

Inbound logistics and operations

Two big topics

Inbound logistics

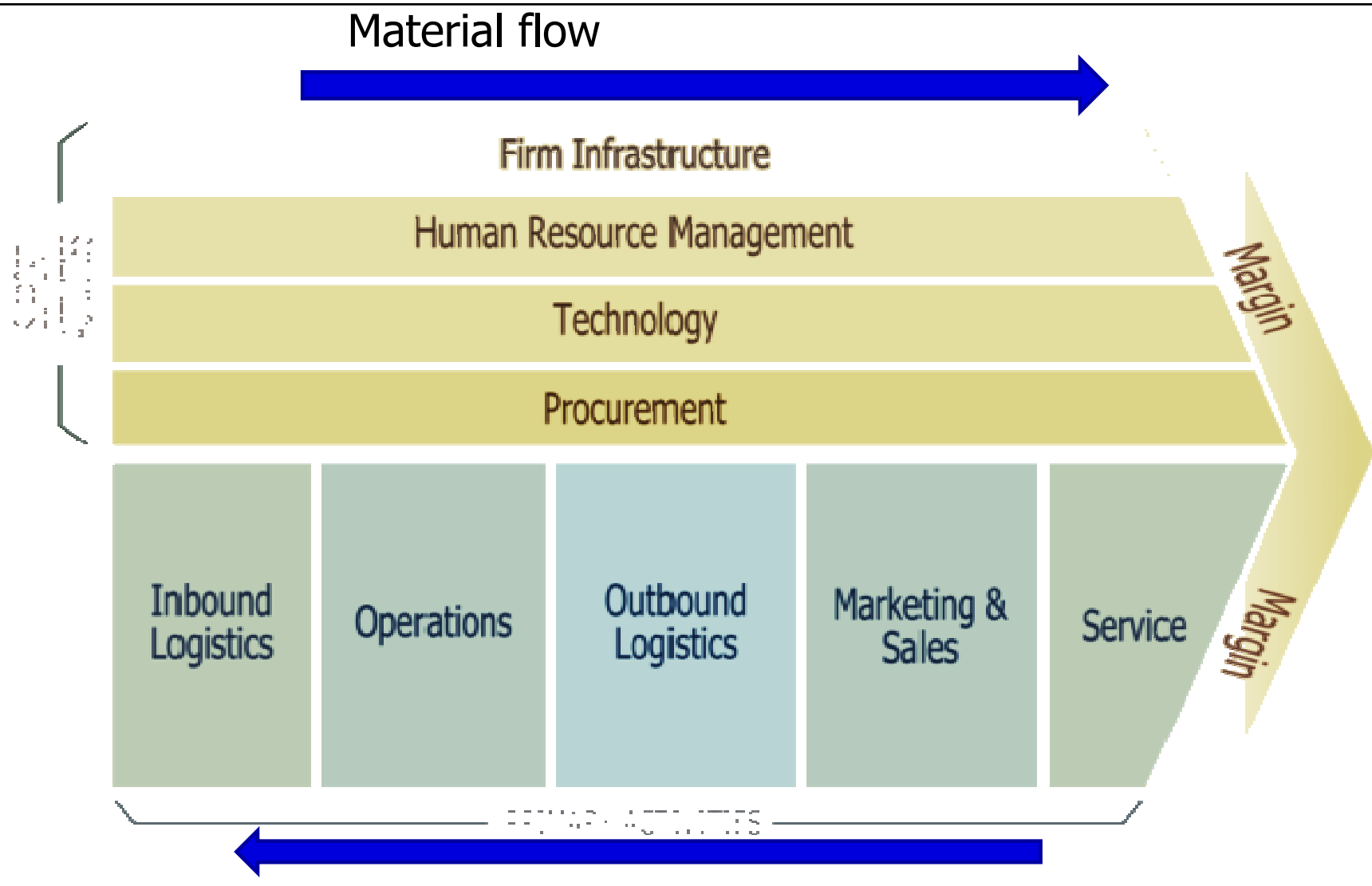
Primary activities - inbound logistic; buying activities; suppliers; warehousing; logistic; distribution

Primary activities



Primary activities – inbound logistics

- Physical flow of material
- part of business operations for manufacturing firm involving the processes of receiving, storing and distributing raw materials for use in production.
- cover anything that company orders from suppliers: tools, raw materials and office equipment



Inbound marketing mix

- Informational and communication mix
- Mix of products and services
- Pricing and contractory mix
- Logistic mix

Informational and communication mix

- Gaining the information from the potential suppliers and communication with the participants on the market (in the area of purchased goods and services, suppliers, prices, terms of delivery and payment and so on.
- Gained information need to be actual and sufficiently detailed.
- Sources of these information are the firm documents such as: accounting, statistics, (operative evidence of individual purchase of the technical department and manufacturing department.)

