suppliers varies by occasion.
Sections with the most critical technology applications.	Sales forecasting, inventory management, network optimization, advanced planning.	Order satisfaction, e-commerce, advanced planning, data recovery from POS (point of sale).

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Hybrid Push - Pull

Customer order Decoupling point

By all means, each supply chain is different. A critical factor that differentiates them is the location of the decoupling point in the supply chain.

The customer order decoupling point (CODP) is the point in the supply chain where a customer's specific order is placed.

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Hybrid Push - Pull

Customer order Decoupling point

The basic options when designing the supply chain are:

- Production towards storage (make-to-stock)
- Assembly based on the order(assemble-to-order)
- Production based on the order(make-to-order), and
- Design based on the order(engineer-to order).

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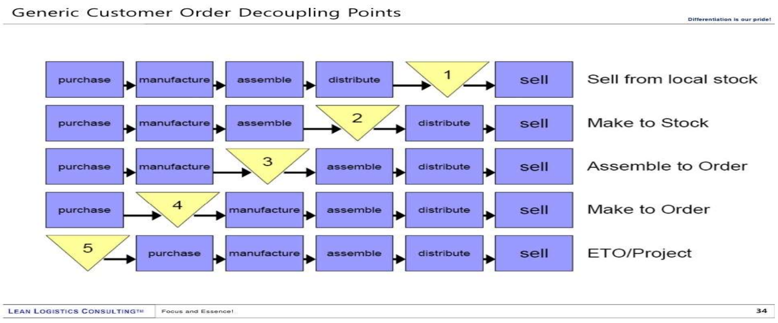
Hybrid Push - Pull

Customer order Decoupling point



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Hybrid Push - Pull

Customer order Decoupling point

Sometimes the customer order Decoupling point CODP is also called the **order penetration point.**

As a rule, customer order Decoupling point (CODP) coincides with the most important storage point (stock point), from where the customer's ordering process begins.

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Hybrid Push - Pull

Customer order Decoupling point

From a value chain perspective, there is usually a fixed customer order decoupling point along the material flow line in the value chain.

From the company's point of view, the customer order decoupling point (CODP) can be placed within the boundaries of its production sector or it can be placed in the suppliers (or even upstream- in the value chain), at the point of connection with the supplier (raw materials inventory), at the point of connection with customers (in the finished products' inventory), or even further downstream in the supply chain.

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Hybrid Push - Pull

Customer order Decoupling point

The customer order decoupling point, therefore, separates the operation phases guided by forecasts (before the decoupling point - upstream of the CODP) from those that are guided by the customer order (demand driven) (decoupling point and more below - the CODP and downstream).

The disconnection point is also the last point where stock is held (Sharman 1984).

The inventory level at the decoupling point is considered important as the delivery agreements are based on the product availability at this point, as well as the lead times and the customer response capabilities after the CODP.

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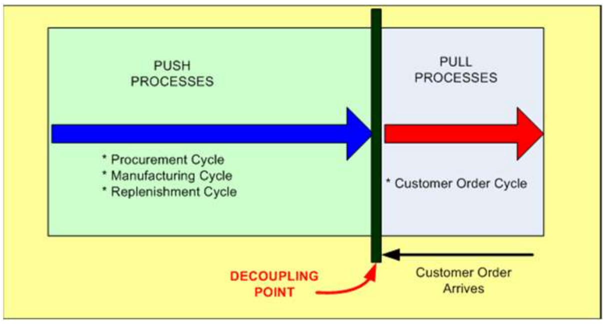
6.3.05.03 Understanding push / pull planning

Hybrid Push - Pull

Customer order Decoupling point



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6.3.05.03 Understanding push / pull planning

Hybrid Push - Pull

Customer order Decoupling point

Another definition of the decoupling point is one that relates it to the concepts of independent demand (e.g., finished product demand) and dependent demand (e.g., component demand).

According to this definition:

Decoupling point is the point where independent demand becomes dependent.

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6.3.05.04 Optimising planning parameters to fine tune inventory holding.

Order execution cycle

In inventory management it is important to understand the meaning of the following two terms:

1. **Total Delivery Time or Lead Time.**
2. **Total Reaction Time.**

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Total Delivery Time / Lead Time

It is the total time allocated between the placement of the order till the receipt by the customer at his warehouse. Indicates the time a project is completed until the delivery of the order.

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Total Reaction Time

It is the time period the customer gives to the supplier to deliver the order to the agreed place.
Indicates the time but not the effort (work) consumed to satisfy the order.

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Total Delivery Time – Lead Time

vs

Total Reaction Time

Exercise:

On day 0, the customer places an order in the system with a requested delivery date on day 6 in his warehouses.

The order is visible to the company at the same moment. On day 4 the storekeeper prepares and loads the order into the truck. The order is delivered to the customer on day 6. What is the total delivery time and what is the reaction time reaction time?

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Total Delivery Time/Lead Time

vs

Reaction Time

Reaction Time **>** Total Delivery Time

When the reaction time is longer than the total delivery time, then it is not necessary to keep stock.

Reaction Time **<** Total Delivery Time

When the reaction time is shorter than the total delivery time, then it is necessary to maintain stock to meet demand until the order is delivered.

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Total Delivery Time – Lead Time

The total delivery time consists of the following sub- period times:

- Order preparation and placement.
- Order receival and entering it in the system.
- Order processing.
- Receival from the warehouse and packaging.
- Transportation.
- Receipt from the customer and unloading.

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Total Delivery Time – Lead Time

During delivery time,
the company is exposed due to
demand uncertainty.
Whether the company can satisfy
demand from existing inventory,
depends on demand and
stock at the moment when the
replenishment order is made.

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Total Delivery Time – Lead Time

Total time is **fixed** only if there is no change at any stage of the order cycle, which is the **exception** and not the rule.

There can be a **change** in every element of the order cycle but also in its total.

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Total Delivery Time – Lead Time

Actual lead time can be short or long and has an average value. The changes, are the ones that can bring additional costs for the customer rather than the absolute price of the total delivery time, while it should:

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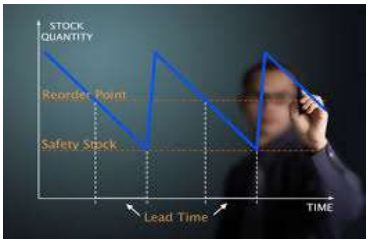
Total Delivery Time – Lead Time



- Hold a safety stock to cover possible delays or
- Lose sales (and customers) due to lack of product.

Delivery time **stability** is generally **preferred** to fast delivery since stability has a greater impact on cost.

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6.3.05.04 Optimising planning parameters to fine tune inventory holding.

Order Policy

Inventory management

Management should determine the amount of inventory needed to achieve the **minimum logistics costs, given the objectives in customer service.**

In other words, it should define the ordering policy, which means:

- **How much stock to order** and
- **When** to place **the order.**

The basic principles of repurchasing or inventory management policy can be examined under conditions of **certainty** and **uncertainty**. The latter case is of course the rule.

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6.3.05.04 Optimising planning parameters to fine tune inventory holding.

Inventory Replenishment

INDEPENDENT - DEPENDENT DEMAND

Independent is the demand for a product that can not be related to any other in any way.

Demand for this product should be forecast.

On the contrary, the demand for a product is dependent, when is related to the demand for another product.

The demand level in the case of dependent demand rely on the related product demand.

For example, the demand for components of a complex final product rely on the demand of the final product.

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6.3.05.04 Optimising planning parameters to fine tune inventory holding.

Order Policy

Inventory management in conditions of certainty

The stock replenishment policy under certainty conditions requires the **balance** of the **order cost** with **inventory retention cost.**

The cost of ordering products from an external supplier, usually includes:

- The cost of placing an order,
- The cost of receiving the product,
- The cost of placing it in the warehouse, and
- The cost associated with processing the payment of the invoice.

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6.3.05.04 Optimising planning parameters to fine tune inventory holding.

Order Policy
Inventory management in conditions of certainty

The best order policy is determined by **minimizing** the sum of:

- **The inventory retention cost and**
- **The cost of the order**

making use of the **economic order quantity (EOQ).**

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Calculating EOQ

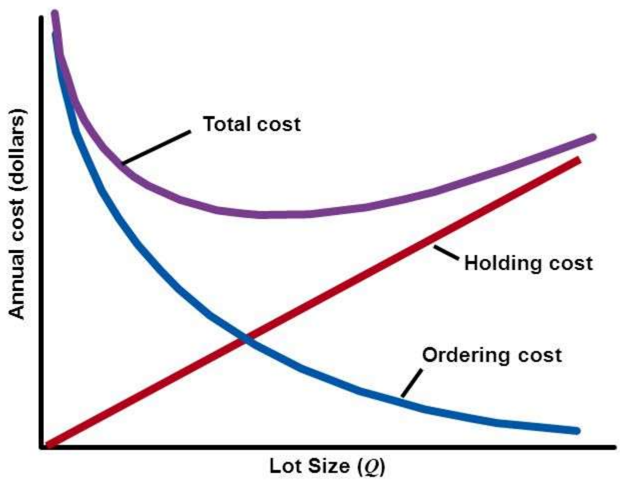

Figure 12.3 – Graphs of Annual Holding, Ordering, and Total Costs

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Order Policy

Inventory management in conditions of certainty

Economic order quantity (EOQ):

$$E = \sqrt{2PD/CV}$$

Where:

P = The cost of the order (€ per order)

D = Annual demand or use of the product (number of product units)

C = Annual inventory retention cost (% of product value).

V = Average cost or value of a unit from the stock.

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Order Policy

Inventory management in conditions of certainty

Fixed replenishment:

Determining the economic order **quantity** (EOQ) and dividing the annual demand by it, determines the **frequency** (order period) and the size of the order that will minimize the two costs (order cost and inventory retention cost). This is the case with a **fixed replenishment (fixed quantity and fixed order period).**

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6.3.05.04 Optimising planning parameters to fine tune inventory holding.

Order Policy

Inventory management in conditions of uncertainty

Companies rarely, if never, don't know what demand to expect for their products. Many factors can affect the accuracy of demand forecasting, such as:

- Economic conditions,
- The competition,
- Changes in legislation,
- Trade changes,
- Changes in the consumer's shopping habits

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Order Policy

Inventory management in conditions of uncertainty

Order cycle time periods are also not fixed.
Transportation time periods, too, can change.

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Order Policy

Inventory management in conditions of uncertainty

The Senior Management therefore have the following options:

- Maintain additional stock as a safety stock or
- Risk a possible drop in sales due to lack of inventory.

This means that there is another comparison that needs to be made between **the inventory retention cost** and the cost of lack of inventory.

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Order Policy

Inventory management in conditions of uncertainty

Minimum, maximum, multiple

Some companies use:

- constant **maximum** and
- **fixed minimum order quantity** (MOQ)

which **range around the price of the economic order quantity (EOQ)** for ordering various products.

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6.3.05.04 Optimising planning parameters to fine tune inventory holding.

