MÄLARDALEN UNIVERSITY
SWEDEN

Introduction to logistics

PPU426 – 2018

What is logistics?

Definition

Logistics is the process of planning, implementing, and controlling the efficient, cost-effective flow and storage of raw materials, in-process inventory, finished goods and related information from point of origin to point of consumption for the purpose of conforming to customer requirements.

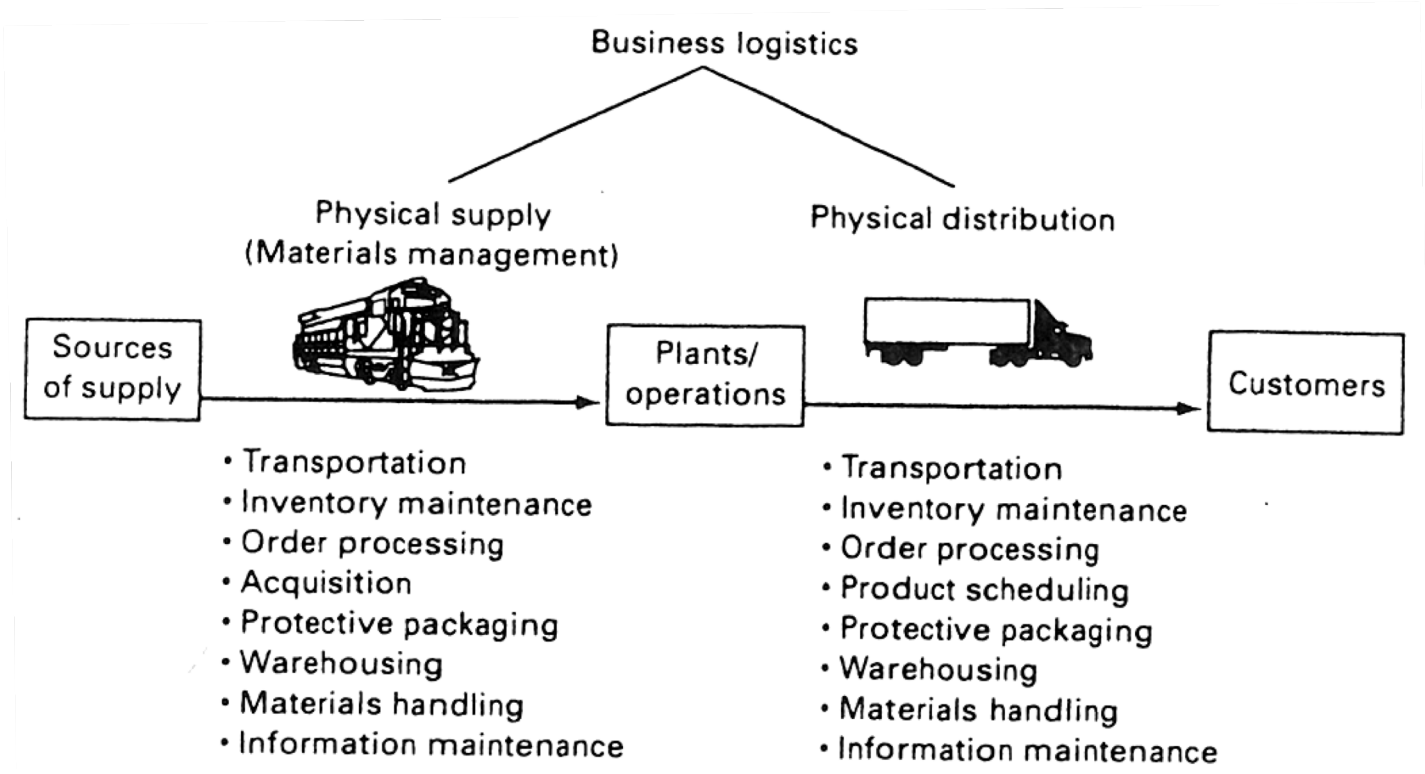
Council of Logistics Management (CLM)

Mission

The mission of logistics is to get the right goods or services to the right place, at the right time, and in the desired condition, while making the greatest contribution to the firm.

