



# Introduction to Operations Management 运营管理概论

## 1- the Company

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# Short history of production



## Pre-history

Humans switch from a nomadic and hunter lifestyle to a sedentary and builder lifestyle

## Antiquity

- Pottery
- Spinning of vegetal and animal fibers



## Middle-age

- Coal as a fuel
- Textile
- Archery, weapons, armour
- Castles and cathedrals building
- Mill widely used (discovered at the end of the Antique age)



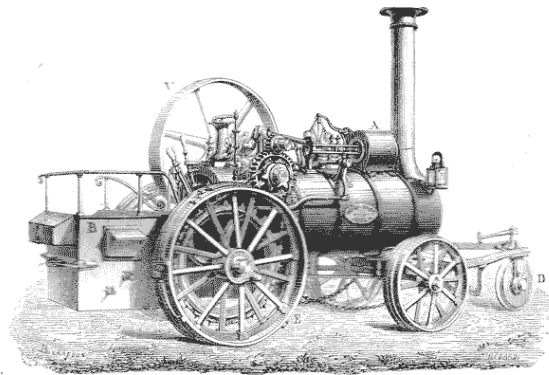
## Renaissance

- Building techniques
- Craftsmanship renewal
- Weapons, clothes, carpets, ceramics, crystals, glass

# 18th and 19th centuries

## The industrial era – transformation in the organisation of production

First industrial revolution linked to steam and coal (1790)



Technology: iron and steel gives birth to new modes of transportation (railway) and communication (telegraph, telephone)



Second industrial revolution (1850 to WWII). Use of electricity.



Organisation speaking, shift from a family workshop to a factory and corporate life. From raw material to finished goods.

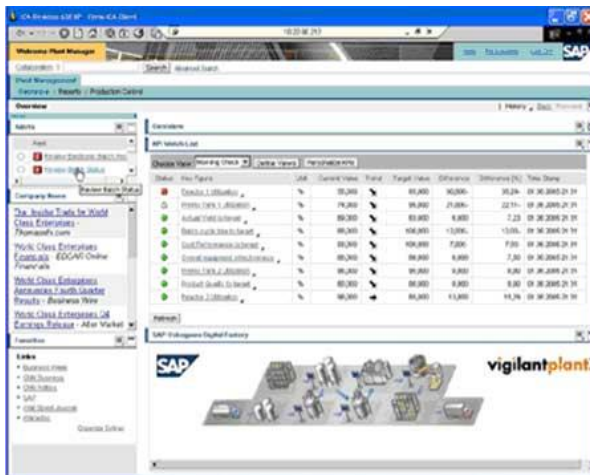


## 20th century

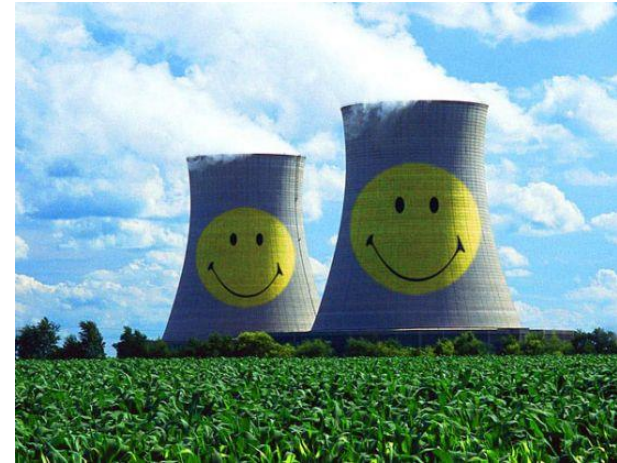
Use of fossil fuels, exponential development of industrial activities