Order Policy

Inventory management in conditions of uncertainty

Minimum, maximum, multiple

These quantities are ordered when the existing stock "falls" to a certain level called **the reorder point (ROP).**

The safety stock is the minimum amount of stock we need to hold without increasing inventory costs and affecting customer service.

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6.3.05.04 Optimising planning parameters to fine tune inventory holding.

Order Policy

Inventory management in conditions of uncertainty

Minimum, maximum, multiple

In addition to the **lower limit** of the minimum where the **security stock** is, it is important to put an **upper limit** on the **maximum amount** of product that we can hold as a stock. Usually the trend is to order:

HOW MUCH	**The economic order quantity** (EOQ)
WHEN ?	**The reorder point**

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6.3.05.04 Optimising planning parameters to fine tune inventory holding.

Order Policy

Inventory management in conditions of uncertainty

Determination of Maximum

We can define the maximum stock as a function of the average stock, the annual demand and the turnover of the stock.

Average stock is the average of the actual maximum stock and the minimum stock

Average Stock = (RMAX + MIN)/2

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6.3.05.04 Optimising planning parameters to fine tune inventory holding.

Order Policy

Inventory management in conditions of uncertainty

Determination of Maximum

The actual maximum stock (RMAX) is the maximum stock reduced by the existing demand during lead time.

RMAX = MAX - Demand(L)

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Order Policy

Inventory management in conditions of uncertainty

Determination of Maximum

So, the average stock is:

Average Stock = (RMAX + MIN)/2 = (MAX - Demand(L) + SS)/2

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6.3.05.04 Optimising planning parameters to fine tune inventory holding.

Order Policy

Inventory management in conditions of uncertainty

Determination of Maximum

The average stock can also be expressed as the ratio of annual demand to turnover.

Average Stock = D/R

D = Annual demand (sales)
R = Stock Turnover

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6.3.05.04 Optimising planning parameters to fine tune inventory holding.

Order Policy

Inventory management in conditions of uncertainty

Determination of Maximum

From the above we have:

Average Stock = (MAX - Demand (L) + SS)/2 = D/R

Thus MAX = 2*(D/R) - SS + Demand(L)

D = Annual demand (sales)

R = Stock Turnover

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6.3.05.04 Optimising planning parameters to fine tune inventory holding.

Order Policy

Inventory management in conditions of uncertainty

Minimum, maximum, multiple

The classic formulas for EOQ do not take into account various parameters that ideally should, such as:

Product life cycle phase	Demand
The life of the product on the shelf	Customer relations
The importance of the product for the company	The costs
The sales pattern	The number of storage spaces
Supply commitments	

These parameters can determine the maximum stock policy, regardless of the EOQ.

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6.3.05.04 Optimising planning parameters to fine tune inventory holding.

Order Policy

Inventory management in conditions of uncertainty

Minimum, maximum, multiple

The minimum stock (safety stock) and the maximum stock, once determined, should not remain stable forever. Instead, these numbers often have to be redefined because the parameters change. That means we can have:

- *dynamic safety stock and*
- *dynamic maximum stock*

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6.3.05.04 Optimising planning parameters to fine tune inventory holding.

Order Policy

Inventory management in conditions of uncertainty

The methods and models used to control stocks in conditions of uncertainty are:

Fixed order point: The order is made when the stock we have in warehouse or has already been ordered, reaches a predetermined minimum limit set to meet demand during the order cycle (re-order point). The **order quantity is fixed** (economical order quantity).

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6.3.05.04 Optimising planning parameters to fine tune inventory holding.

Order Policy

Inventory management in conditions of uncertainty

- **Periodic replenishment or fixed order period / interval.** This model compares the current stock with the forecast demand and places an order for the required **(variable) quantity** at **regular predefined time periods**. In other words, the interval time between orders is fixed. This model works in the case of combined orders with different products but can lead to high levels of inventory.

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6.3.05.04 Optimising planning parameters to fine tune inventory holding.

Order Policy

Inventory management in conditions of uncertainty

- **Lot for lot**: It is also called DOQ (Discrete Order Quantity) (specific quantity of the order), and is a method for determining the size of the order, where the needs that exist in each time period, are the quantities of the order. This method is often used mainly for expensive products and products whose demand is not continuous but is intermittent. In these cases the quantity is the same as in cases where a period is determined by the specific requirements in that period.

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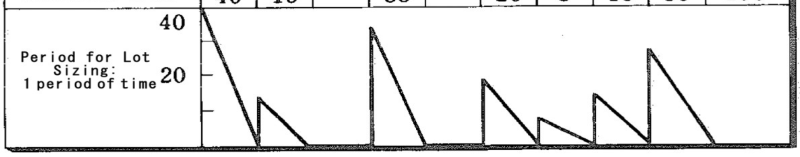
6.3.05.04 Optimising planning parameters to fine tune inventory holding.

Order Policy

Inventory management in conditions of uncertainty

Lot for lot

Period	1	2	3	4	5	6	7	8	9	Total
Net Requirements	40	15		35		20	5	15	30	160
Scheduled Order	40	15		35		20	5	15	30	160



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Order Policy

Inventory management in conditions of uncertainty

- **On demand replenishment:** It is the model where both the **quantity and the order period are variable**. Depending on the forecast, we place an order at such a time and quantity that will satisfy our needs, to receive the right quantity on time, in order to serve our customers.

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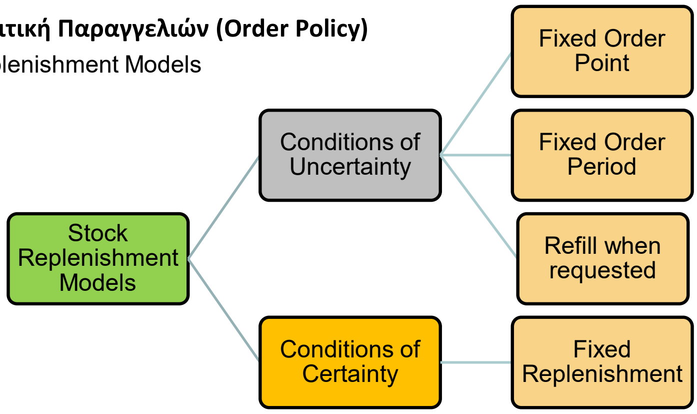
6.3.05.04 Optimising planning parameters to fine tune inventory holding.

Πολιτική Παραγγελιών (Order Policy)
Replenishment Models



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DEMAND, PRODUCTION AND DITRIBUTION REQUIREMENTS PLANNING

6.3.05.05 Establishing safety stock.

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6.3.05.05 Establishing safety stock.

Safety stock or Buffer stock

The security stock is the stock held to satisfy uncertainties:

1. In demand which exceeds the quantities foreseen for a certain period to be covered by the circular stock.
2. Delivery time period that can be delayed for various reasons.
3. In the organization and proper monitoring of inventory.

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6.3.05.05 Establishing safety stock.

Safety stock or Buffer stock

In other words, **safety stock** is:

The stock held in addition to the cyclical stock to cover demand and / or the uncertainty / variability of the total lead time, where cyclical stock is the stock held until the next order is received.

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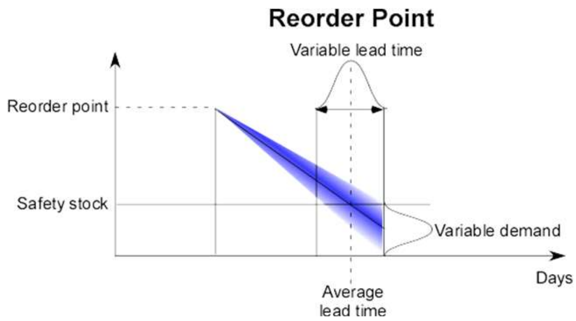
6.3.05.05 Establishing safety stock.

Safety stock or Buffer stock



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6.3.05.05 Establishing safety stock.

Safety stock or Buffer stock

Companies should therefore appreciate:

1. If there is a need for a safety stock and
2. The amount of the safety stock,

depending on the level of service they want to achieve.

Level of service is the degree to which customers receive the right product, in the right quantity and quality, at the time and place agreed.

If we want the level of service to be 100% then we have to keep very high safety stocks.

We usually work with an "acceptable" level of service.

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6.3.05.05 Establishing safety stock.

Impacts of High and Low Safety Stock

	Manufacturers	Retailers
High Safety Stock	• It makes us not pay much attention to accurate and efficient demand forecasts. • High cost for stock retention. • High committed capital (working capital) for stock maintenance.	• Increase of Operating costs, since increased inventory management is required. • It distorts the real needs of the shopkeeper and therefore reduces the accuracy of forecasts and orders.
Low Safety Stock	• They reduce the successful implementation of promotions. • They lead to irregular orders from traders. • They cause devaluation of brand loyalty and brand equity due to possible shortcomings. • Lack of product encourages competitors' sales.	• The chances of stock out increase. • Loss of revenue due to stock outs. • Reduced customer satisfaction. • Decreased confidence in the store. • Profits for competitors.

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6.3.05.05 Establishing safety stock.

Safety Stock
Calculation

Different methods are used to calculate the safety stock. These methods can be categorized as follows, under 3 "umbrellas":

- Fixed security stock.
- Calculation of safety stock in relation to time.
- Statistical calculation of security stock.

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6.3.05.05 Establishing safety stock.

Safety Stock Calculation

Fixed Security Stock

Many companies maintain a stable level of security for their products for many order cycles. This number can be based on estimations or calculations. This method could lead to high stock costs or stock-outs (especially if we do not adjust the numbers often) as demand is not always stable.

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6.3.05.05 Establishing safety stock.

Safety Stock Calculation

Calculation of safety stock in relation to time

The amount of safety stock that is related to time is used to calculate the stock required for a fixed period of time. In addition to **the cyclical inventory which is the expected demand at the total time of satisfaction of the order, usually a percentage (%) or the average of the sales of a day (or week) is added.**

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6.3.05.05 Establishing safety stock.

Safety Stock Calculation

Calculation of safety stock in relation to time

For example,

If the total lead time is two weeks (cyclical stock), the company can hold three or four weeks of safety stock. That is, a stock of one or two weeks in addition to the cyclical stock.

This method has the **disadvantage**, especially when the products are **slow moving**, to lead us to commit large funds for the **maintenance of stocks.**

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6.3.05.05 Establishing safety stock.

Security Inventory Calculation

Statistical calculation of security stock

The statistical method of calculation uses the curve of the normal distribution, type "bell". Assume that the **error between the forecast demand and the actual demand, follows a probability of normal distribution.** The normal distribution is characterized by two parameters - **mean value and deviation**. Since the predicted demand is the same or the probability is less or greater than the actual demand, the average value of the error distribution is assumed to be zero. In statistics, it is like saying that there is no "trend" in the projected demand.