What is logistics?

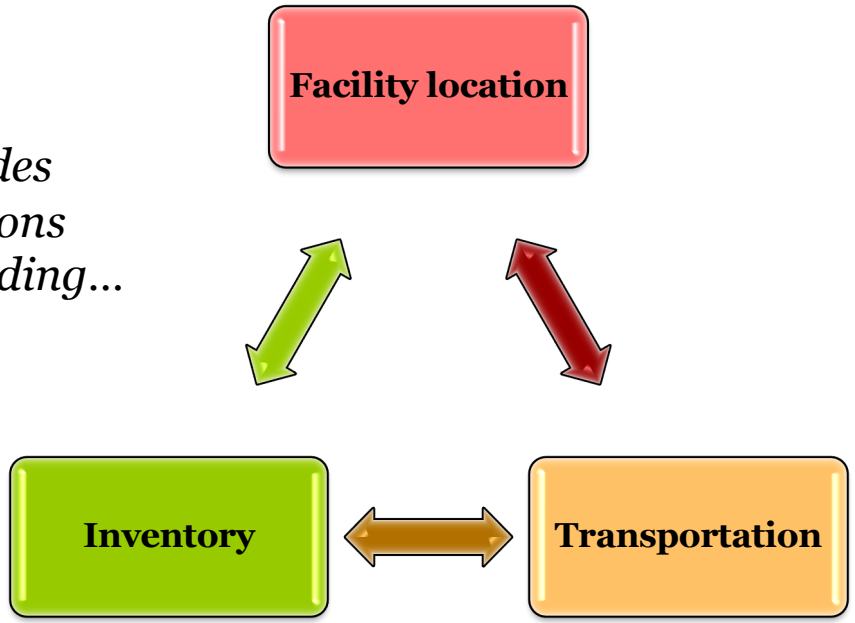
Supply chain



Customer service levels

Customer Service standards set the level of output and degree of readiness to which the logistics system must respond

Includes decisions regarding…



Customer service levels

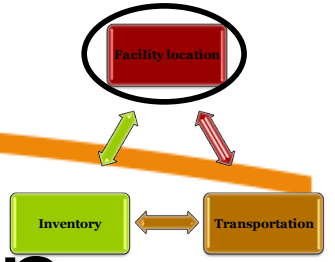
Low service levels allow centralized inventories at few locations and the use of less expensive forms of transport.

High service levels generally demands for decentralized inventories at many locations and the use of more expensive forms of transport.

Customer service broadly includes inventory availability, speed of delivery, and order filling speed and accuracy.

Logistics customer service is for many firms the speed and dependability with which items ordered by customers can be made available.

"Someone calling themselves a customer says they want something called service."

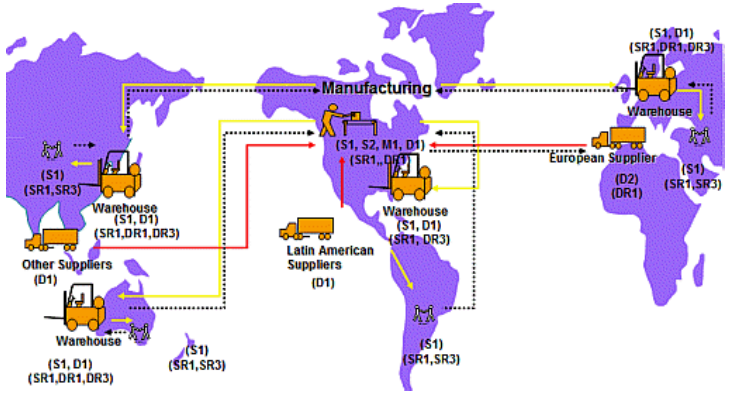


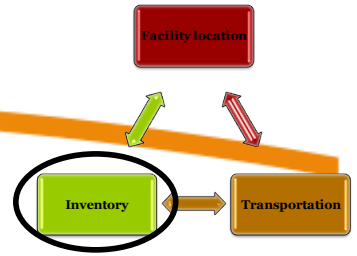
Facility location decision

The **geographic placement** of the stocking points and their sourcing points create an outline for the logistics plan.