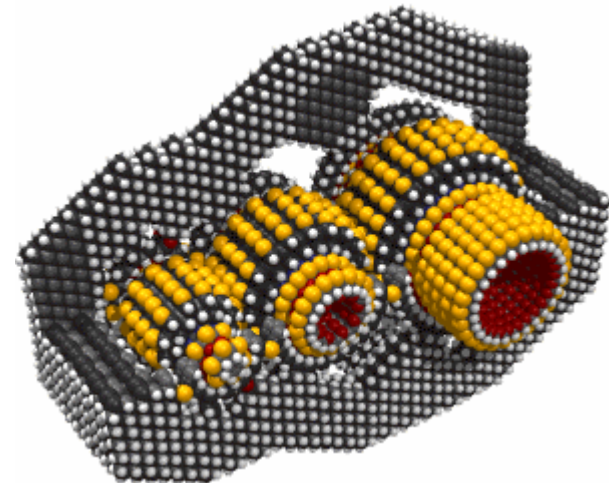
## The IT revolution



## Nuclear energy



## Biotechnologies, Nanotechnologies





## 21st century? (1)



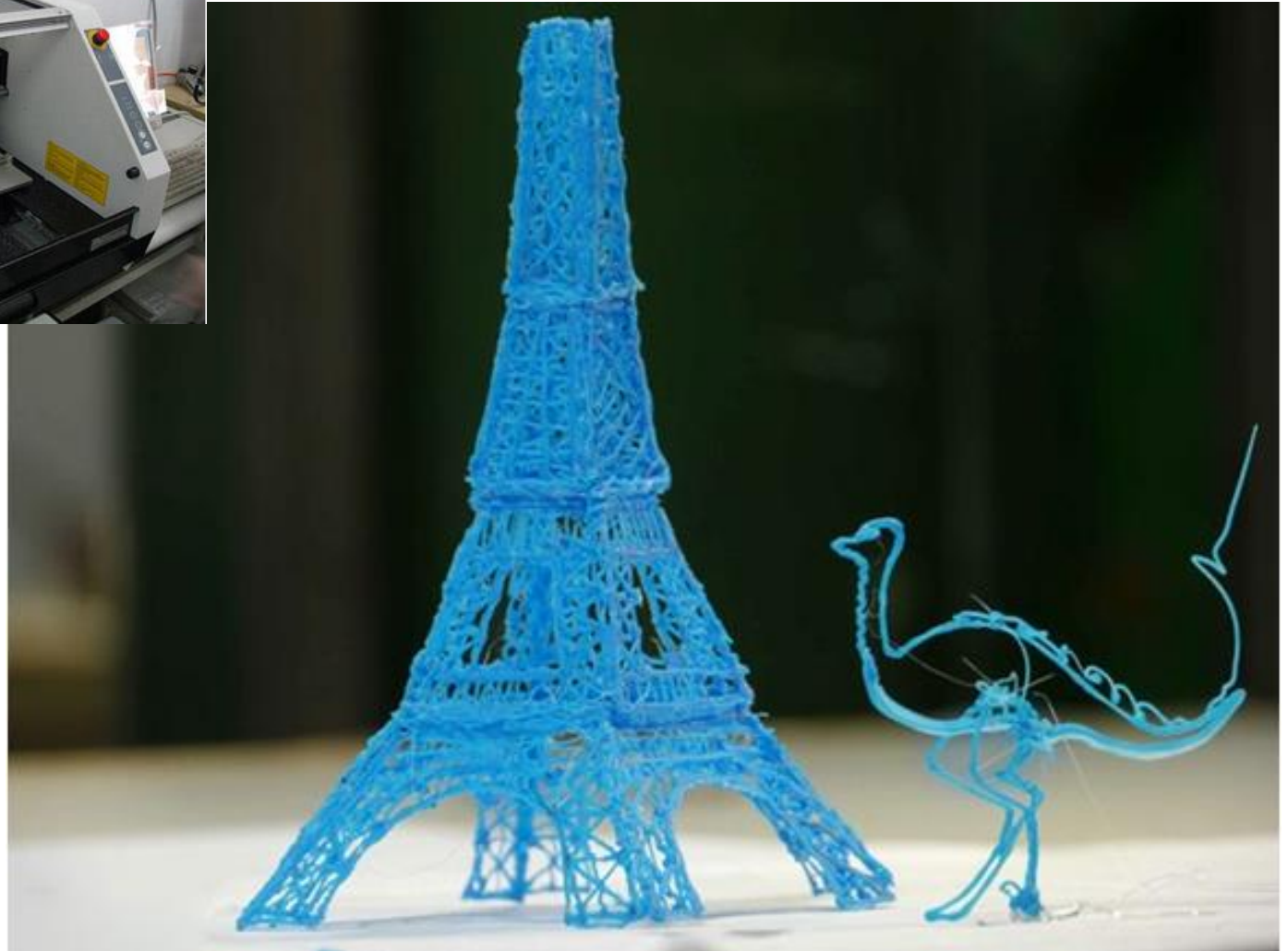
Circular economy  
Eco design



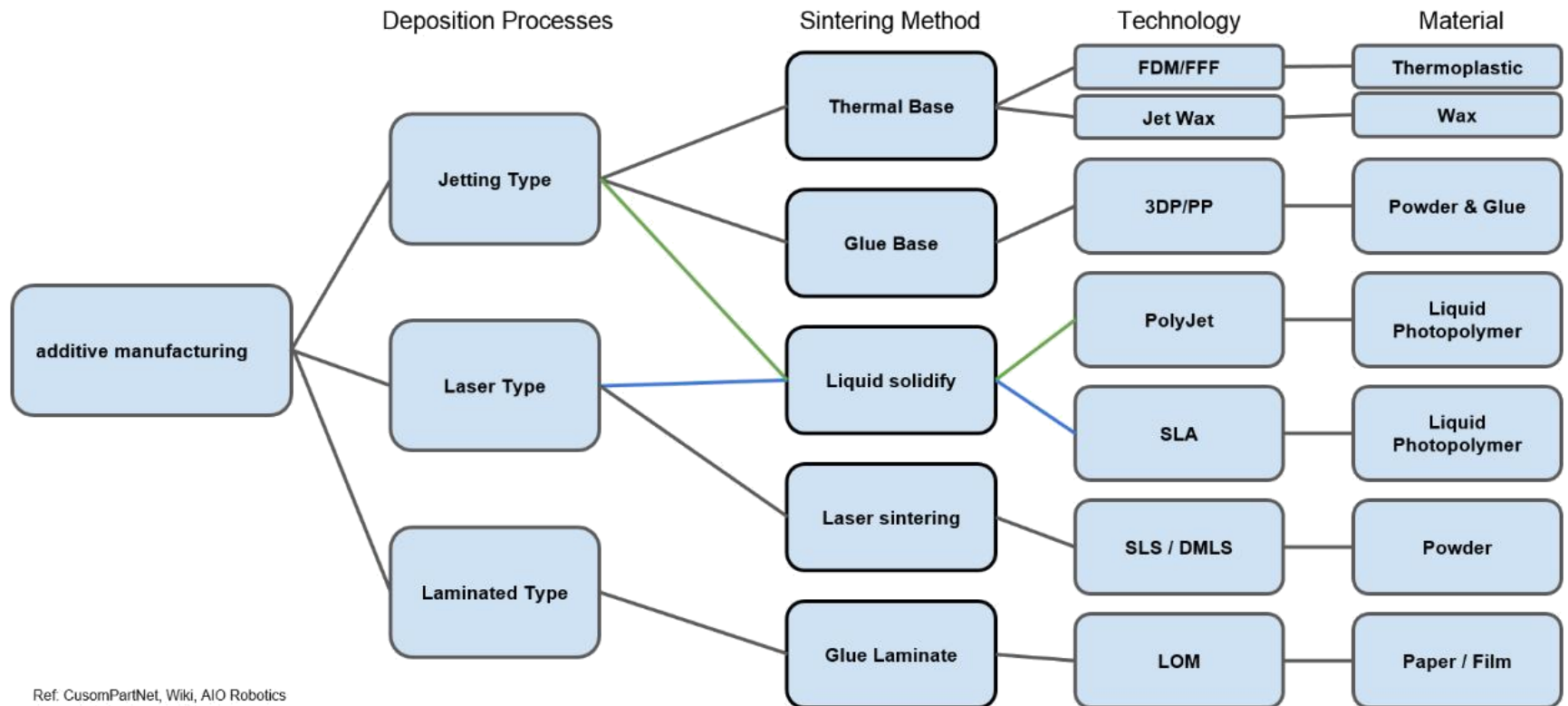
## 21st century? (2)



3D Printing



# Main types of laser printing technologies (non metal)





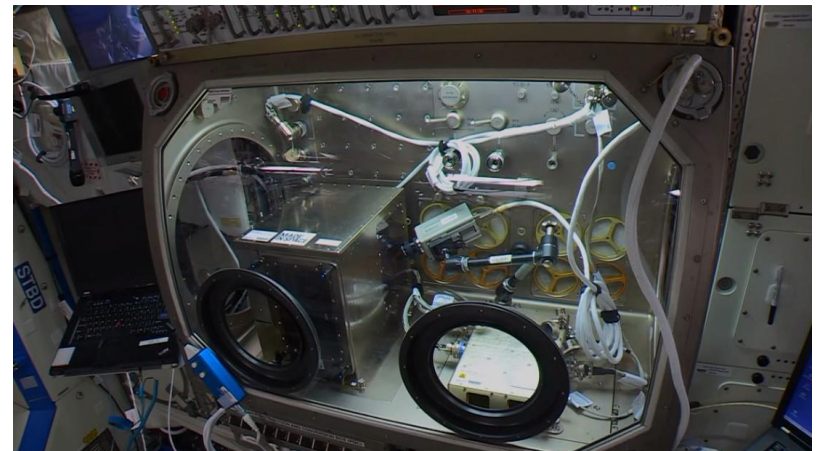
# Industrial 3D printing is not a dream anymore



Selective laser printing  
Microfabrica Inc



Monash university (Melbourne)



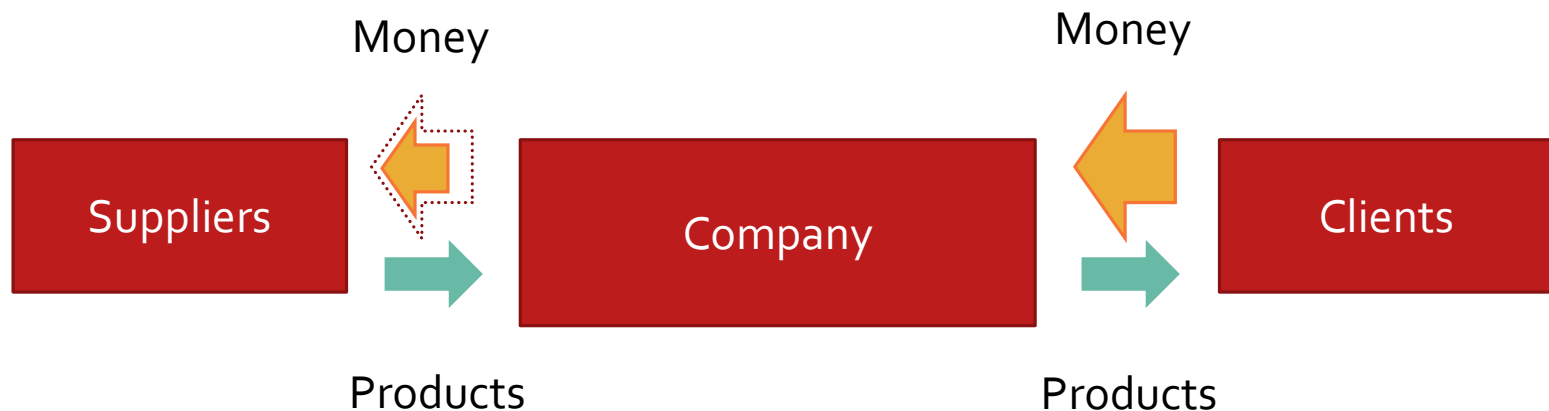
Zero Gravity printer.  
Design send by email to the ISS  
Company: Made in Space



# The Company

From an economic point of view, the company is a structure:

- With one or more employees
- Organised to deliver **goods** or **services** to customers in a competitive environment (the market) or non competitive environment (monopoly)
- In a **relational** context





A company adds value (perceived or real).  
Customers are willing to pay for this value.

- **Goods** are physical objects, something we can touch, feel, or see. **Services** are the performance of some useful function
  - The **wealth** is measured by the amount of goods and services produced
  - **Potential** sources of wealth a transform our resources into **useful** goods.
  - By **transforming** the raw materials they purchase and **adding value** to them through **manufacturing**.
  - Converting raw materials to a form that is of far more value and use **to the consumer** than the original raw materials.
- >> *The customer of one supplier buys a product, adds value to it and supplies yet another customer*

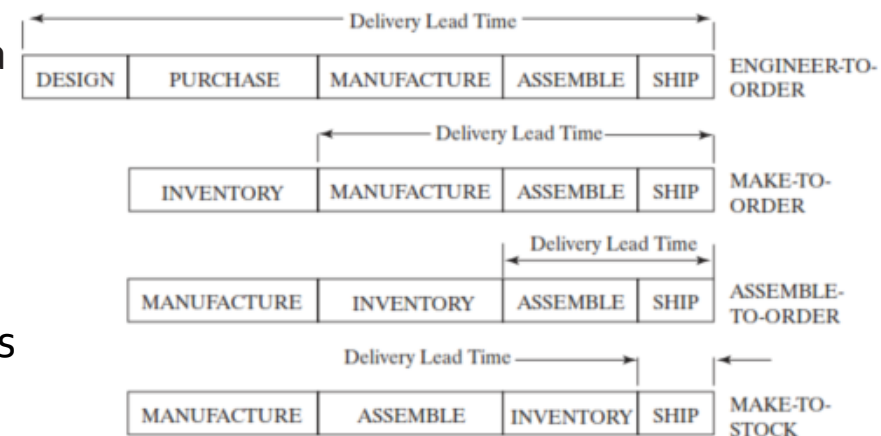
# Why manufacturing

## Client expectations

- A fair price
- Higher-(right) quality products and services
- Delivery lead time
- Better presale and after-sale service
- Product and volume flexibility

**Order qualifiers:** Customer requirements may be based on price, quality, delivery, and so forth and are called **order qualifiers**. For example, the price for a certain type of product must fall within a range for the supplier to be considered.

**Order winners:** Those competitive characteristics, or combination of characteristics, that persuade a company's customers to choose its products or services are called **order winners**.