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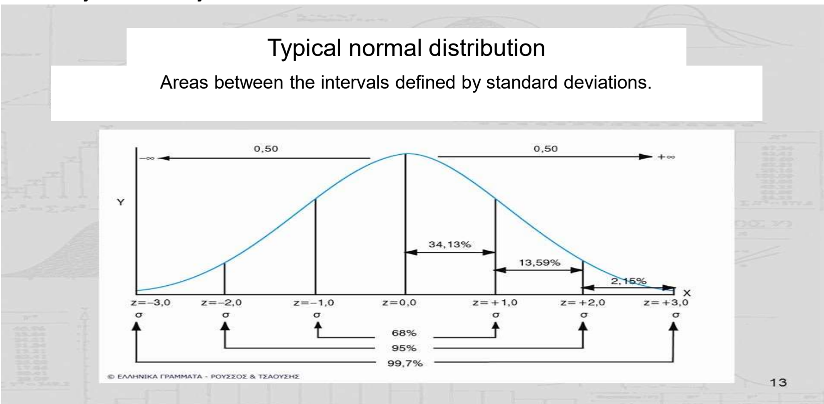
Security Inventory Calculation - Statistical Calculation



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6.3.05.05 Establishing safety stock.

Security Inventory Calculation

Statistical calculation

The deviation in the normal distribution, (denoted as σ) indicates the range of the error.

In the statistical method of calculating the safety stock, it reveals the level of service.

In business terms, it indicates how many times, as a percentage, a manufacturer / producer can serve its customers without experiencing stock-out.

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6.3.05.05 Establishing safety stock.

Security Inventory Calculation

Statistical calculation

So, if safety stock is not held, then according to the curve, a company will be able to serve customers in 50% of cases during the lead time.

If a safety stock is kept equal to σ, then one will be able to serve customers in 68% of cases and if the safety stock rises to 2σ then the service level becomes 95%.

Here the percentages 50%, 68%, 95%, indicate service levels and the numbers 0,1 and 2 indicate service rates.

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6.3.05.05 Establishing safety stock.

Security Inventory Calculation

Statistical calculation

We will use Z as a function that converts the desired level of service into a service factor. The calculation of the safety stock with this method is

$$SS = Z*\sigma.$$

SS = Safety Stock

σ = service factor

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6.3.05.05 Establishing safety stock.

Security Inventory Calculation

Statistical calculation

This is applicable when the total lead time of the order (lead time) is the same as the time we have predicted. But this is not happening in most cases. So, in most cases a factor of the total order satisfaction time (lead time) is entered as a multiplier in the calculations. This factor is calculated as the square root of the ratio of lead time l and predicted time t.

$$, SS = Z*\sigma*\sqrt{(\frac{l}{t})}.$$

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6.3.05.05 Establishing safety stock.

Security Inventory Calculation

Statistical calculation

The re-order point in this case is:

$$ROP = d*L + SS = d*L + Z*\sigma*\sqrt{(\frac{l}{t})}.$$

d = demand

L = total lead time

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6.3.05.05 Establishing safety stock.

Security Inventory Calculation

Statistical calculation

Statisticians have developed many other formulas for calculating safety stocks. These types usually include the 4 basic parameters that affect the security stock:

- *Service level,*
- *Total Lead Time,*
- *Forecast Demand,*
- *Actual Demand.*

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6.3.05.05 Establishing safety stock.

Security Inventory Calculation

Statistical calculation

ERP systems also take values from these parameters from historical data and use similar statistical formulas to calculate a value for the security stock.

In today's business environment, relying on these parameters is not enough.

In practice they can lead to re-order points and levels of safety stocks that do not match market demand or seasonality. **There are many other factors to be considered.**

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6.3.05.05 Establishing safety stock.

Factors affecting the safety stock.

1. **Stage in the product life cycle.**

- **Introduction:** When a product is introduced to the market, the error in forecasting demand can be large. The error can be either positive or negative and depends on the customer response. That's why we keep a medium level of safety stock.
- **Growth:** At the growth stage, we need to maintain a high level of safety stock to meet growing demand.
- **Maturation:** At this stage the safety stock should be as low as possible or not exist at all, because the demand forecast is almost specific.
- **Drop:** We should not maintain safety stock.

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6.3.05.05 Establishing safety stock.

Factors affecting the safety stock.

2. **Product life on the shelf.**

Consumables: Products with a short life on the shelf require a low safety stock.

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6.3.05.05 Establishing safety stock.

Factors affecting the safety stock.

3. Importance for the business.

- High **profitability** products, with high **growth prospects.**
- Products that have the **special attention** of the company.
- **The average sales** for this product are high.

All of these situations require high levels of safety stock.

If a product is not among the company's bestsellers, we do not need to worry about the amount of safety stocks.

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6.3.05.05 Establishing safety stock.

Factors affecting the safety stock.

4. The sales pattern.

- **Seasonal:** Just before the season, demand is rising. Then we must maintain a high safety stock level.
- **Normal:** Low safety stocks should be kept.

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6.3.05.05 Establishing safety stock.

Factors affecting the safety stock.

5. Constraints in supply

- **Distance from suppliers:** *High safety stock should be kept if the distance is long.*
- **Relationships with suppliers:** *If suppliers are reliable and can protect us from supply volatility, we can maintain low safety stock.*
- **Logistics Cost:** The high cost of logistics obliges us to maintain a high safety stock.

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6.3.05.05 Establishing safety stock.

Factors affecting the safety stock.

5. Constraints in supply

- **Supplier's ability to deliver on time:** If the supplier's ability to deliver on time *is high,* then we can maintain *low safety stock.*
- **Negotiating ability in relation to the supplier:** *If it is large, then we can maintain low safety stock.*
- **Number of suppliers:** If *more than one supplier* can supply us with the same product, then a *small safety stock* is needed.

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6.3.05.05 Establishing safety stock.

Factors affecting the safety stock.

6. Demand

- **Stable:** Without calculating the seasonal sales cycle, the demand for some products is predetermined and stable. In such cases, low safety stocks are required.
- **With fluctuations:** If the demand for a product is sudden and random, then it may be necessary to maintain a high level of safety stock.

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6.3.05.05 Establishing safety stock.

Factors affecting the safety stock.

7. Interaction with customers.

- **Customer type:** *Profitable customers* create the need to maintain a *high level of safety stocks for their service.*
- **Promotions:** Promotions lead to a sudden increase in demand and require *high safety stocks to be served.*
- **Customer tolerance time:** How long can a customer wait for a product? If the time is long, then we maintain a small *level of safety stock.*
- **Distributors / Vendors:** Trusts with distributors and vendors lead to reduced safety stocks.

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6.3.05.05 Establishing safety stock.

Factors affecting the safety stock.

8. Cost

- **Unit cost:** *If unit cost is high,* then high safety stocks will lead to high capital costs for storing them. In such cases, we need to maintain *low security reserves*
- **Cost of stock-out:** *If it is high,* then we need to maintain *a high safety level of stock.*

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6.3.05.05 Establishing safety stock.

Factors affecting the safety stock.

9. Number of storage spaces.

- **Centralization:** (Few storage spaces) Reduces demand gaps and uncertainty and thus requires less safety stocks. To overcome problems such as increased response time to customer orders and increased shipping costs, physical centralization can be avoided.
- Instead of physically accumulating stocks, there are various methods to have the advantages of centralization such as reduced stocks. These methods are: Information aggregation, specialization, common product components, product replacement, etc.

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6.3.05.06 Optimising Distribution Requirements Planning (DRP).

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6.3.05.06 Optimising Distribution Requirements Planning (DRP).

DRP: What is it?

Distribution requirements design (DRP) is a systematic method to make product distribution and delivery more efficient by determining:

- *which products,*
- *in what quantities and*
- *at what points*

needed to properly address the demand that exists and to avoid shortages.

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6.3.05.06 Optimising Distribution Requirements Planning (DRP).

DRP: What is it?

It then creates centralized and long-term program requirements for each level in the distribution system. These programs feed the necessary information to the master production schedule (MPS).

The goal is to minimize shortages and reduce the costs of ordering, transporting and holding stocks.

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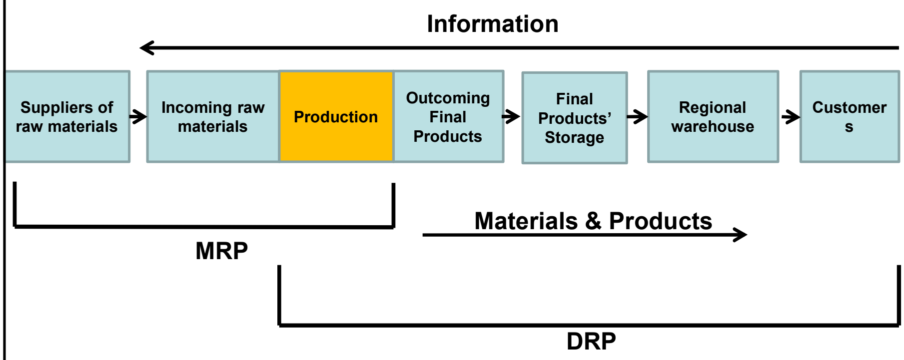
6.3.05.06 Optimising Distribution Requirements Planning (DRP).

DRP: What is it?



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6.3.05.06 Optimising Distribution Requirements Planning (DRP).

DRP
Necessary planning information (planning inputs):

- Total order lead times (Lead times) and replacement times
- Capacity.
- Demand forecasts (taking into account seasonality).
- Requirements at the service level.
- Current stock levels.
- Cyclical stock goals, pre-build stock and safety stock.
- Suggested replacement amounts.

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6.3.05.06 Optimising Distribution Requirements Planning (DRP).

DRP: How does it work?

In the DRP model the distribution tasks work either with the pull method or the push method.

In the **pull method** we have the products moving towards the top of the network (upstream) satisfying customer orders.

This provides **greater availability** for consumers because local management controls the availability of products

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6.3.05.06 Optimising Distribution Requirements Planning (DRP).

DRP: How does it work?

Managing distributed stock can be difficult because each order is new at the point of supply as demand flows upstream. This is called:

“Bullwhip effect”

Small changes in consumer’s demand create large shifts, an in higher level in the supply chain network.

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6.3.05.06 Optimising Distribution Requirements Planning (DRP).

DRP: How does it work?

On the other hand, the push method, sends the products downstream.

In generally has **lower costs** because loads are designed and stored in large quantities and in bulk.

But service levels may be lower if central planning deviates too much from real demand.

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6.3.05.06 Optimising Distribution Requirements Planning (DRP).

DRP: How does it work?

DRP ideally combines the **service levels** of the **pull** technique with the efficiency and savings of the **push** technique, but it depends on:

1. Accurate predictions and
2. Stable procedures.

If both exist, with DRP, we have high levels of order satisfaction with low inventory.

The majority of users include DRP modules in ERP software.

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6.3.05.06 Optimising Distribution Requirements Planning (DRP).

Typical DRP.
Disadvantages.

- It does not take into account the limitations that exist
- Considers that the safety stocks are stable
- Considers that the networks (production, storage, distribution) are stable
- Has a poor response to change
- It does not have the ability to prioritize the messages received,
- Has limited visibility to the environment outside the business, and
- It does not have the ability to work with systems developed by manufacturers, suppliers or customers.