The proper **scope** for the facility location problem is to include all product movements and associated costs from plant, vendor, or port location through the intermediate stocking points and to the customer locations.

The **essence** of facility location strategy is finding the lowest cost assignments, or alternatively the maximum profit assignments





Inventory decisions

Inventory adds time value and is essential to logistics management because it is usually not possible or practical to provide instant production or ensure delivery times to the customers.

Two **strategies** are allocating (pushing) inventories to the stocking points versus pulling them into stocking points through inventory replenishment rules.

Inventory strategy

- **Storage systems** are needed since demand usually cannot be predicted exactly. Also, production is not instantly responsive, nor is transportation reliable with zero delivery time at a reasonable cost.
- Firms use **inventories** to improve supply-demand coordination and lower overall costs.
- By warehousing some inventory, a firm can often lower production costs through economical production lot sizing and sequencing and lower transportation costs through the shipment of larger, more economical quantities.

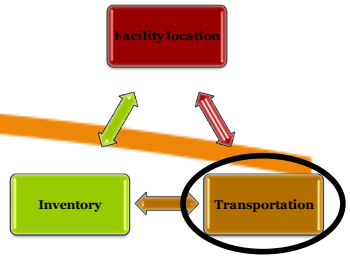
Inventory strategy

The **storage system** can be separated into two important functions:

- Inventory holding (storage)
- Materials handling

Storage is simply the accumulation of inventory for a period of time. Different locations in the warehouse are chosen, depending on the purpose of storage.

Materials handling refers to those activities of loading and unloading, moving the product to and from various locations within the warehouse, and order picking.



Transport decisions

Transportation adds place value to the products and services and is essential because no modern firm can operate without providing for the movement of its raw materials and/or finished products.

Transport decisions can involve mode selection, shipment size, and routing or scheduling.

Transportation usually represents the most important single element in logistics costs in most firms.

Transport decisions

The user of transportation has a wide range of services at his disposal, all revolving around the **five basic modes** water, rail, truck, air, and pipeline.

Transportation service may be viewed in terms of **characteristics** that are basic to all services: price, average transit time, transit time variability, and loss and damage

- **Price (cost)** of transport service to a shipper is rate for transporting goods plus any accessorial or terminal charges for additional services.
- **Transit time** is the average time it takes for a shipment to move from its point of origin to its destination.
- **Variability** refers to the usual differences that occur between shipments by various modes.

Modes of transport

- **Rail** : long hauler and slow mover of raw materials and of low valued manufactured products and prefers to move shipment sizes of at least a full carload.

- **Truck**: transportation service of semi finished and finished products. The inherent advantage of trucking is its door-to-door service such that no loading and unloading is required between origin and destination.

- **Air:** dependable and fast (but costly) long distance transportation.

- **Water:** availability and dependability limited by waterway system and influenced by weather in scope for several reasons.

- **Pipeline**: the most economically feasible products to move by pipeline are crude oil and refined petroleum products, but the transportation is slow (about 3 or 4 miles per hour). This slowness is tempered by the fact that products move 24 hours a day and 7 days a week.

Transports: Europe – Asia?