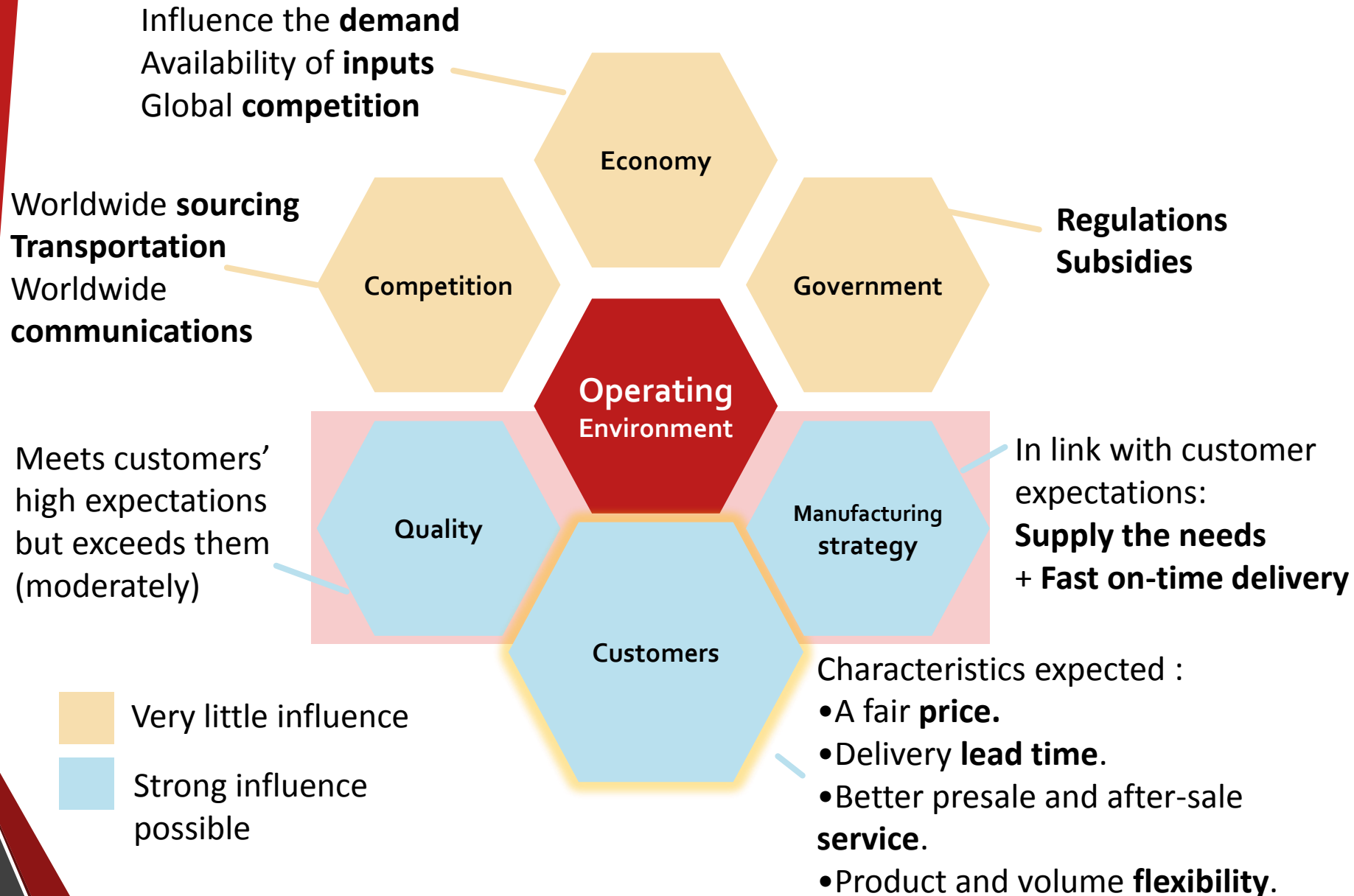
# The operating environment

History

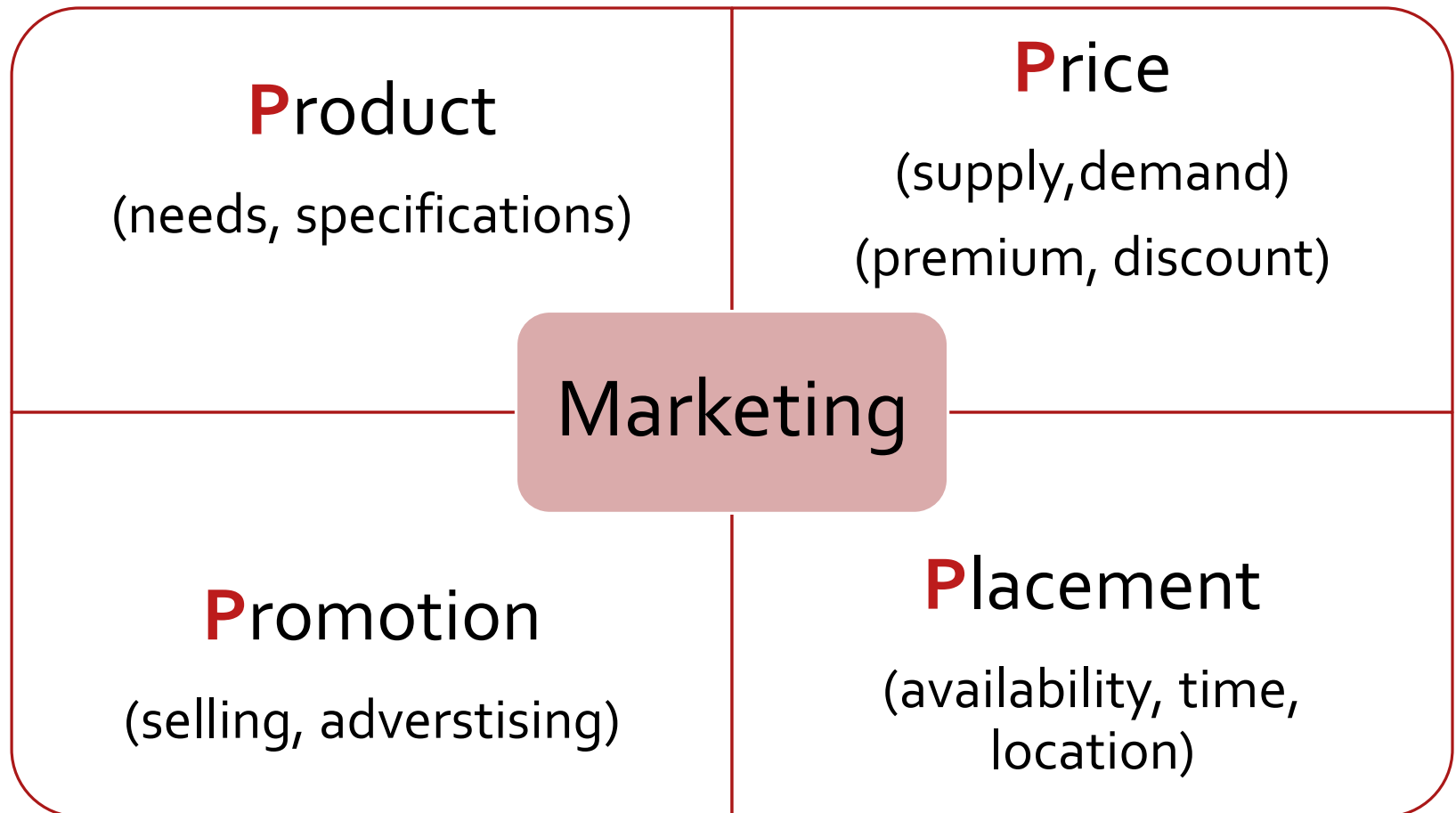
Company

Supply Chain

Organisation



The perceived value is designed by Marketing as the 4 « P »