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6.3.05.06 Optimising Distribution Requirements Planning (DRP).

Typical DRP.

Disadvantages.

Design without taking into account limitations.

Traditional DRP does not take into account the real limitations of distribution networks such as limited capacity and planning, limited storage space, and the ability of manufacturers and suppliers to meet the requirements.

DRP simply creates a plan based on customer demand forecast and security inventory policy and considers that all necessary steps will be taken to execute the plan.

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6.3.05.06 Optimising Distribution Requirements Planning (DRP).

Typical DRP.

Disadvantages.

Considers that the Security Stock is stable.

Typical DRP considers the safety stock to be a fixed amount. It is not possible to change the safety stock over time to maintain a consistent level of service.

As a result, sometimes there is not enough stock, while other times there is too much stock.

It is a no-win situation.

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6.3.05.06 Optimising Distribution Requirements Planning (DRP).

Typical DRP.

Disadvantages.

Considers that the Networks (distribution, storage) are stable

Typical DRP suggests products should be distributed based on predefined options. Products are traded on a regular basis, without taking into account alternative possibilities (eg product availability in another warehouse, availability of more / less means of transport), or the ability to optimize product handling (eg full product promotion).

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6.3.05.06 Optimising Distribution Requirements Planning (DRP).

Typical DRP.

Disadvantages.

Has a poor response to changes.

Typical DRP systems usually run work in night batches or on weekends. But customer orders can change at any time, as can product availability.

Typical DRP can not react to these changes, but it follows the original data.

But even if he "ran" in real time, the plans it would produce would not suggest the best solutions or the system would not prioritize them properly.

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6.3.05.06 Optimising Distribution Requirements Planning (DRP).

Typical DRP.
Disadvantages.

It does not have the ability to prioritize the messages received.

Typical DRP systems may be able to enable users to perform a series of actions, but they cannot prioritize these actions.

Thus, important actions are omitted without information, while on the contrary irrelevant tasks are implemented without substantial result for the business.

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6.3.05.06 Optimising Distribution Requirements Planning (DRP).

Typical DRP.
Disadvantages.

Has limited visibility to the environment outside the business

Typical DRP systems design within business boundaries.

In other words, the parameters they use are from the company alone.

Taking the best into account, can design a complete distribution network, but do not include suppliers, manufacturers or customers in the whole process.

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6.3.05.06 Optimising Distribution Requirements Planning (DRP).

Typical DRP.

Disadvantages.

Has no possibility of cooperation.

Typical DRP systems do not work together. Users (planners / schedulers) can not easily share information between different parties or with customers and suppliers.

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6.3.05.06 Optimising Distribution Requirements Planning (DRP).

Typical DRP.

Disadvantages.

Requires many manual procedures

Typical DRP system requires the implementation of many manual processes to meet customer demand. This large number of manual processes increases order satisfaction time, handling costs, and yields lower profit margins.

Also, customer service is not valuable, and their dissatisfaction can further reduce profits.

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6.3.05.06 Optimising Distribution Requirements Planning (DRP).

DRP system optimization

Improvement Methods:

1. **Implement demand management**

We change customer behaviors while predicting demand accurately. Through it, we can also change and improve all the necessary DRP parameters.

2. **Scheduled distribution**

We determine precisely the conditions, especially the time, under which the deliveries take place.

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6.3.05.06 Optimising Distribution Requirements Planning (DRP).

DRP system optimization

3. **Cooperation opportunities.**

But the most important feature of the improved DRP is the ability of the company's production and distributions to cooperate with suppliers and customers, in order to ensure the following improved parameters for the DRP:

- Lower stocks of finished products
- Better customer service
- Opportunities for timely redesign when conditions change
- Production programs with given priorities

This collaboration is achieved through common information databases that strengthen communication.

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6.3.05.06 Optimising Distribution Requirements Planning (DRP).

DRP system optimization

From control to cooperation

Moving away from the logic of controlling the components as is done in **MRP and DRP** systems, and moving towards a logic of cooperation, all the basic movements, information, raw materials and products are gathered in a single system.

This system is called **supply chain management system** with these key features of cost reduction and improved result (bottom line).

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6.3.05.06 Optimising Distribution Requirements Planning (DRP).

DRP system optimization

From control to cooperation

The supply chain management system offers the following:

- It takes into account all the necessary costs and restrictions.
- Creates, dynamically, various distributions of the security stock in the network.
- Optimizes the distribution network.
- It provokes action and warns of things that are important, hierarchical and relevant to all levels of the trafficking plan.
- Transparency and full cooperation throughout the supply chain.

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6.3.05.06 Optimising Distribution Requirements Planning (DRP).

DRP system optimization

From control to cooperation

The principle of **collaborative supply chain planning** is the logical evolution of the classic DRP system and extends the design process to include manufacturers, suppliers and customers.

This results in a plan that takes into account constraints such as supplier capacity, production, storage and transportation. **It is a plan that uses all the resources and examines the supply chain from one end to the other.**

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6.3.05.06 Optimising Distribution Requirements Planning (DRP).

How collaborative chain design optimizes the classic DRP system

Takes into account all costs and restrictions.

Every distribution network has limitations (storage, transportation, etc.) and every action done on the network has a cost. Classic DRP does not recognize restrictions.

In contrast, collaborative design not only recognizes them, but also identifies costs in terms of costs (e.g. transport costs) and profits. Achieving the goals without violating the restrictions allows the creation of an optimal traffic plan much better than that of the classic DRP.

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6.3.05.06 Optimising Distribution Requirements Planning (DRP).

How collaborative chain design optimizes the classic DRP system

Takes into account all costs and restrictions.

Storage constraints. Is there space in the warehouse for storing products? Are there any alternative places where they can be stored?

Handling constraints. Are the appropriate means available for unloading, moving and loading products in warehouses?

Transportation constraints. Is there sufficient capacity to transport the products by the desired means? What alternative means are there?

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6.3.05.06 Optimising Distribution Requirements Planning (DRP).

How collaborative chain design optimizes the classic DRP system

Takes into account all costs and restrictions.

Transportation costs. For example, what is the cost of rail compared to road or air? Do full loads have advantageous pricing? Can future shipments complement the current ones for better use of means of transport?

Opportunity cost production versus outsource or replacement. What is the difference in cost if we produce the product in exchange for giving it for production to a third party or replacing it with another similar one?

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6.3.05.06 Optimising Distribution Requirements Planning (DRP).

How collaborative chain design optimizes the classic DRP system

Takes into account all costs and restrictions.

Supply chain collaboration planning systems are considering distribution alternatives. They take into account the relevant constraints and optimize the final plans in relation to the cost and profit targets. They result in improved service levels and lower costs.

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6.3.05.06 Optimising Distribution Requirements Planning (DRP).

How collaborative chain design optimizes the classic DRP system

Dynamic Security Stocks

Classic DRP considers the security stock to be a fixed amount. In contrast, the collaborative supply chain management system considers the security stock to be a dynamically changing quantity that must change over time in order to have a consistent level of customer service. If the goal is to maintain the level of service, for example, at 98%, then the safety stock will fluctuate based on demand and expected changes in demand.

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6.3.05.06 Optimising Distribution Requirements Planning (DRP).

How collaborative chain design optimizes the classic DRP system

Dynamic Security Stocks

Classic DRP systems also manage security stocks as the property of that warehouse. Collaborative design systems use security inventory policies throughout the warehouse network to reduce aggregate inventories. You can thus compare the cost of holding stocks with the additional intra-transport costs associated with establishing a dynamic security stock.

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6.3.05.06 Optimising Distribution Requirements Planning (DRP).

How collaborative chain design optimizes the classic DRP system

Optimized distribution

Collaborative supply chain design optimizes turnover based on cost and profit targets.

e.g.

Minimize transport costs → Full loading of vehicles.

Minimize stock investment → Delay stock development to the last possible stage or vehicles may be moving half-loaded.

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6.3.05.06 Optimising Distribution Requirements Planning (DRP).

How collaborative chain design optimizes the classic DRP system

Optimized distribution

It also recognizes that the distribution network is dynamic.
Sources of supply can vary based on invisible constraints or customer priorities in the supply chain. Planners need to consider the impact that "special" decisions have on costs and profits. E.g. The designer may recommend replacing an upgraded product for a good customer or in-stock to make up for deficiencies caused by a damaged pallet in a warehouse.

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6.3.05.06 Optimising Distribution Requirements Planning (DRP).

How collaborative chain design optimizes the classic DRP system

Important, hierarchical warnings (Alerts).

Collaborative design offers important but also hierarchical warnings that help designers solve serious problems.

This is how they see the impact of problems throughout the supply chain (upstream - downstream). They can go directly from the warning to the cause of the problem.

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6.3.05.06 Optimising Distribution Requirements Planning (DRP).

How collaborative chain design optimizes the classic DRP system

Full transparency and cooperation in the supply chain.

Collaborative design "introduces" external partners to actively participate in the design process. Different profiles are defined for each, and thus, depending on the level of collaboration, they have access to similar information.

For example, good customers can see the plans, change orders and forecasts, while on the other hand, suppliers' access can only be limited to information about stocks that exist in specific warehouses and without the possibility of changes.

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ESLog - MODULE E :

DEMAND, PRODUCTION AND DITRIBUTION REQUIREMENTS PLANNING

6.3.05.07 Adapt inventory level taking into account product life cycle.

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6.3.05.07 Adapt inventory level taking into account product life cycle.

Product Life Cycle-PLC:

The principle behind the product life cycle has to do with the gradual development of a product. It starts with its **introduction in the market**, and continues with its steady **growth as it is established**. The life cycle continues with accelerated product growth while competitors introduce similar products to the market, which pushes aggregate demand and ends when **product life falls**.
It is important to know that the operation of the supply chain, which includes the holding of stocks, is based, among other things, on the life cycle of a product.

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6.3.05.07 Adapt inventory level taking into account product life cycle.

Product Life Cycle-PLC:

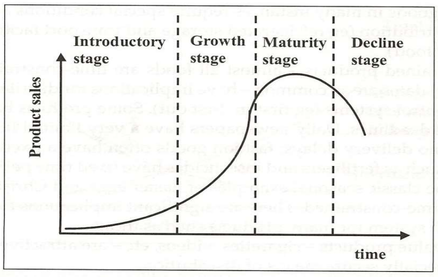

Fig: Typical product life cycle curve showing the stages introduction, growth, maturation and decline.

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6.3.05.07 Adapt inventory level taking into account product life cycle.

Introductory stage:

There is a need for immediate response to demand with the organization of logistics to ensure:

- Stock availability (extra security stock to support product import),
- Fill them up quickly so we can respond to sudden increases in demand.

Growth stage:

Here sales are more predictable. Inventory requirements are more balanced, the system is more cost-effective, but with high inventories to cope with increases in demand. Here we can observe the trade-off between level of service and cost.

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6.3.05.07 Adapt inventory level taking into account product life cycle.

Maturity stage:

The introduction of competing products and substitutes increases competition in prices and the level of service. Effective inventory management that keeps stocks low is essential to maintaining market share, especially for good customers.