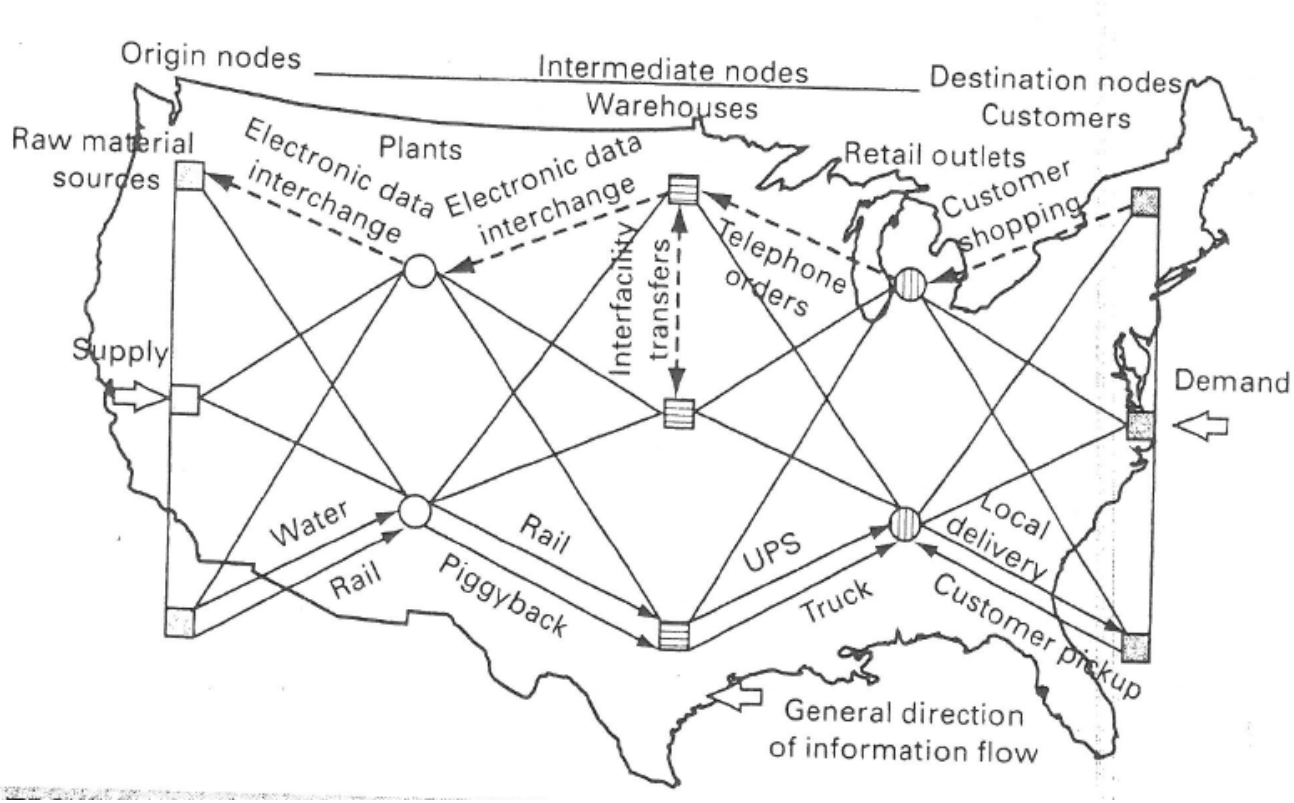
EXPENSIVE

SLOW

TRAIN?

Train routes: Europe – Asia

Logistics planning problem



The **links** of the network represent the movement of goods or information between various inventory storage points, represented by the **nodes**.

Information flow

In addition there is a **flow of information**. Information is derived from sales revenues, product costs, inventory levels, warehouse utilization, forecasts, transportation rates and the like.

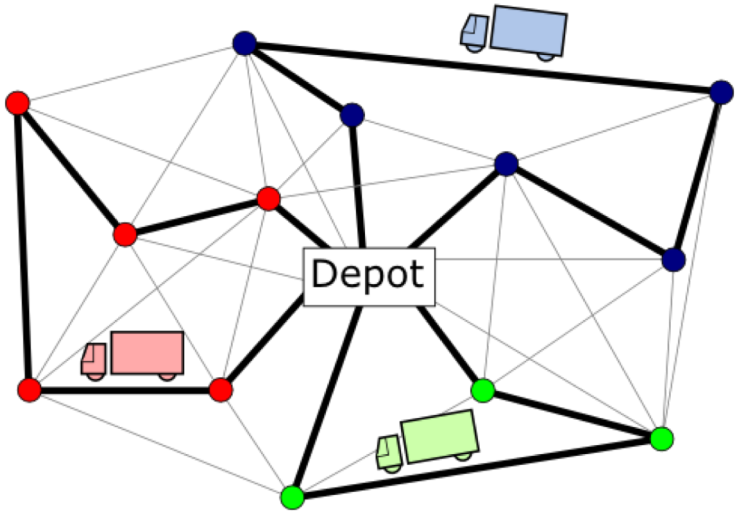
Links in the information network usually consists of the mail or electronic methods for transmitting information from one geographical point to another. **Nodes** are the data collection and processing points, such as a clerk who handles order processing and prepares bills of laden or computer that updates inventory records.