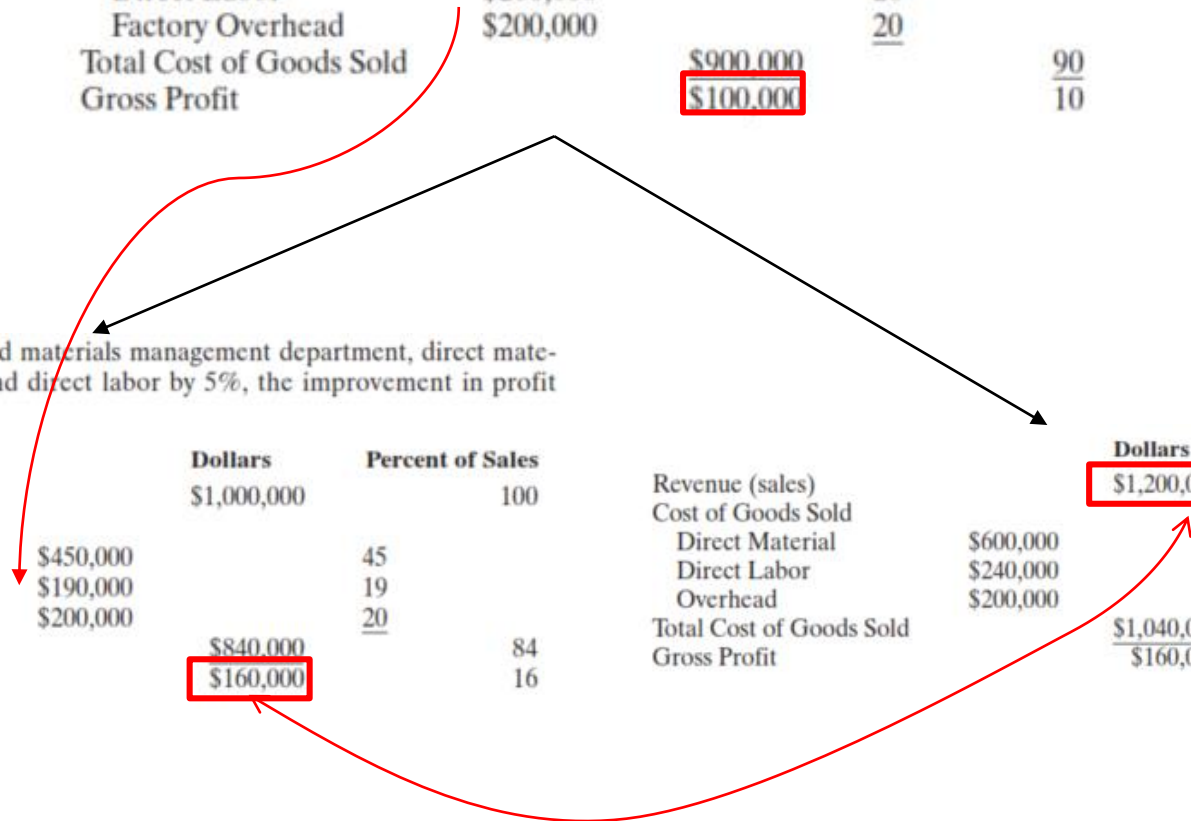
# Why is operations management a bigger lever than sales?

	Dollars	Percent of Sales
Revenue (sales)	\$1,000,000	100
Cost of Goods Sold		
Direct Material	\$500,000	50
Direct Labor	\$200,000	20
Factory Overhead	\$200,000	20
Total Cost of Goods Sold	<u>\$900,000</u>	<u>90</u>
Gross Profit	<u>\$100,000</u>	<u>10</u>

If, through a well-organized materials management department, direct materials can be reduced by 10% and direct labor by 5%, the improvement in profit would be:

	Dollars	Percent of Sales
Revenue (sales)	\$1,000,000	100
Cost of Goods Sold		
Direct Material	\$450,000	45
Direct Labor	\$190,000	19
Overhead	\$200,000	20
Total Cost of Goods Sold	<u>\$840,000</u>	<u>84</u>
Gross Profit	<u>\$160,000</u>	<u>16</u>

	Dollars	Percent of Sales
Revenue (sales)	<u>\$1,200,000</u>	100
Cost of Goods Sold		
Direct Material	\$600,000	50
Direct Labor	\$240,000	20
Overhead	\$200,000	17
Total Cost of Goods Sold	<u>\$1,040,000</u>	<u>87</u>
Gross Profit	<u>\$160,000</u>	<u>13</u>