Decline stage:

The product becomes obsolete. Here we should not maintain a security stock and the existing logistics structure should support the existing activity of the product but with minimal risk and minimum cost.

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DEMAND, PRODUCTION AND DITRIBUTION REQUIREMENTS PLANNING

6.3.05.08 Identifying causes for stock obsolescence and propose ways for minimising this.

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6.3.05.08 Identifying causes for stock obsolescence and propose ways for minimising this.

Problem

Deleting inactive / redundant products is a chronic supply chain problem and costs a lot of money.

While excessive stocks of inactive product are usually discussed, the same does not apply to the **causes of the problem**.

Usually, such stocks are reduced by selling the products at below cost prices or by donating them.

Many times, other priorities do not allow companies to develop effective solutions to minimize the root causes.

Sometimes it is difficult to analyze the complexity of the main causes that do not allow us to deal with.

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6.3.05.08 Identifying causes for stock obsolescence and propose ways for minimising this.

High and low level main causes of stock devaluation.

If we analyze the large and devalued stock, through the S&OP process, we often see that the main causes are related to:

- **long lead times,**
- **poor forecasting accuracy,**
- **quality problems**
- **design obsolescence.**

The above general causes can be analyzed in more detailed, low-level causes.

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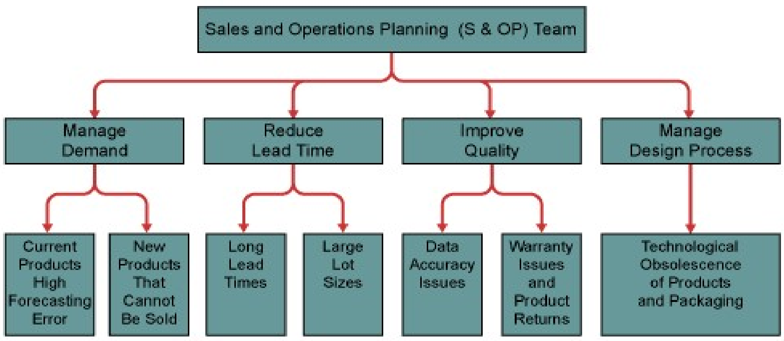
6.3.05.08 Identifying causes for stock obsolescence and propose ways for minimising this.

Determining Causes of Inventory Depreciation through S&OP process.



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6.3.05.08 Identifying causes for stock obsolescence and propose ways for minimising this.

Causes of Inventory Depreciation.

Long order satisfaction time (Lead Time).

The **lead time** may be due to **large lot sizes**.

e.g. , If the actual lead time is 30 days, but the required order size is 90 Days of Sales (DOS), then the size of this load leads to a higher average stock than the lead time alone.

In this case, the average stock increases from 15 to 45 DOS, considering a stable sales rate.

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6.3.05.08 Identifying causes for stock obsolescence and propose ways for minimising this.

Causes of Inventory Depreciation.

Long order satisfaction time (Lead Time).

Of course, the real causes of heavy loads need to be investigated. There may be other reasons for ordering large loads, such as better shipping conditions, etc.

Other reasons for long lead time may also be:

- **complex procedures,**
- **programming problems and / or**
- **late deliveries.**

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6.3.05.08 Identifying causes for stock obsolescence and propose ways for minimising this.

Causes of Inventory Depreciation.

Inaccurate predictions.

The 2nd main reason for excess and devalued stock is the bad practices of demand management.

Some primary causes of bad forecasts can be :

- inaccurate historical data,
- poor methodology for modeling forecasts,
- failure to adapt supply chain design to product life cycle,
- overly optimistic sales forecasts.

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6.3.05.08 Identifying causes for stock obsolescence and propose ways for minimising this.

Causes of Inventory Depreciation.

Poor quality and design.

Improved quality levels of a product reduce "junk" and highly devalued inventories.

Finally, various techniques can be used to improve the design processes of new products or services, which will help make better use of stocks and not devalue them.

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6.3.05.08 Identifying causes for stock obsolescence and propose ways for minimising this.

Use of the DMAIC method to find and limit the root causes of stock devaluation.

The DMAIC problem-solving methodology (Define, Measure, Analyze, Improve, Control) can lead us to the root causes of the excess and devalued inventory problem by defining key process input variables (KPIVs).

Once the causes of the problem of excess and depleted stock have been identified, measures should be taken to reduce these causes - the optimization phase.

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6.3.05.08 Identifying causes for stock obsolescence and propose ways for minimising this.

Conclusions - Benefits

Benefits of reducing / minimizing excess and devalued stock include:

- Higher management system accuracy,
- Creating quantified stock models showing the relationship between stock investment versus lead time and changes in demand,
- Better accuracy in valuing stocks and storage points,
- Better accuracy in order cycles and - most importantly -
- Permanent reduction in the cost of excess and devalued stock.

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ESLog - MODULE E :

DEMAND, PRODUCTION AND DITRIBUTION REQUIREMENTS PLANNING

6.3.05.09 Running the demand management, supply management and the scenario analysis of the Sales and Operations Planning (S&OP) process.

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6.3.05.09 Running the demand management, supply management and the scenario analysis of Sales and Operations Planning (S&OP) process.

Sales & Operations (S&OP) Planning Process

Sales & Operations (S&OP) planning is a **periodic** decision-making process involving the Management and middle management of a company.

The purpose of S&OP is:

- To balance supply & demand at a centralized level.
- To synchronize the operational with the financial planning.
- To connect strategic planning with daily sales and operations.

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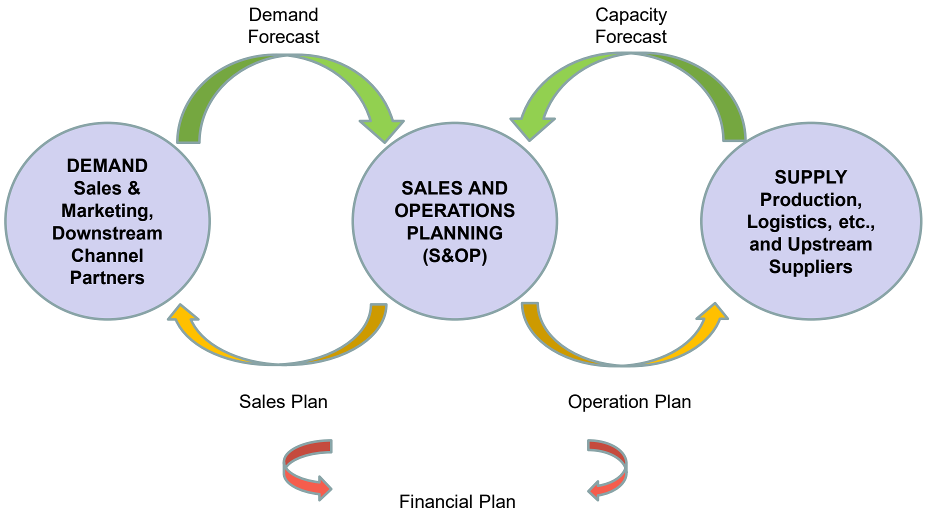

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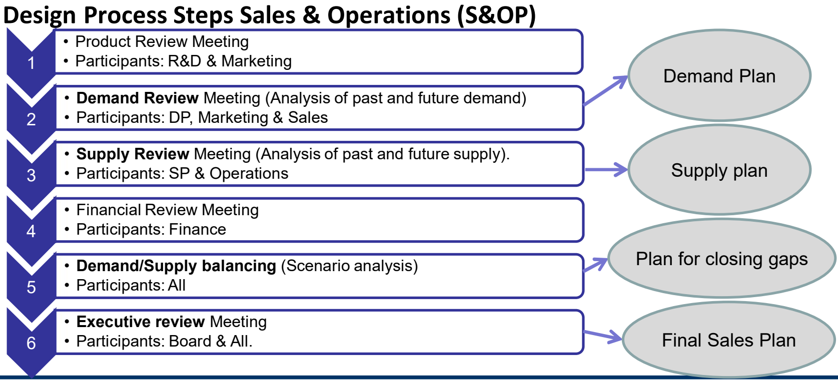
6.3.05.09 Running the demand management, supply management and the scenario analysis of the Sales and Operations Planning (S&OP) process.

Design Process Steps Sales & Operations (S&OP)



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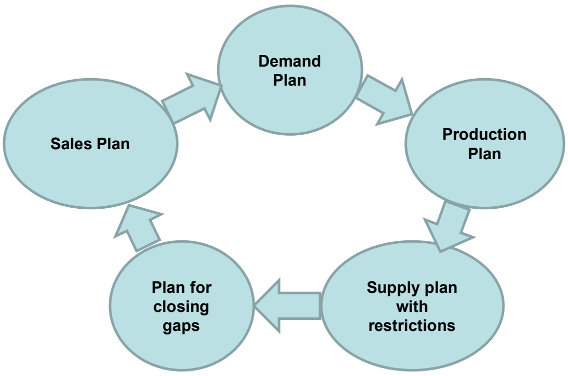
6.3.05.09 Running the demand management, supply management and the scenario analysis of the Sales and Operations Planning (S&OP) process.

Information Flow in the Design Process Sales & Operations (S&OP).



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6.3.05.09 Running the demand management, supply management and the scenario analysis of the Sales and Operations Planning (S&OP) process.

S&OP is a powerful process, but its success mainly depends on whether **there are the right behaviors, from the participants.**

For example, the executives of the departments of production, sales, marketing, finance, will have to work honestly in order to be able to implement the S&OP.

If each department prioritizes its own specific issues (eg production is only interested in reducing costs in the department and does not try to meet demand, even with some overtime), then it does not work effectively.

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ESLog - MODULE E :

DEMAND, PRODUCTION AND DITRIBUTION REQUIREMENTS PLANNING

6.3.05.10 Understanding the functionalities of inventory optimisation tools.

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6.3.05.10 Understanding the functionalities of inventory optimisation tools.

Inventory optimization

Inventory optimization is scientifically defined as:

The goal for a minimum stock throughout the supply chain network but meets the constraints where they are entered by the planner.

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6.3.05.10 Understanding the functionalities of inventory optimisation tools.

Best stock per family Stock Keeping Unit (SKU), and per channel .

The goal of customer service is usually not an absolute number.

There may be different service goals for :

- different families of SKUs,
- different customers or
- different sales channels.

In these cases, we need to determine which are the most profitable channels, the most profitable SKUs families and the most profitable customers. With the right information we can determine the above, and therefore optimize stocks in the most profitable SKUs families, customers or channels.

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6.3.05.10 Understanding the functionalities of inventory optimisation tools.

Best stock per family Stock Keeping Unit (SKU), and per channel.

Reduction of SKU:

If we have SKUs families specific to some customers or similar products packaged and stored simply in a different way, then **postponement is a way to transfer this customization** to **the last possible moment**.

We store the basic product and the
we differentiate ***only*** *when we have received the order.*
So, we can reduce stocks.

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6.3.05.10 Understanding the functionalities of inventory optimisation tools.