A major difference in the network is that **product** mainly flows “down” the distribution channel (toward the final customer), whereas **information** mainly, but not entirely, flows “up” the channel (toward raw material sources).

Vehicle Routing

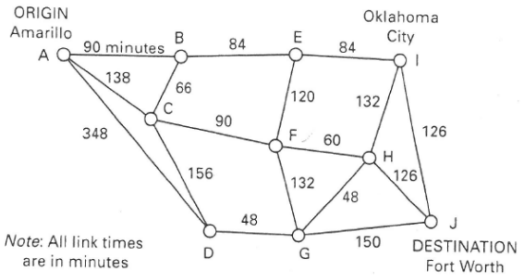
Because transportation costs typically range between 1/3 and 2/3 of total logistics costs, improving efficiency through the maximum utilization of transportation equipment and personnel is a major concern.

To reduce transportation costs and also to improve customer service, finding the best paths that a vehicle should follow through a network of roads, rail lines, shipping lanes, or air navigational routes that will minimize time or distance is a frequent decision problem.

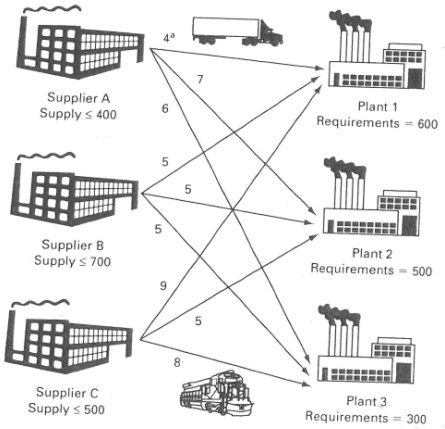


Vehicle Routing

- **Separate and single origin and destination points:** Perhaps the simplest and most straight forward of routing a vehicle through a network is the shortest route method.



- **Multiple origin and destination:** When there are multiple source points that may serve multiple destination points, there is a problem off assigning destinations to sources as well as finding the best routes between them. This type of problem is frequently solved by a special class of linear programming algorithm known as the transportation method.

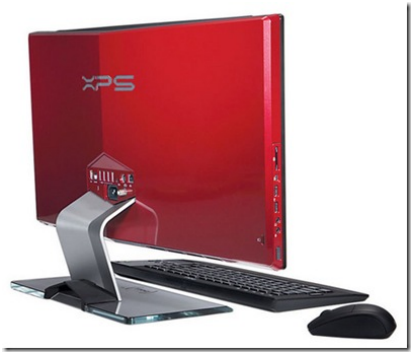


- **Vehicle routing and scheduling:** More realistic restrictions are now included. These restrictions add a great deal of complexity to the problem and make it very difficult to find an optimal solution. However good solution can be found using heuristic procedures (specific algorithms to determine the best, although not always optimal, path to a destination).

Product characteristics

Logistics costs are sensitive to such characteristics as product weight, volume (cube), value, and risk.

A firm producing **high valued goods** (such as computers) with logistics costs being a fraction of total costs will likely give little attention to the optimality of logistics strategy.



A firm producing **low value goods** (such as paper clips) with logistics costs being a large part of total costs will likely give much attention to the optimality of logistics strategy.

Product characteristics

- **Weight/Bulk Ratio**: Products with a high density, i.e. have a high weight-bulk ratio show good utilization of transportation equipment and storage facilities. However, for products with low density, the weight capacity of transportation equipment is not fully realized before the bulk carrying limit is reached.