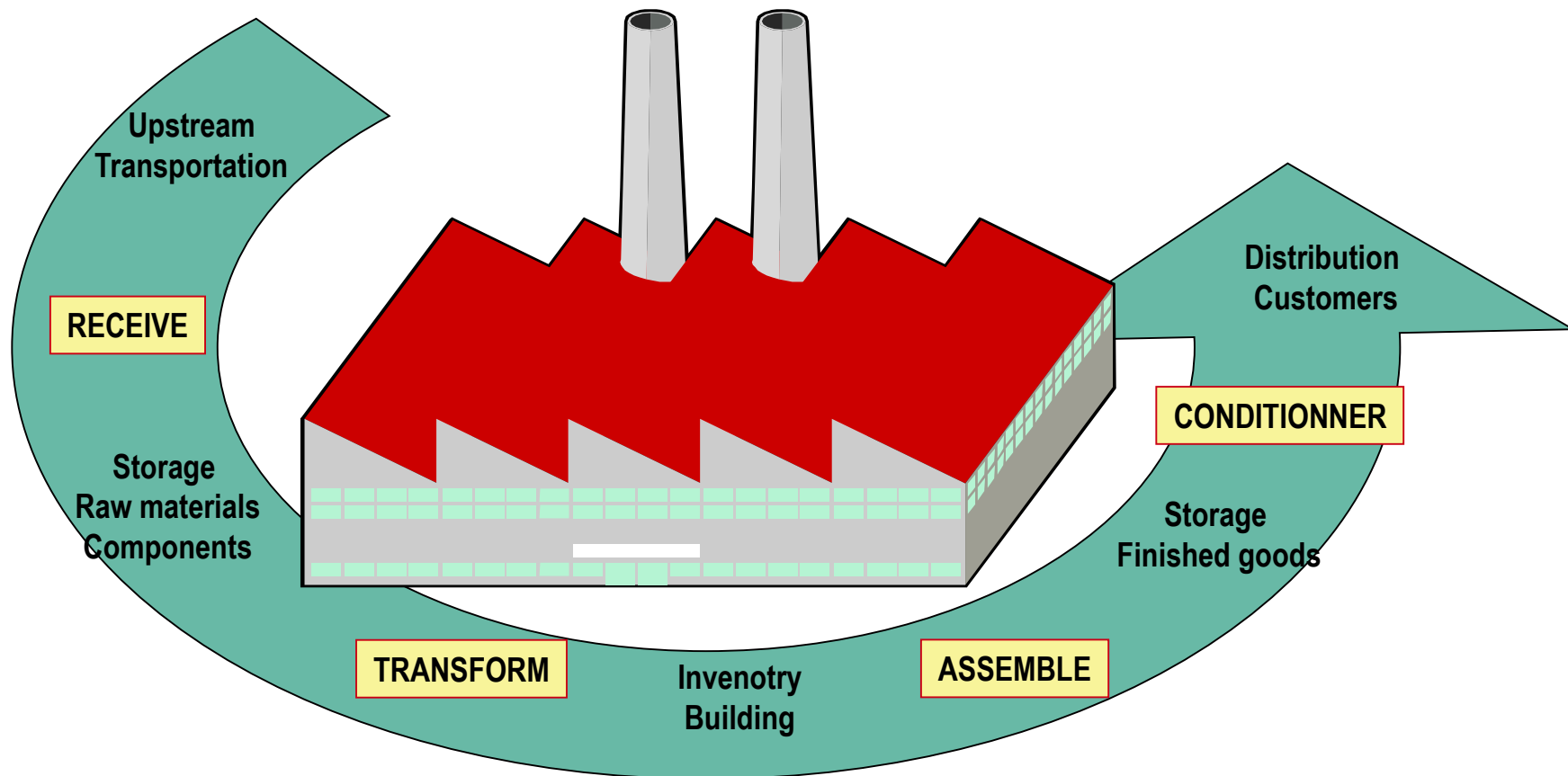


# The supply CHAIN

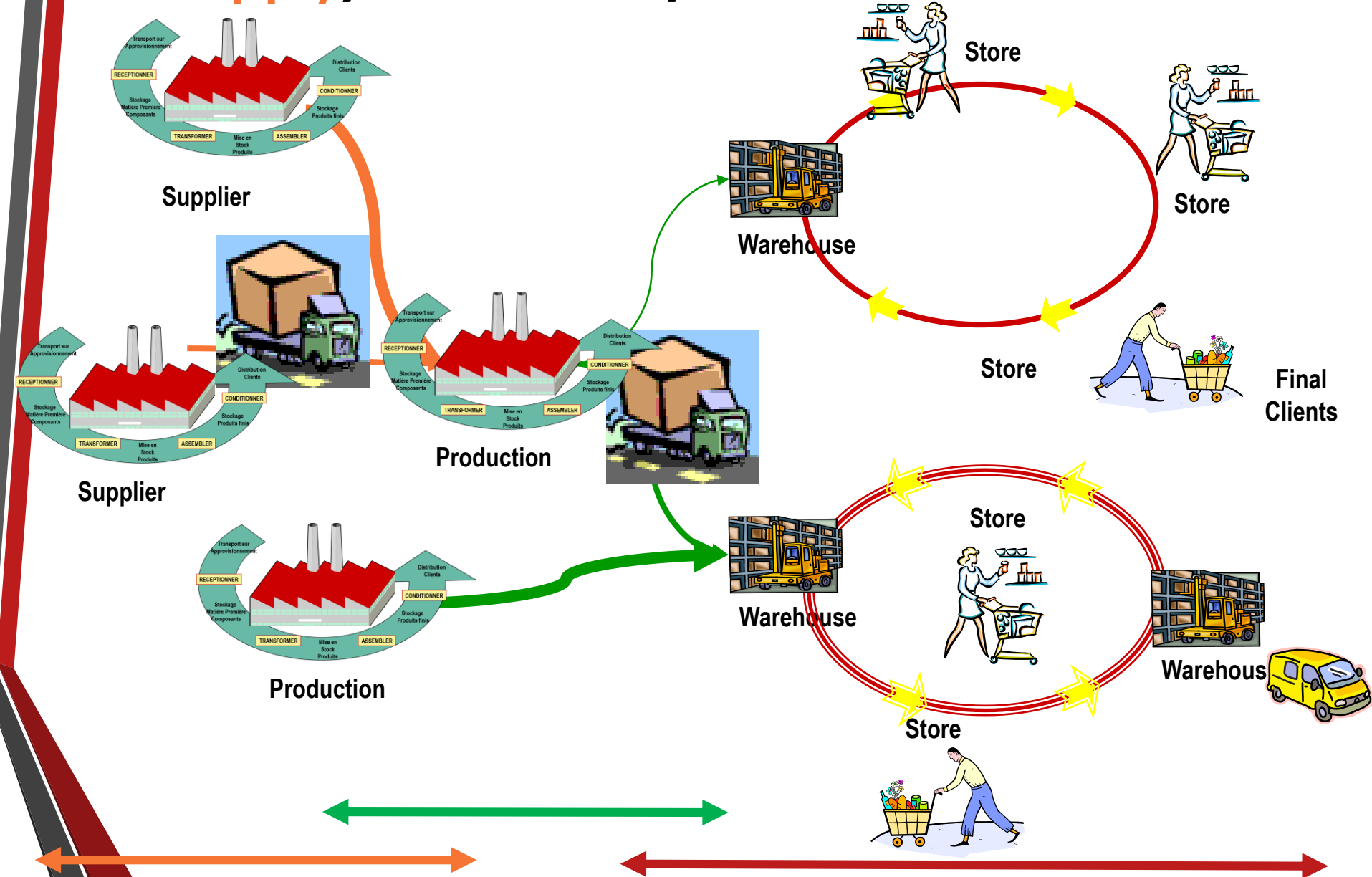
- The supply chain includes all activities and processes to supply a product or service to a final customer.
- Any number of companies can be **linked** in the supply chain.
- A customer can be a supplier to another customer so the total chain can have a number of **supplier/customer relationships**.
- Although the **distribution system** can be direct from supplier to customer, depending on the products and markets, it can contain a number of **intermediaries** (distributors) such as wholesalers, warehouses, and retailers.
- **Product or services** usually flow **from** supplier to customer and design, and **demand information** usually flows from customer to supplier. Rarely is this not so.

*The basic elements are the same: supply, production, and distribution.*

# Manufacturing logistics



# Supply, Production, Distribution





# The Supply Chain of the 320 assembly

## A320 Family workshare + transport

### Who makes what?

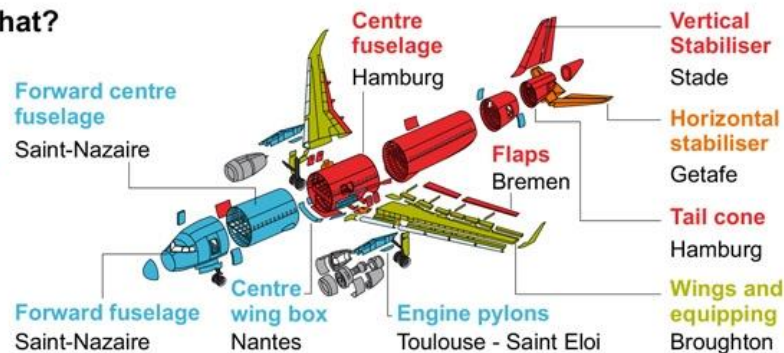
#### AIRBUS

in FRANCE

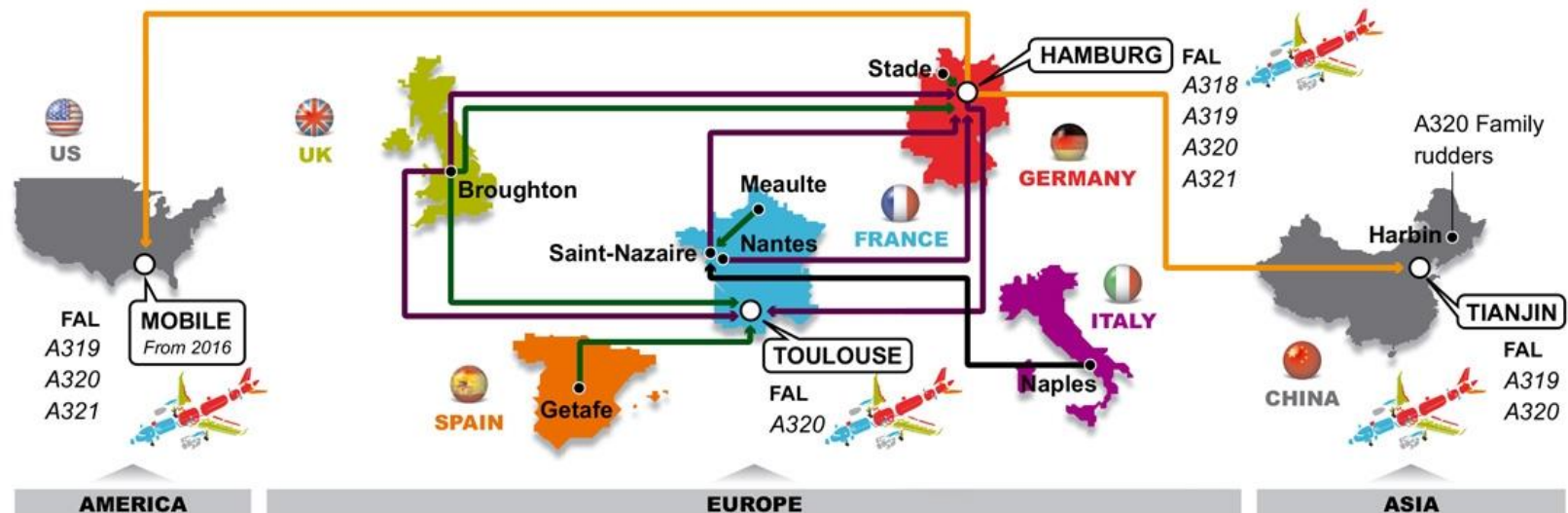
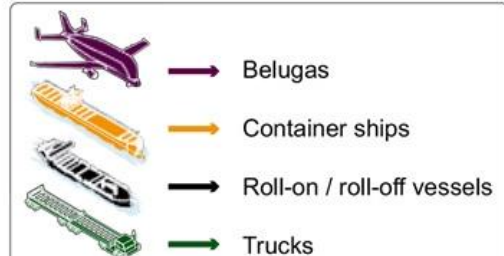
in GERMANY