Best stock per family Stock Keeping Unit (SKU), and per channel.

Reduction of SKU:

When there is a significant increase in SKUs or we store packages of e.g. 2,4,6,8 from the same product, another way of dealing is:

In agreement with sales and marketing to reduce packaging without affecting sales. Any **reduction:**

- Will release part of the warehouse,
- will facilitate production and
- will reduce stocks.

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6.3.05.10 Understanding the functionalities of inventory optimisation tools.

Multi echelon inventory management.

A supply chain that operates at many levels can have many stages and possibly many players at each stage.

The lack of cooperation in shaping the amount of stocks results in higher stocks and therefore higher costs.

Success in a multi-layered supply chain is to reduce overall costs by treating orders and inventories as a whole, across the supply chain.

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6.3.05.10 Understanding the functionalities of inventory optimisation tools.

Multi echelon inventory management.

To improve inventories at multiple levels, we try through software models to optimize inventories from one end of the supply chain to the other.

These models consider that it can be kept in stock at any stage of the supply chain and not just in a specific warehouse. This small change, compared to the previous generation models, helps a lot in improving the efficiency of the supply chain and reducing the total stock.

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6.3.05.10 Understanding the functionalities of inventory optimisation tools.

Multi echelon inventory management.

How does it work?

When modeling a problem with multi-level inventories, the goal is to determine the right inventories throughout the supply chain.

There are many ways to have stocks in the supply chain.

In Fig. 1 we see a typical stock strategy. Here the triangles symbolize the security stock held at that particular stage. At every stage we have a safety stock. This allows the actions at this stage to be isolated from the other stages.

Experience, however, shows that at each stage there is a tendency to increase stocks over time, which results in a high overall cost. Here each stage covers its own lead time.

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6.3.05.10 Understanding the functionalities of inventory optimisation tools.

Multi echelon inventory management.

How does it work?

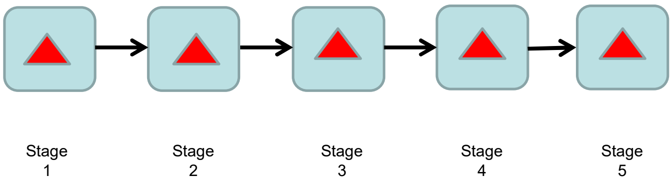

Figure 1

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6.3.05.10 Understanding the functionalities of inventory optimisation tools.

Multi echelon inventory management.

How does it work?

Fig. 2 shows the other end. It has divided the stock along the supply chain into the most extreme form. Here only in stage 5 we have security stock. This forces us to increase inventory in stage 5, unlike Fig. 1, because stage 5 must now cover the lead time for all stages in the supply chain. This removes the safety stock from the other stages because stage 5 covers all the lead time in the chain.

In most real situations, this is considered excessive and is problematic because we keep a stock of security at the most expensive and differentiated point. So while we have an interesting theoretical case, it is unlikely to be the best stock strategy in reality.

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6.3.05.10 Understanding the functionalities of inventory optimisation tools.

Multi echelon inventory management.
How does it work?

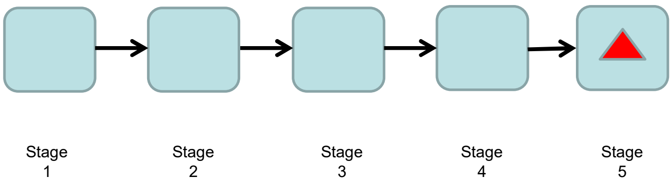

Figure 2

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6.3.05.10 Understanding the functionalities of inventory optimisation tools.

Multi echelon inventory management.
How does it work?

In Fig. 3 we will assume that stage 3 is that of high value in the supply chain. In this scenario, the safety stock in stage 2 covers the lead times of stages 1 and 2, while stage 5 covers steps 3, 4 and 5. This is an example of what the optimal safety stock policy might be . We have placed the right amount of stock in different places to reduce the working capital and achieve high levels of service.

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6.3.05.10 Understanding the functionalities of inventory optimisation tools.

Multi echelon inventory management.
How does it work?

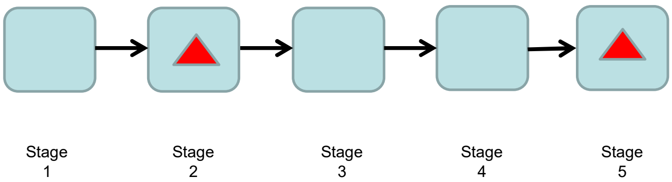

Figure 3

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6.3.05.10 Understanding the functionalities of inventory optimisation tools.

Vendor Managed Inventory

Here suppliers have access to inventory data so they can and do manage product shipments and improve inventory performance. Merchants also have the ability to place orders, pick up shipments, invoice and pay bills.

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6.3.05.10 Understanding the functionalities of inventory optimisation tools.

Vendor Managed Inventory

Features and Functions

- Builds close relationships between business partners on many levels.
- It offers the knowledge of suppliers to the upcoming demand and is a step forward in production planning.
- Activates wholesalers to offer better service with reduced stocks and increase profit margins.
- Improves inventory performance and reduces replacement costs for retailers.

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6.3.05.10 Understanding the functionalities of inventory optimisation tools.

Replacement Management

It is implemented through the following steps:

1. We see the stocks of the network
2. We forecast and / or determine the demand (sales profile),
3. We optimize service levels and reduce inventories to increase inventory turnover ratio.

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6.3.05.10 Understanding the functionalities of inventory optimisation tools.

Replacement Management
Features and Functions

- Optimizes policies to synchronize the stock needs of stores and DCs.
- Uses 'what-if' scenarios to evaluate alternative strategies for security stocks.
- Balances service level goals across multiple demand channels.
- Discover great shopping opportunities.

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6.3.05.10 Understanding the functionalities of inventory optimisation tools.

Replacement Management
Features and Functions

- Facilitates cooperation with suppliers and warehouses
- Allows the procurement department to focus on supplier analysis and negotiation.
- Reduces the negative impact of slow moving products, categorizing them for special replacement handling.
- Redistributes products when there is no balance in stocks.

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6.3.05.10 Understanding the functionalities of inventory optimisation tools.

Inventory management
Strategy / Tactics / Operational

The activities of the supply chain and therefore the **inventory management** can be divided into levels

- **strategy,**
- **tactics and**
- **operational** management.

The characteristics of each level are:

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6.3.05.10 Understanding the functionalities of inventory optimisation tools.

Inventory management
Strategy / Tactics / Operational

Strategy: Network optimization, including the number, locations and size of warehouses, distribution centers and facilities. Time horizon> 1 year

Tactics: Inventory decisions, including stock quantity, items and quality. Time horizon: Small to medium (2 weeks to 18 months)

Operational: Catering planning, current inventory and demand forecasting, supplier transfer, inventory collection, storage and transportation to customers. Time horizon: Immediate (<2 weeks).

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6.3.05.10 Understanding the functionalities of inventory optimisation tools.

Inventory management
Strategy / Tactics / Operational

The first approach to supply chain and inventory management should be at a **strategic level,** where fundamental decisions are made about the company's business objectives.

Once the decisions are made at the strategic level, business decisions can be defined at the regular level and **finally at the operational level**, with each level taking into account the goals and decisions of the previous (higher) level.

It is important that **the decisions and goals implemented at each level are in agreement with each other**. Otherwise the company strategy will not be implemented and conflicting policies will not bring the optimal desired result.

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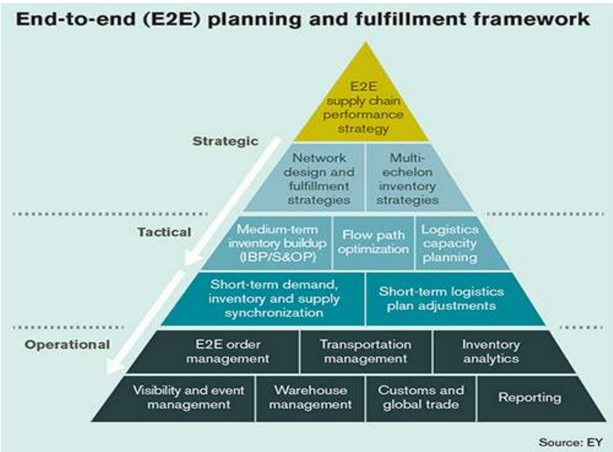
6.3.05.10 Understanding the functionalities of inventory optimisation tools.



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Scenario Management

Scenario analysis is used by companies to manage risk (risk management) and to develop strong strategic plans to deal with the uncertain future.

The success of the scenario analysis method in helping companies manage large capital investments and change the corporate strategy has made it a classic tool of medium-long-term strategic planning.

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Scenario Management

Where is it used?

Many companies have applied the method of scenario analysis and planning to a wide range of issues, from relatively simple, tactical decisions to complex strategic planning processes.

Usually, their application focuses on the areas of greatest uncertainty for a function such as e.g. the demand (and therefore the stock).

What is it doing?

It systematically develops various plausible, alternative, future scenarios in which the operation should be completed, and determines how these affect its success.

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Scenario Management

Procedure

We create a set of 4-5 scenarios and,

- We examine the social, political and technological forces that will influence our project or strategy.

Scenarios are developed by a team of experts and decision makers within the company.

Scenario analysis includes:

the construction or development of scenarios (steps 1-4 below)

And **converting** the content of the scripts into decisions (steps 5-8 below).

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Scenario Management

Procedure Steps

1. ***Defining a focal issue or decision:*** *Scenarios work best if they try to see the future through the lens of a particular topic. Without this background, there is a risk of being too general and vague.*
2. ***Determination of driving forces.*** *These are the social, economic, environmental, political and technological factors that are most relevant to the central issue.*

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Scenario Management

Procedure Steps

3. ***Writing scenario plots.*** *They are the stories that explain how the driving forces affect and what results they bring to the functions we examine.*
4. ***Enrichment of scenarios (Flesh out scenarios).*** *Good scenarios combine the understanding of today's relevant trends with a clear look at exports as seen by decision makers. They must combine the data extracted from the analysis of the quantitative and qualitative data related to the assumptions contained in each scenario.*

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Scenario Management

Procedure Steps

5. See the implications. *Once the scenarios are fully developed, decision makers will need to study the consequences and implications they have on the output of the operation.*

6. Selection of "leading indicators": *These indicators will help those who make decisions to monitor changes in the external environment and the progress of the project.*

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6.3.05.10 Understanding the functionalities of inventory optimisation tools.

Scenario Management

Procedure Steps

7. ***Scattering of scenarios (Disseminate scenarios).*** *Once the scenarios have been "built" and "combed", they should be scattered within the organizations that will implement them.*
8. ***Integration of exported scenarios in everyday processes (Integration).*** *E.g. Change the reward system in the affected areas to confirm a coordinated move towards the strategic objectives formulated in the scripts. Use or change existing systems to monitor progress in relation to the goals set as well as changes in the external environment.*

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ESLog - MODULE E :

DEMAND, PRODUCTION AND DITRIBUTION REQUIREMENTS PLANNING

6.3.05.11 Implementing Vendor Management Inventory (VMI) process.

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6.3.05.11 Implementing Vendor Management Inventory (VMI) process.