- **Value-Weight Ratio:** Storage costs are particularly sensitive to value. Low product value means low storage cost, but high transportation cost in relation to sales value. The opposite is true for high value products.

- **Risk Characteristics**: When a product shows high risk (e.g. is flammable) more restrictions on the distribution system are needed. Both transport and storage costs are higher.

	Weight/ Bulk		Value/ Weight		Risk	
Cost	*High*	*Low*	*High*	*Low*	*High*	*Low*
Storage	**Low**	**High**	**High**	**Low**	**High**	**Low**
Transportation	**Low**	**High**	**Low**	**High**	**High**	**Low**

Consumer products

Consumer Products are those that are directed to end users.

- ***Convenience Products*** are those goods and services that consumers purchase frequently, immediately, and with limited comparative shopping. Typical products are food.

- ***Shopping Products*** are those for which customers are willing to seek and compare: shopping many locations, comparing price and quality, performance, and making a purchase only after careful deliberation. Typical products are fashion clothes.

- ***Specialty Products*** are those for which buyers are willing to expend a substantial effort and often to wait a significant amount of time in order to require them. Buyers seek out particular types and brands of goods and services. Typical products are custom made automobiles.

Consumer products

	Convenience products	Shopping products	Specialty products
Distribution	**Wide** with many outlets	⟷	**Centralized** with few outlets
Logistics costs	**High** but justified by the increased sales potential	⟷	**Low** because of limited distribution
Customer service	Product availability and accessibility	⟷	**Low** in terms of logistics

Industrial Products

Industrial Products are those that are directed to individuals or organizations that use them to produce other goods or services.

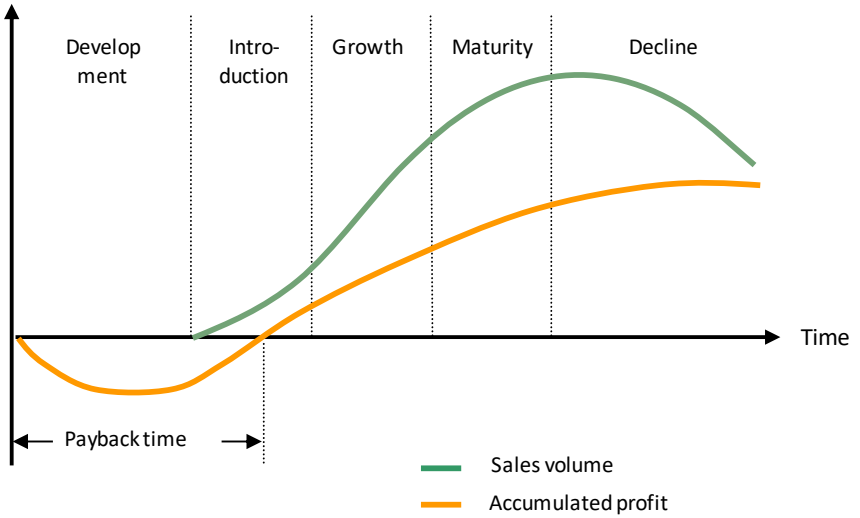
Traditionally, industrial goods and services have been **classified** according to the extent to which they enter the production process.

- Goods that are part of the finished product, such as raw materials and component parts
- Goods that are used in the manufacturing process, such as buildings and equipment
- Goods that do not enter the process directly, such as supplies and business services.

Product life cycle (PLC)

The **physical distribution strategy** differs for each stage.