in UK

in SPAIN

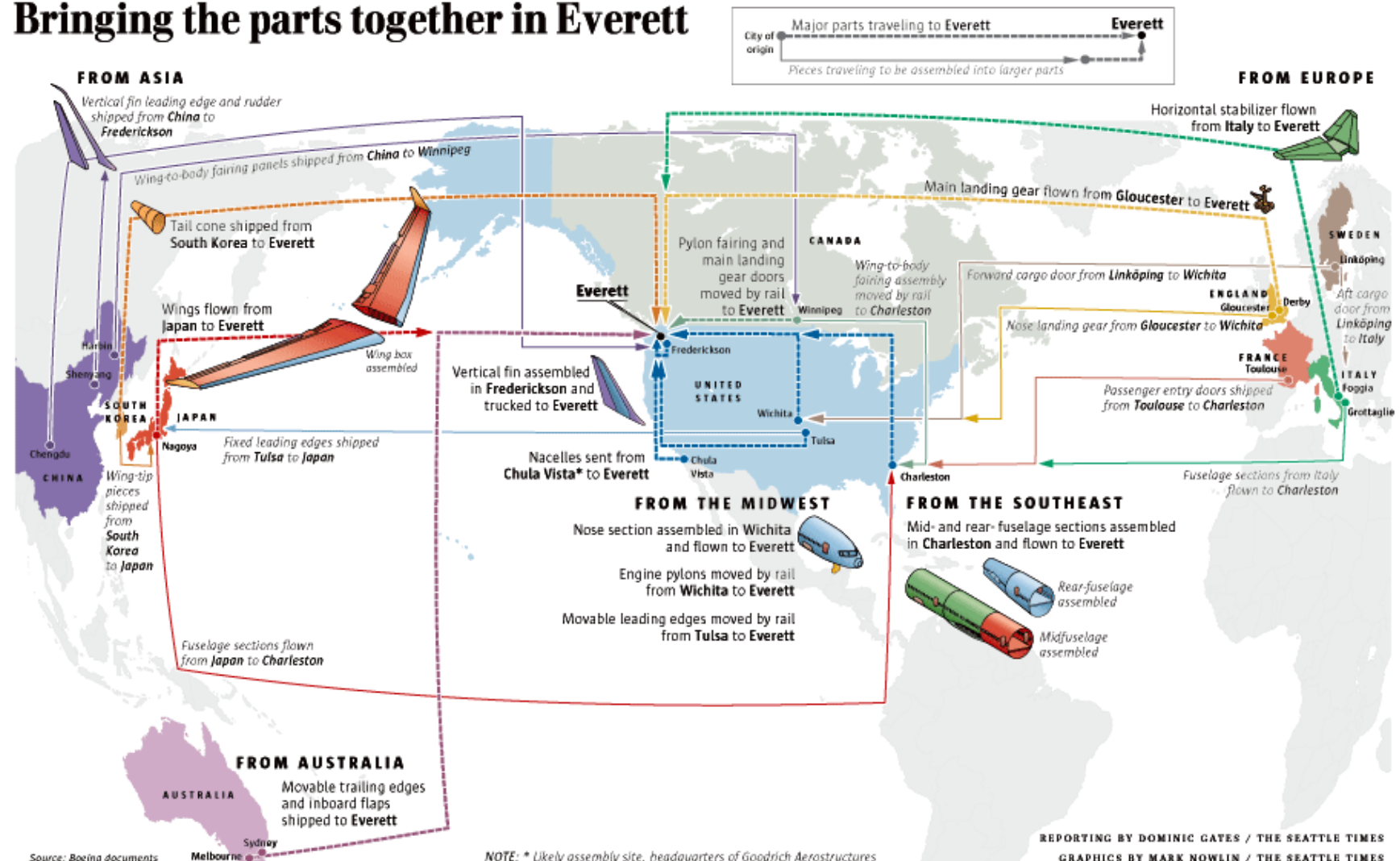


### Operations in seven countries, three continents, 24 hours a day



# Boeing is no different (in terms of complexity)

## Bringing the parts together in Everett

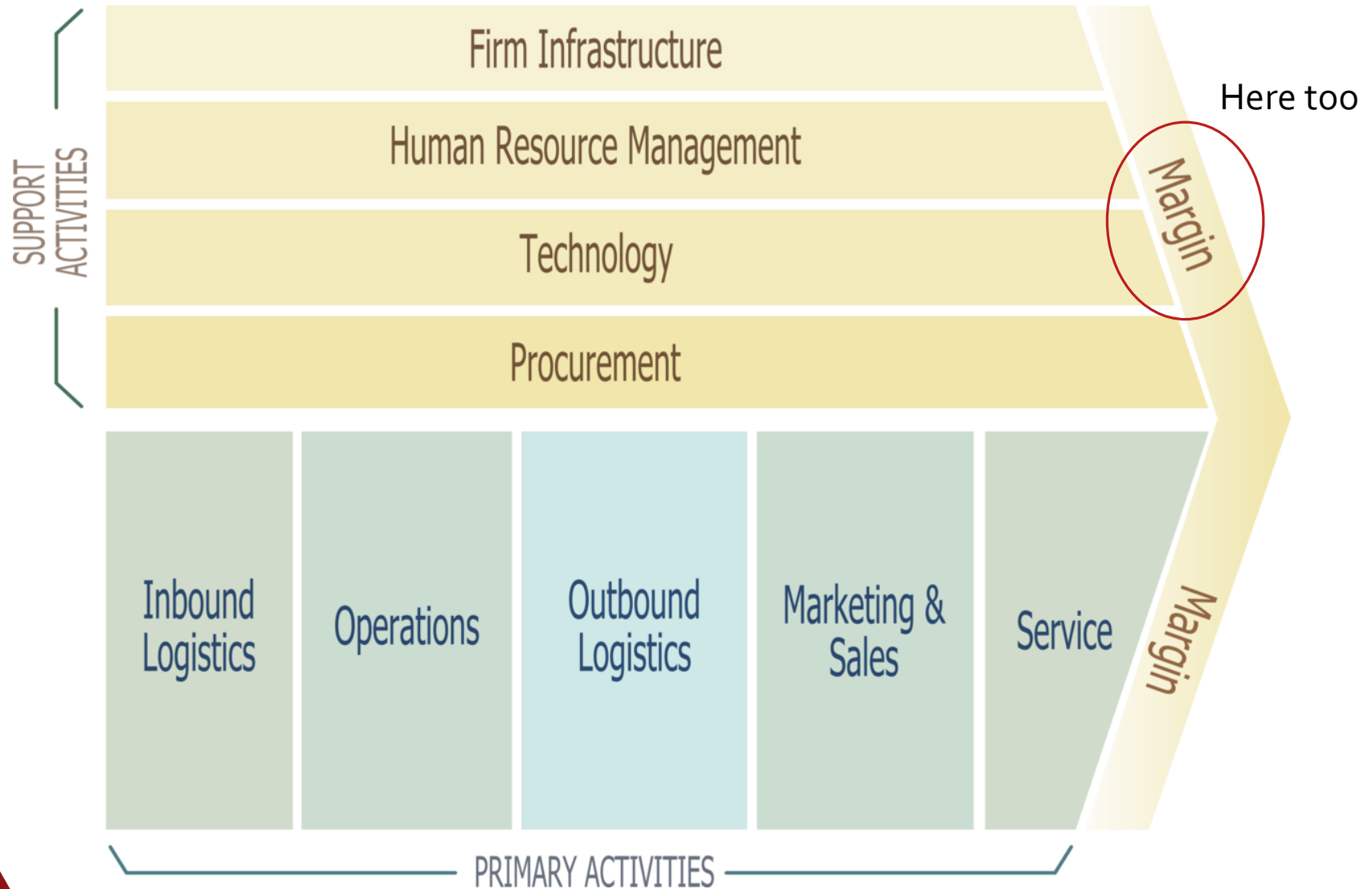



To manage a supply chain, one must not only understand the network of suppliers and customers along the chain but must also try to efficiently plan material and information flows along each chain to maximize cost efficiency, effectiveness, delivery, and flexibility.

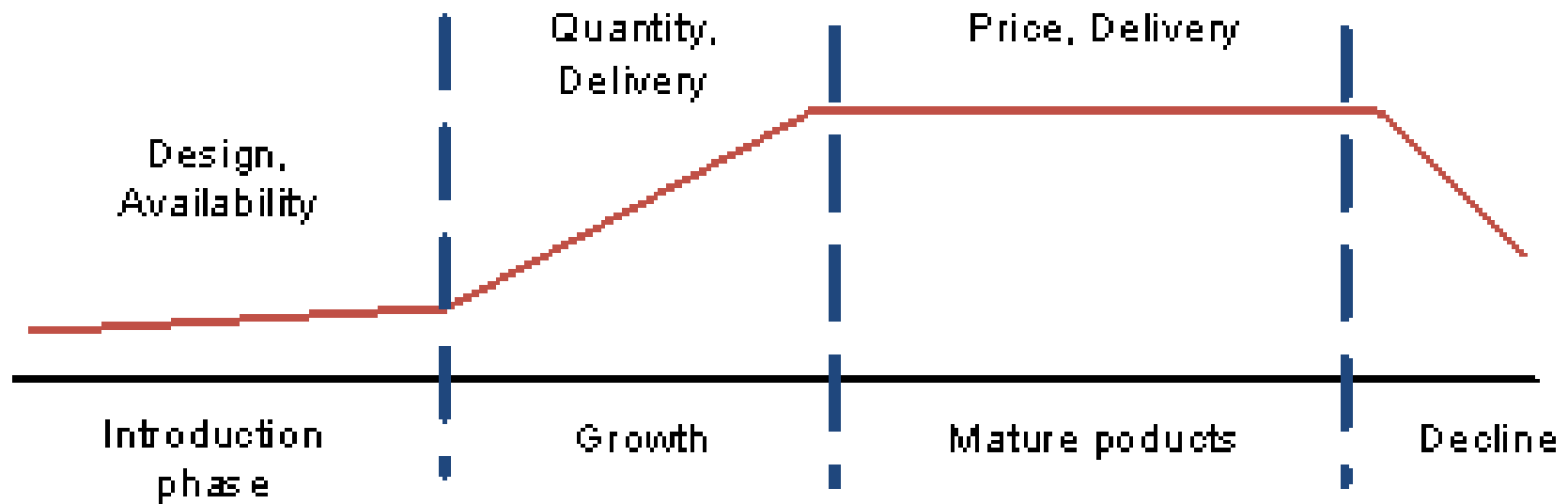




# The Porter value Chain



Along the lifecycle of a product, the **order winners** may change,   
It will impact the way the company serves its customers