Vendors Management Inventory (VMI)

Vendor Management Inventory is an inventory management system where:

Vendor is responsible to manage his customer's inventory.

That means he is the one who takes all necessary actions for stocks replenishment in day to day operation and is the owner of the stock till the time this is sold to the customer.

The procedure is also known as Supplier Managed Inventory, Consignment Inventory, Consignment Stores.

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6.3.05.11 Implementing Vendor Management Inventory (VMI) process.

Basic steps for a successful VMI system

1. Good communication of all involved parties' expectations .
2. Customer's commitment for reliable information exchange.
3. Vendor's commitment for reliable exchange and use of information.
4. Successful systems control before their use
5. Acceptance from all involved parties, that system implementation is a continuous process and not a one-off project.
6. Adequate time and money deposition to implement.

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6.3.05.11 Implementing Vendor Management Inventory (VMI) process.

Basic steps for a successful VMI system

1. Good communication of all involved parties' expectations

Customers should exchange with their vendors their objectives and expectations from VMI implementation.

Both parties' requirements in software and hardware should be defined and their systems' communication should be achieved. As a final step, an implementation plan should be prepared in order to define each party's responsibilities (economic and others).

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6.3.05.11 Implementing Vendor Management Inventory (VMI) process.

Basic steps for a successful VMI system

2. Customer's commitment for reliable information exchange.

Vendors should be able to "see" their customers' sales and stock related data. Without accurate information, the ability to replenish stock correctly, in order to satisfy existed demand, might be limited.

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6.3.05.11 Implementing Vendor Management Inventory (VMI) process.

Basic steps for a successful VMI system

3. Vendor's commitment for reliable exchange and use of information

In order to fulfil the 2nd step, vendor should warranty that all customer's classified information might be communicated, received and used in a proper, secure mode, according to business needs. During planning phase, information accuracy and reliability issues should be discussed.

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6.3.05.11 Implementing Vendor Management Inventory (VMI) process.

Basic steps for a successful VMI system

4. Successful systems control before their use

Like every new system, preliminary controls would reveal existing problems and warranty system's proper application.

5. Acceptance from all involved parties, that system implementation is a continuous process and not a one-off project.

Should be underlined that there is no any on/off button in place for implementation. Adjustments and fine tuning might be necessary in case of fluctuations in demand. Long term adjustments might also be necessary. There is no system that would be 100% ready to use, from the beginning.

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6.3.05.11 Implementing Vendor Management Inventory (VMI) process.

Basic steps for a successful VMI system

6. Adequate time and money deposition to implement.

2-2,5 years were needed to implement the majority of the successful VMI systems, not to mention thousands of euros invested for training and IT needs.

So it is obvious that it is very important and challenging to find the resources and time needed for system's implementation.

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6.3.05.11 Implementing Vendor Management Inventory (VMI) process.

Successful VMI

What happens when circumstances change?

In case of an **increased market demand**, vendors might **loose the motivation** to implement VMI systems that, in other circumstances, could differentiated them from their competitors.

In such a case, customers' stock could be managed by **distributors** instead of vendors. Some of distributors already apply VMI, but most of them do not have the appropriate technical equipment to manage. Another option is to use a 3rd party logistics provider (3PL's) to manage stock inventories.

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6.3.05.11 Implementing Vendor Management Inventory (VMI) process.

Successful VMI

What happens when circumstances change?

Whoever has the responsibility of VMI system application, it is very important to understand that:

Communication is the key for a successful implementation of any Vendor's Management Inventory system.

Accurate and **reliable information** should be used during implementation along with:

- **time**
- **money**
- **effort**

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6.3.05.11 Implementing Vendor Management Inventory (VMI) process.

Successful VMI

VMI is not a perfect solution as far inventory management concerns.

A Harvard University study trying to examine the correlation between VMI systems and higher profits, showed that implementing a VMI system there is no warranty for higher profits, comparing to traditional stock management systems.

Same study showed that information accuracy and reliability along with an effective mechanism for sharing needed information are the basic factors for higher profits in supply chain.

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6.3.05.11 Implementing Vendor Management Inventory (VMI) process.

Successful VMI

VMI implementation some times fails since there are compromises in one or more of the following basic steps:

- Setting clear objectives for VMI system
- Selecting appropriate vendor, compatible with our objectives
- Selecting the appropriate VMI model to implement
- Implementing the program based on a well-defined project plan and proper resources

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ESLog - MODULE E : DEMAND, PRODUCTION AND DITRIBUTION REQUIREMENTS PLANNING

6.3.05.12 Developing Key Performance Indicators (KPIs) relative to inventory management.

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6.3.05.12 Developing Key Performance Indicators (KPIs) relative to inventory management.

Inventory management KPIs

Inventory management is a key operation, especially for companies selling physical products and no services.

Therefore we can define KPIs measuring:

- How effectively the inventory is managed and
- How inventory management impacts sales volume.

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6.3.05.12 Developing Key Performance Indicators (KPIs) relative to inventory management.

Inventory management KPIs

Characteristics of successful KPIs:

- Measure cross functional performance instead of specific departments separately (silo).
- Trying to capture effectiveness increase instead of pure efficiency.
- They are specific, in order to reveal the sections that need improvement.
- Beware of “Vanity KPIs”. They show good image, but do not focus to effectiveness increase.

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6.3.05.12 Developing Key Performance Indicators (KPIs) relative to inventory management.

Inventory management KPIs

Successful KPIs could be:

- Inventory turnover
- Inventory Days of Supply - Coverage
- Inventory to Sales ratio
- Inventory Carrying cost
- Inventory Accuracy
- Demand forecast accuracy.
- Order cycle time
- Supplier's quality index

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6.3.05.12 Developing Key Performance Indicators (KPIs) relative to inventory management.

Inventory Turns or Inventory turnover ratio

The "inventory turnover" KPI shows the amount of inventory sold during a given period, or in other words, how many times during a given period your average inventory has been sold. Calculations are:

$$\frac{\text{Cost of sold products}}{\text{Cost of } average\ stock} \quad \text{or} \quad \frac{\text{Sales}}{\text{Average stock}}$$

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6.3.05.12 Developing Key Performance Indicators (KPIs) relative to inventory management.

Inventory Turns or Inventory turnover ratio

Inventory turnover is a KPI that reflects supply chain effectiveness along with quality and demand of our products and sales practices we have in place.
Usually we are striving for a **high inventory turnover ratio**, since it indicates that more sales are being created for a given stock level.
In other words, we use less stock for a given amount of sales.
On the contrary, a low inventory turnover ratio indicates ineffectiveness and difficulty in turning our stock to revenues.

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6.3.05.12 Developing Key Performance Indicators (KPIs) relative to inventory management.

Inventory Turns or Inventory turnover ratio

Some times a very high inventory turnover ratio may lead to stockouts and thus missed sales, since there is no stock available to cover the existed demand.

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6.3.05.12 Developing Key Performance Indicators (KPIs) relative to inventory management.

Inventory Turns or Inventory turnover ratio

Key terms

Turns: The number of times stock is sold during a given period (usually a year).

Average days to turn inventory / Coverage: The number of days we need to sell the stock we have, or, in other words, how many days' demand covers the existing stock.

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6.3.05.12 Developing Key Performance Indicators (KPIs) relative to inventory management.

Inventory Turns or Inventory turnover ratio

Key terms

Success indicators: A higher inventory turnover ratio than those achieved by our key competitors.
It is always important to compare our achieved results with a given benchmark for the specific industry type, to see how good or bad we are in inventory management. Trends are more important than pure numbers.

Inventory turnover ratio is one of the best KPIs since it captures how effectively a company turns its stock to revenues.

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6.3.05.12 Developing Key Performance Indicators (KPIs) relative to inventory management.

Inventory Days of Supply – Coverage

Inventory days of supply is a term used to define the number of days that a given stock level of a product could cover the existing demand under given circumstances. It can be used, besides others, by manufacturers (calculate the time between raw materials supply and final products production) and merchants (how many days existing stock should last under a given demand without replenishment).

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6.3.05.12 Developing Key Performance Indicators (KPIs) relative to inventory management.

Inventory Days of Supply – Coverage

Example: Rotation & Coverage:

The average weekly sales of a product are 100 units. The average stock is 400 units, that means it covers 4 weeks demand.

a) Find the inventory turnover ratio for a year.
b) If forecasted sales for the coming weeks are as shown in table below, define the number of weeks the existing stock of 500 units can cover, per week.

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Example:

	Weeks	1	2	3	4	5	6	7
Average Sales		100	100	100	100	100	100	100
Forecasted Sales		90	105	110	105	100	90	85
Average Stock	400							
Rotation	?							
Coverage	4							
Current Stock on hand	500	?	?					
Current Coverage	?	?	?					

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Example:

a) 100 * 52 weeks = 5200 units sold/year
   Inventory turnover ratio = 5200 / 400 = 13

b) week 0: 500 units current stock on hand, covers 4.9 weeks
   week 1: 410 units current stock in hand, covers 3.9 weeks
   week 2: 305 units current stock in hand, covers 2.9 weeks
   week 3: 195 units current stock in hand, covers 1.9 weeks
   week 4: 90 units current stock in hand, covers 0.9 weeks

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6.3.05.12 Developing Key Performance Indicators (KPIs) relative to inventory management.

Inventory to Sales ratio

"Inventory to Sales ratio" KPI, measures the amount of stock we hold in relation to the amount of sales we have achieved (demand we have covered).

The related form is:

$$\textit{Inventory to Sales ratio} = \frac{\textit{Stock Value}}{\textit{Sales value}}$$

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6.3.05.12 Developing Key Performance Indicators (KPIs) relative to inventory management.

Inventory to Sales ratio

The "inventory to sales" ratio achieved by a company, is **important to be compared** to respective ratios achieved by other **similar companies.**

e.g. Consumer goods companies like supermarkets, operate having a smaller "inventory to sales" ratio comparing to companies selling furniture or machinery.

This KPI is close related to "Inventory turnover ratio" and if examined together, they can show the financial stability of a company.

It is important to say that a high carrying inventory cost mean that you want to sell your inventory as soon as possible.

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6.3.05.12 Developing Key Performance Indicators (KPIs) relative to inventory management.

Inventory to Sales ratio

Key terms

Inventory Turns: How many times in a year retained inventory is sold. Πόσες φορές τον χρόνο πουλιέται όλο το απόθεμα.

Carrying Cost: Cost related to inventory storage, such as warehouse leasing, storage environmental conditions control (e.g. temperature, humidity) and administration.

Success indicators

A small or a falling "Inventory to Sales" ratio.

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6.3.05.12 Developing Key Performance Indicators (KPIs) relative to inventory management.

Carrying or retention cost

Carrying cost, is the cost related to **maintenance (storage in a proper condition) of an inventory unit for a given period**, usually a year.

It is a combination of:

- Cost of capital,
- Storage cost and
- Obsolescence cost.