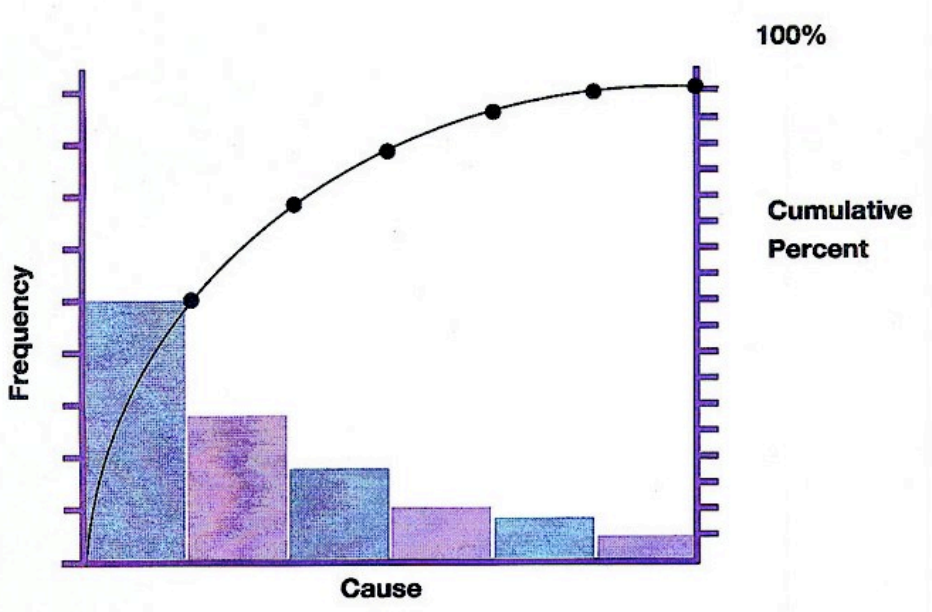
- During the introductory stage, the strategy is a cautious one, with stocking restricted to relatively few locations. Product availability is limited.
- The growth stage may be fairly short
- During the maturity stage, sales growth is slow or stabilized at a peak level. At this time the product has its widest distribution.
- During the decline stage, sales volume declines as a result of technological change, competition, or waning consumer interest.



The 80/20 curve

The **product line** of a typical firm is made up of individual products at different stages of their respective life cycles and with different degrees of sales success.

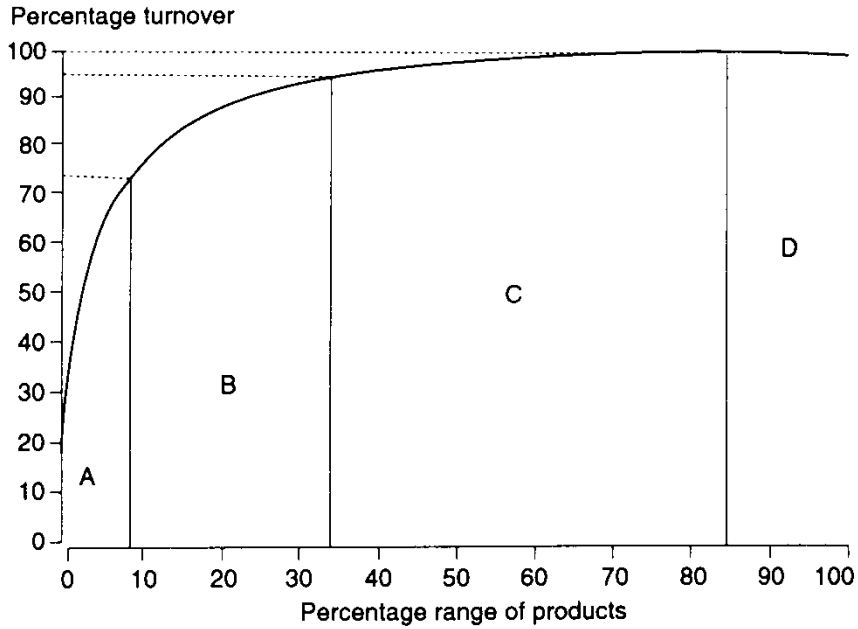
Pareto´s law: 80 percent of a firm's sales are generated by 20 percent of the product line items.



ABC product classification

A products apply for approximately 10% of items or 66.6% of value
B products apply for approximately 20% of items or 23.3% of value
C products apply for approximately 70% of items or 10.1% of value

=> Each category of items should be distributed differently



Thank you!

Next lecture:
Friday 2018-11-16

Forecasting techniques, Linear regression, Time series, Exponential smoothing

Book chapter: “Forecasting demand”