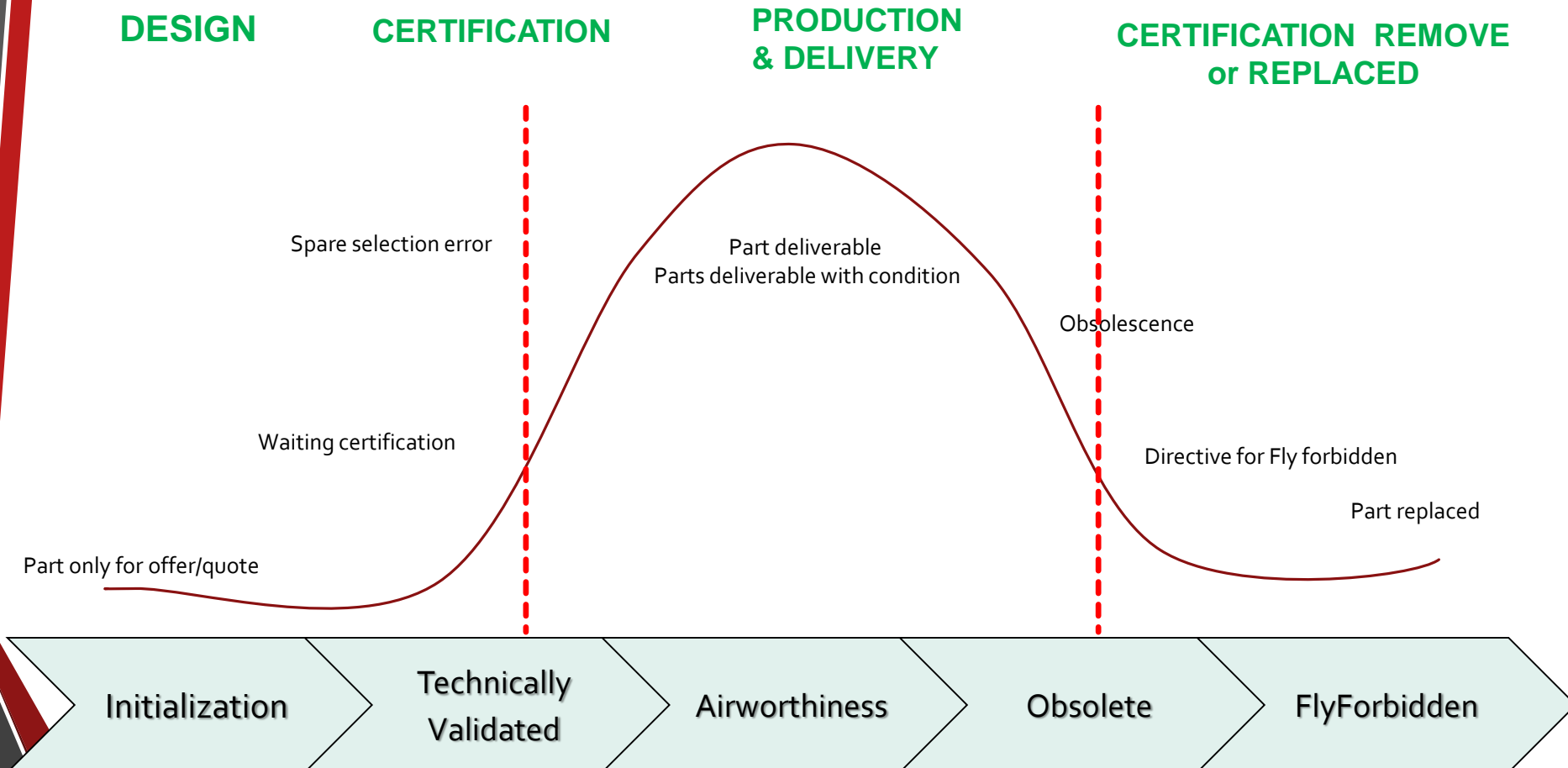


**Note:** *this does not fully apply to airplanes due to the very high unit cost, the nature of negotiations, and the quality requirements.*

However, it is not rare to see introduction phase actions for innovators / early adopters with airlines (ex. A380 or B787 for the first few units)

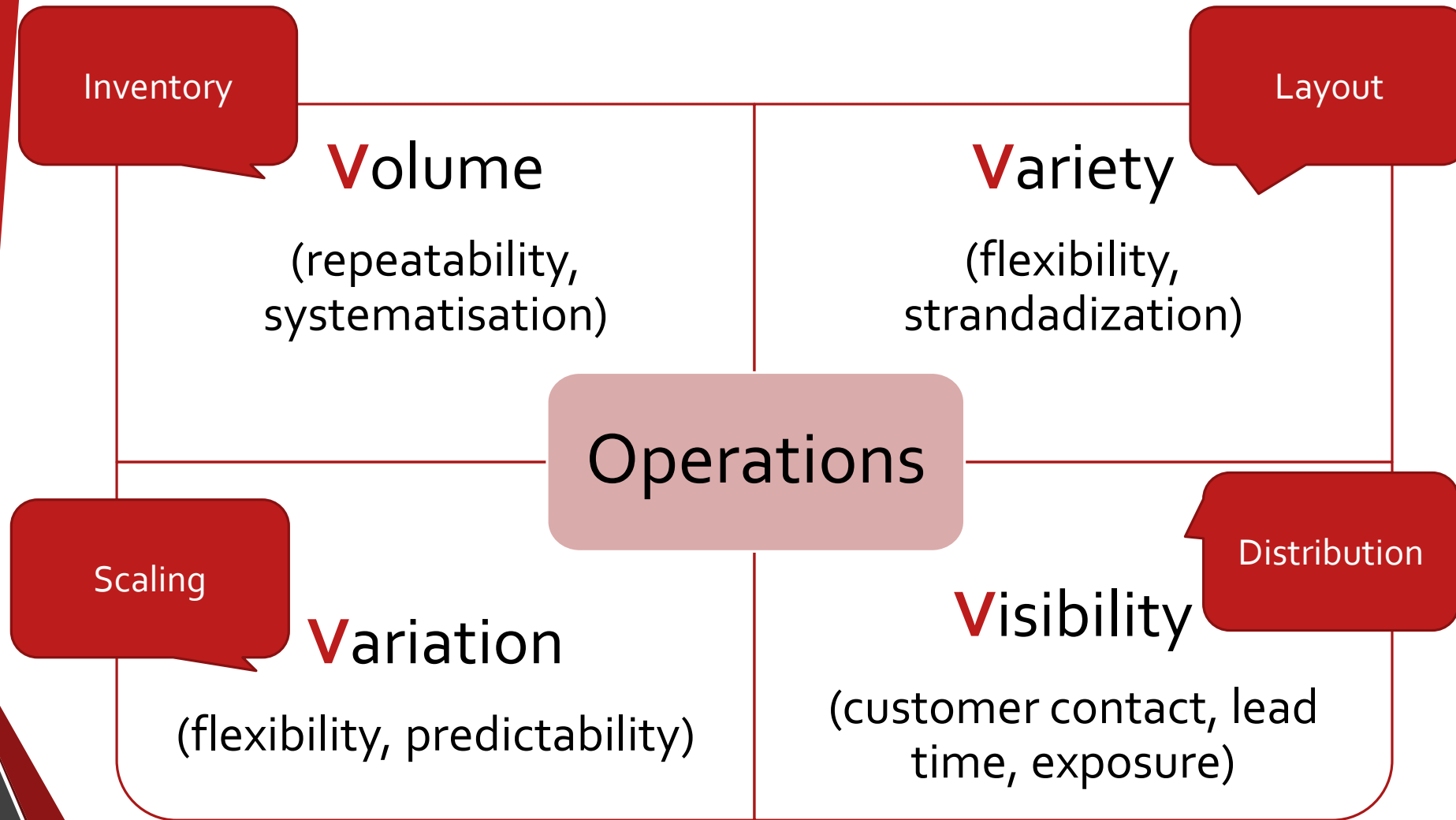
In aerospace, the product lifecycle can be transcribed for the spare parts lifecycle (see your maintenance class)

- A part is used for different needs following its maturity (life cycle)





Operations transform input resources into output products.  
But they differ by the 4 « V »:



## Typology of operations (1/2)

**Low****Volume****High**

- Low repetition
  - Each staff member performs more than a job
  - Less systemisation
  - High unit cost
- High repetition
  - Specialization
  - Systemization
  - Capital intensive
  - Low unit cost

**High****Variety****Low**

- Flexible
  - Complex
  - Match customer needs
  - High unit cost
- Well defined
  - Routine
  - Standardized
  - Regular
  - Low unit cost



## Typology of operations (2/2)

**High****Variation in demand****Low**

- Changing capacity
- Anticipation
- Flexibility
- In touch with demand
- High unit cost