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6.3.05.12 Developing Key Performance Indicators (KPIs) relative to inventory management.

Carrying or retention cost

Carrying cost (H) is measured in €/unit/year.

We can also see it as a fraction, h, of product unit cost.
For a given product unit cost of C, inventory carrying cost, H, should be:

$$H = h\,C$$

Total carrying cost is increased proportionally to the amount of batch received and the cycle inventory held.

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6.3.05.12 Developing Key Performance Indicators (KPIs) relative to inventory management.

Carrying or retention cost

Cost of capital: It is the most important part of carrying cost in case of long lasting products. In order to calculate the associated cost of capital, the best approach is to evaluate the weighted-average cost of capital (WACC), that takes into account the rate of interest paid on company's equal capital along with its net debt cost.

Obsolescence cost: Estimates the devaluation of a stored product, due to present market value or due to its quality degradation. This cost can be varied significantly depending on the type of product (e.g. perishables or technology products vs e.g. crude oil).

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6.3.05.12 Developing Key Performance Indicators (KPIs) relative to inventory management.

Carrying or retention cost

Physical storage cost. Consists of:

1. **Handling Cost:** Represents the additional receipt and warehousing cost that is changing depending on the quantity of products received. Handling cost that is irrelevant to the received quantity and is changing depending on the number of orders is included in order cost.
2. **Occupancy cost**: Occupancy cost, usually is expressed as step function (0/1) or fixed cost, representing a sudden increase in cost in case we need to use more storage space.
3. **Miscellaneous costs**: e.g. product damages, pilferages, additional insurance cost, etr.

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6.3.05.12 Developing Key Performance Indicators (KPIs) relative to inventory management.

Carrying or retention cost

Carrying cost index reflects the cost a company pays in order to store a certain inventory for a given period.

It is used to show the margin that could be produced from the current inventory and to help suppliers to revise their production cycle.

Success indicators: Carrying cost should be low but not the lowest that could be. It should be as low, along with order cost, as should be, in order to achieve the minimum total inventory cost.

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Calculating EOQ

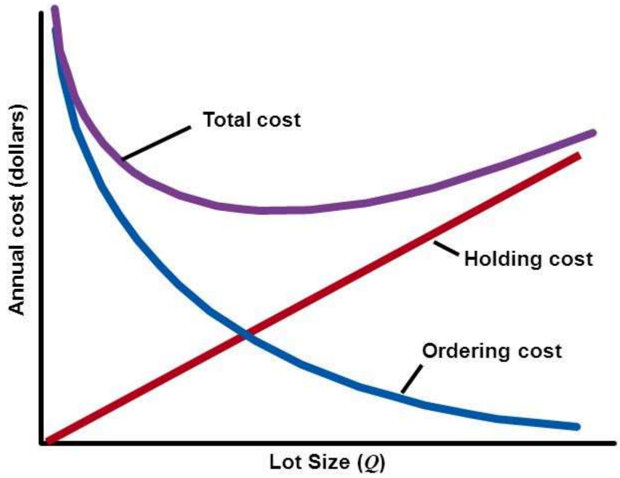

Figure 12.3 – Graphs of Annual Holding, Ordering, and Total Costs

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6.3.05.12 Developing Key Performance Indicators (KPIs) relative to inventory management.

Inventory accuracy

Inventory accuracy index, compares the actual inventory level to the one that is presented in our books.

This index requires stocktaking to be done frequently comparing books content with actual inventories in order to ensure that our data management procedures are good.

Inaccurate results could mean higher cost, insufficient order management and in the bottom line, unsatisfied customers along with incapability in warehouse management and control.

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Demand forecast accuracy.

Reveals the deviation between actual and forecasted demand in a production or sales environment.

Using this index, we are helping production operations to be more efficient reducing the gap between actual and forecasted demand.

It is also contributes to inventory carrying cost reduction, a basic index in inventory management theory.

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Order cycle time

Delivery Cycle time and total order cycle time (Lead time) are two important figures that should be evaluated in a supply chain.

We can easier intervene and change delivery cycle time than total order cycle time.

Our target is to have values as lower as we can, but most importantly as STABLE as we can.

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Supplier Quality Index

An index that reflects the performance of our partners/suppliers in:

- inventory management
- products and service quality
- Low and procedures compliance

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DEMAND, PRODUCTION AND DITRIBUTION REQUIREMENTS PLANNING

6.3.05.13 Selecting and implementing appropriate information technology system (ITS) such as Advanced Planning Systems (APS).

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6.3.05.13 Selecting and implementing appropriate information technology system (ITS) such as Advanced Planning Systems (APS).

Advanced Planning Systems

Advanced planning systems are systems that manage production procedures, in a way that:

- raw materials and
- production resources

are used properly to satisfy the existed demand.

APS fits where simple planning methods can not deal with complex prioritisation issues successfully.

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Advanced Planning Systems

An advanced planning system is considered **a strategic option** and helps us to use properly and improve KPIs.

Signs that an advanced planning system is necessary to our operations, could be:

- Low returns of capital invested,
- high operational costs,
- on-time deliveries below set objective.
- lost sales due to lack of resources.

Companies can depreciate such an investment in a year, or less.

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6.3.05.13 Selecting and implementing appropriate information technology system (ITS) such as Advanced Planning Systems (APS).

Advanced Planning Systems

Advantages

- Cooperative resource scheduling and master planning (improved use of resources, reduced stocks, better investment planning).
- Cooperative demand planning and use of shared data (preventive demand stabilization).
- Unification of existing software systems and standardization (reduced IT costs).
- Faster data flow into supply chain.
- Reduced work load in routine jobs.
- Integrated Company.

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6.3.05.13 Selecting and implementing appropriate information technology system (ITS) such as Advanced Planning Systems (APS).

Basic criteria for choosing APS right

1. **Set as clear, your requirements and objectives, as possible:** What planning and programming issues want to resolve, which operations would you like to influence? The right software will help you to succeed and gain basic strategic advantages, so pay attention to these items during procurement procedure, not to mention the right operational capabilities, software must has. The most important is to think of and record our detailed requirements and objectives. This is the best warranty for a successful choice of the proper APS.

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6.3.05.13 Selecting and implementing appropriate information technology system (ITS) such as Advanced Planning Systems (APS).

Basic criteria for choosing APS right

2. **Analyse flexibility, adaptability and upgrade possibility of the software.**
   System's capabilities should satisfy a wide range of present and future planning, programming and business challenges. Should also be:

- Able to "run" as many "what if" scenarios as possible
- Accurate
- Able to host more users or/and parameters depending on company's development.

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6.3.05.13 Selecting and implementing appropriate information technology system (ITS) such as Advanced Planning Systems (APS).

Basic criteria for choosing APS right

3. **Verify that the selected APS offers a clear picture of company's operations to all involved parties & individuals.** In order to be aware of resource capabilities, existing workload, stock levels, production and/or distribution programs, etr

4. **Verify how** the selected software can help you to **provisionally manage potential changes** in production, feedstock procurement or in the supply chain in general. It is obvious that the reality not fits to the plan, even if the later has been done perfectly and is updated in real time. Since the changes will happen, having a strategy and the tools to follow them up and manage, is very important and shows a successful selection.

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6.3.05.13 Selecting and implementing appropriate information technology system (ITS) such as Advanced Planning Systems (APS).

Basic criteria for choosing APS right

5. Software should help to **improve key performance indicators (KPIs)** and **return on investment (ROI), measuring and following up all set objectives.** This way helps to achieve continuous improvement.

6. If locations that company operations are taking place are more than one, **software should support all these locations and all necessary links between them**. APS should help several locations to operate as a single one.

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6.3.05.13 Selecting and implementing appropriate information technology system (ITS) such as Advanced Planning Systems (APS).

Basic criteria for choosing APS right

7. Evaluate, during the demo operation,

- how “easy to use” the software is.
- How it resolves the problems appeared?
- The kind of training and support that is provided by the supplier.

Answering to these questions helps you to reduce risks during the procurement, supports the system installation and makes easier to manage the changes that would cause.

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6.3.05.13 Selecting and implementing appropriate information technology system (ITS) such as Advanced Planning Systems (APS).

Basic criteria for choosing APS right

8. **Prepare a list of potential system suppliers**. That list should include only preferred APS suppliers that cover the whole range of your requirements. Some globally known APS providers are:
   - SAP, Oracle
   - Wassermann, DynaSys
   - MAPICS APS
   - Agilsys APS

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6.3.05.13 Selecting and implementing appropriate information technology system (ITS) such as Advanced Planning Systems (APS).

Basic criteria for choosing APS right

9. **Prepare a Request for proposal (RFP).** RFP should:

- **Be focused on APS selection.** Through RFP we collect all needed information asked from suppliers regarding project implementation
- Give you the opportunity to **collect all needed measurements and data** in order to define, buy and implement a "fit for purpose" APS software for your company.
- Define the **availability** and the **possibility to be delivered within a reasonable timescale.**
- Define **risks** and **support terms**.
- Give **assurance** on suppliers responses (clause provision)

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6.3.05.13 Selecting and implementing appropriate information technology system (ITS) such as Advanced Planning Systems (APS).

Basic criteria for choosing APS right

10. **Proposal evaluation.** If supplier is proposing a prototype (standard module) CRM, our consultant should help us to evaluate it compared to our business needs. It is critical to detect potential gaps, if any, in system's capabilities and ask for a detailed timeplan to fix them.

11. **Evaluate other software characteristics.** Discuss with supplier, several system characteristics should help us to achieve our goals. Customised APS have a lot of characteristics have been designed for different types of companies, that might fit to our needs.

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6.3.05.13 Selecting and implementing appropriate information technology system (ITS) such as Advanced Planning Systems (APS).

Basic criteria for choosing APS right

12. **Demo operation at work places & contract signage:** By doing so, we are focusing on system's behaviour at specific work places and on its use by specific personnel. If it works properly we are ready to sigh the implementation contract

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6.3.05.13 Selecting and implementing appropriate information technology system (ITS) such as Advanced Planning Systems (APS).

Basic criteria for choosing APS right

Implementation

Customized Draft procedures

Despite formal/general operating procedures are of high importance, customized procedures are invaluable.

This is a critical point for a smooth transition to a stable, continuous operation of the new APS.

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6.3.05.13 Selecting and implementing appropriate information technology system (ITS) such as Advanced Planning Systems (APS).

Basic criteria for choosing APS right

Implementation

Pilot / Continuous Use

During pilot use, it is possible to discover problems and inconsistencies related to the system and the software. It is an unavoidable part of the whole installation procedure. What we have to do is, to detect all these problems and schedule their solution as soon as possible.

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6.3.05.13 Selecting and implementing appropriate information technology system (ITS) such as Advanced Planning Systems (APS).

Basic criteria for choosing APS right

Post implementation improvement.

Since software has been installed, implemented and is operational, there are more to be done:

1. Quantify all benefits that system offers. Compare the results with profits that have been budgeted during implementation study.

2. Detect if there is room for improvement. If yes, go and get it

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Good luck!

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