- Stable
- Routine
- Predictable
- High utilization
- Low unit cost

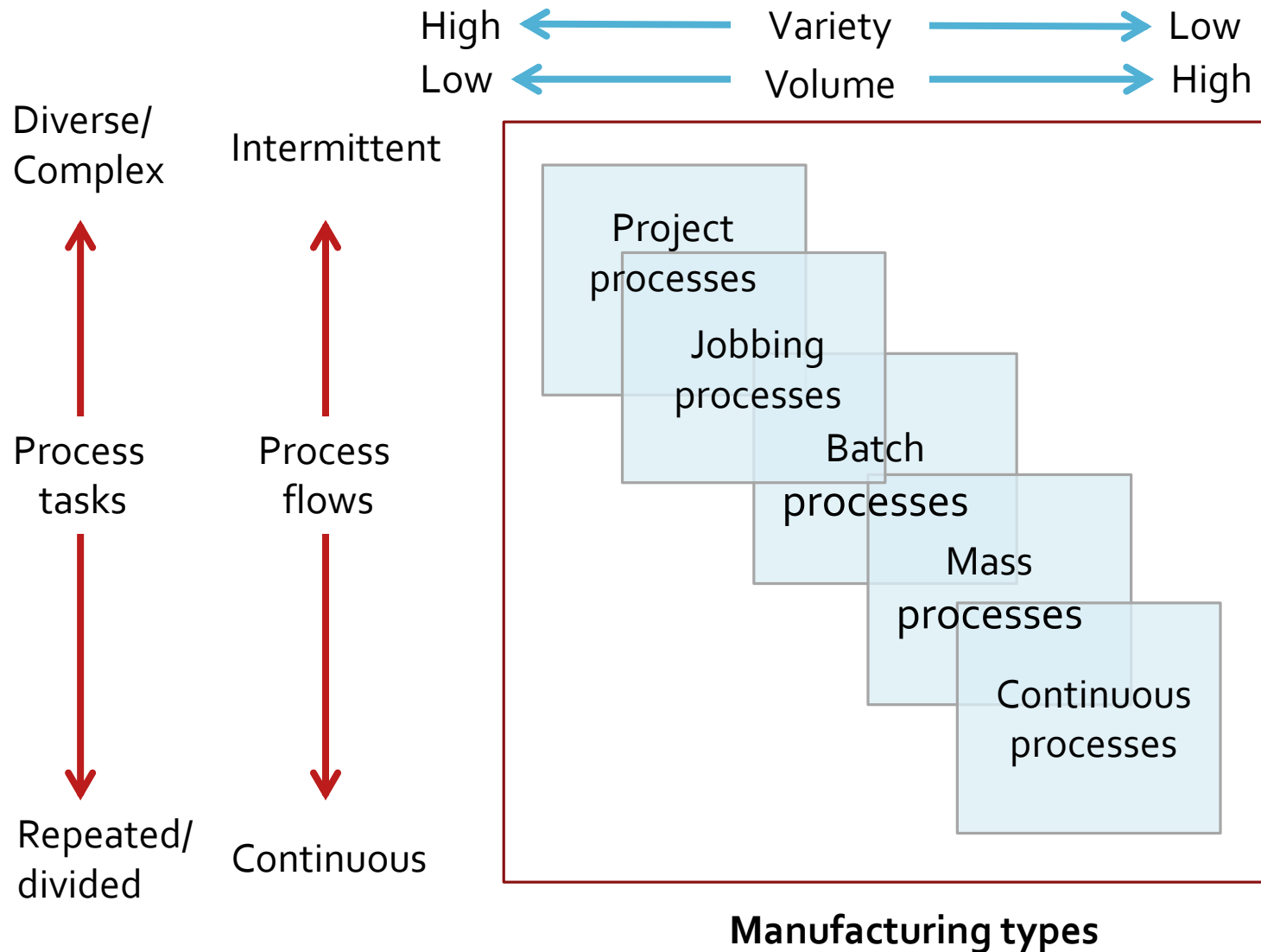
**High****Visibility****Low**

- Short waiting tolerance
- Satisfaction by customer perception
- Contact skills needed
- High unit cost

- Time lag production vs consumption
- Standardized
- Regular
- Low unit cost



# Different process types imply different volume-variety characteristics



# Consequences of non-optimal product-process positioning

## Manufacturing types

Project processes

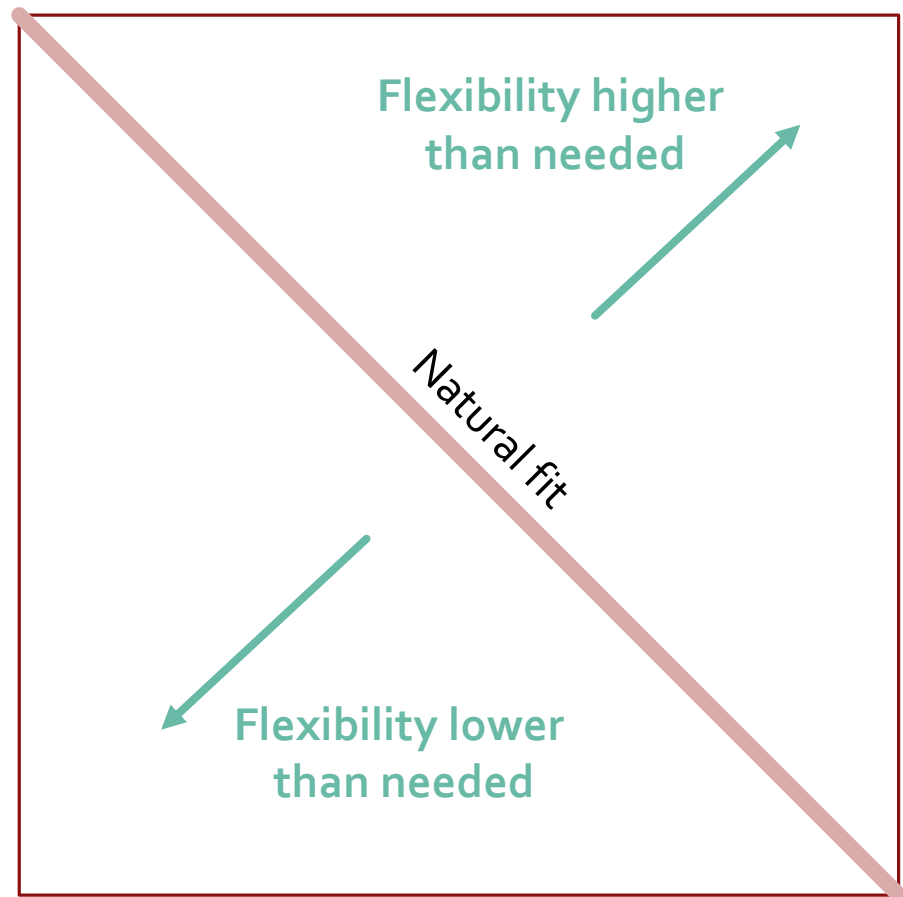
Jobbing processes

Batch processes

Mass processes

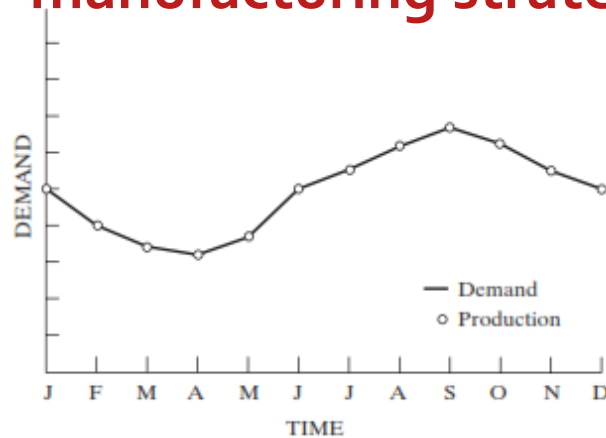
Continuous processes

High ← Variety → Low  
Low ← Volume → High

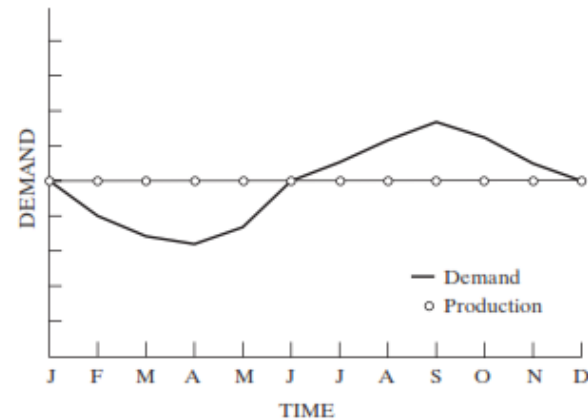




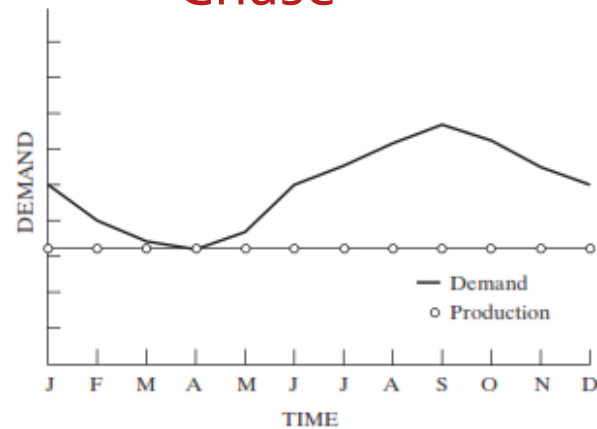
The need for flexibility is not only related to the product, it's related to the demand pattern too. There are 4 **manufacturing strategies**



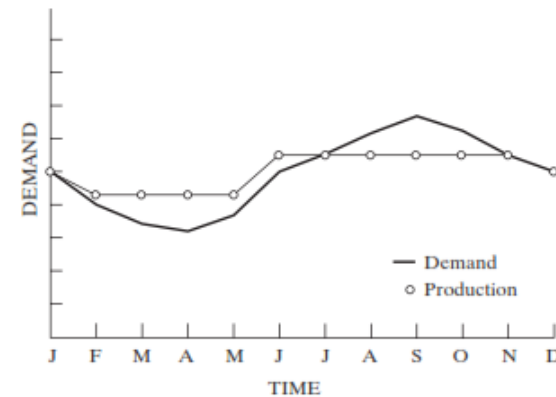
Chase



Level



Subcontract



Hybrid



Capacity is not the only thing to consider when a company wants to outsource

## Outsource