Informational and communication mix

- The ground of communication mix is in perfect information about suppliers such as:
 - Research of suppliers
 - Choice of supplier
 - Communication during the process of ordering and contractation
 - Communication during the delivery of goods
 - Communication after the delivery
 - Evaluation of the supplier and decision concerning the following customer supply relationship.

Product mix and mix of services

- Product mix is based on the decision in these area:
- Qualitative parameters of each individual product and its substitutes.
- Wide and deep of purchased product line and assortment
- The choice of material depends on the specifics and norms demanded by the end users and consumers. (national and international norms).
- Purchase alternatives: own production, cooperation, leasing

Princing and contractory mix

- We find the optimal terms for our company, based on the real and actual information concerning the suppliers
- Suppliers compete each other in the area of products, quality, terms of delivery terms of payment .
- We assume also the discounts and rebate and eventually surcharge (for extra services)
- Contractory mix includes the decision concerning the way of ordering deliveries. It can be ordering by samples (e.g. fair trade , exhibition) or standard ordering (e.g. repeated order, long-term cooperation within suppliers)
- The economic and administration burden is based on the form of purchase order.

Logistic a delivery mix

- Is connected with the decision about purchase realization and its final delivery to the company.
- Decision include these :
 - The distribution channel
 - Bulk of delivery , period of ordering, the solution for the unpredictable problems
 - Logistic transport in the company : transport , way of manipulation, size of the package, storing, handling and so on.
 - Technology and organization of logistic processes

Support activities - procurement

- (paperworks, transaction costs)
- Planning, organizing, coordination, motivation (i.e. leading people), evidence, checks,
- ...methods, techniques, tools and methods of action...for activities in input logistics and procurement

- modern approach defines the inbound marketing
- Utilises the similar marketing methods: research of suppliers, choice of the convenient supplier, regime and terms of delivery and payment of supplies, and so on.

Activities of procurement management

The goal of PM :

- Right quality
- Right amount
- Right time
- Right vendors
- Right cost
- Right terms

Right quality

- Value analysis – process for assessing the performance of a product or service relative to its cost. Performance includes any quality characteristic that is important to the buyer.
- Helpful when comparing products

Right quantity

- Need for sales forecasting or demand forecasting (sugar, butter before Xmas)
- Rely on inventory data – information on the number of such items the business already has in stock
- Purchase quantity may be influenced by vendors (wholesalers sell in very large batches)

Timing purchases

- Using the sales and inventory data
- Periodic reordering – items that are used or sold at a relatively constant rate
- Nonperiodic reordering – for items used at irregular time intervals
- Lead time - period between starting an activity and realizing its result
- Depends also on seasonal factors, cash flow and tax consequences

Choosing the right vendors

Depends on numerous factors such as:

- Price
- Quality
- Lead time
- Location
- Delivery and shipping options
- Reliability
- Customer service

You can choose to work with a large number of vendors or develop close working relationship with a small number of vendors.

Price

- In the case of large or expensive purchase buyers ask several vendors to provide a price quotes showing what they would charge to fill the order.
- Quantity discount - discount given to buyers for purchasing a large quantity of a product or service from a vendor. (The larger the order, the larger the quantity discount.)
- Volume buying (buying in bulk) means purchasing a large quantity from vendor, typically to take advantage of a quantity discount.

Payment conditions

- B2C demand the payment at the time of purchase.
- B2B purchases are often handled differently – extra time to pay for purchase (30 - 60days)
- **Trade credit** – is the extended payment time given by one business to another business for purchased goods or services.
- Cash discount is a discount given to buyers who pay for purchases in cash, either at time of purchase or within a set time period after purchase.

The process of purchasing

- Product specification – detailed description of the characteristics (size, shape, capability, etc.) of a product.
- Purchase order – document issued by a buyer to a vendor that lists the items to be purchased, their quantities and prices, terms of payment and delivery.
- Invoice (bill of sale)- document issued by a vendor to a buyer on fulfilment of purchase order.
- Packing slip – list of all items in shipment.

Warehousing – inventory management

- Inventory is the amount of merchandise a business has available for sale at given time.
- Inventory level – quantity of merchandise
- Inventory value – the monetary value of merchandise

Main task of managing inventory is :

- Not too little, not too much
- Knowing when to restock certain items, what amounts to purchase or produce, what price to pay – as well as when to sell and at what price – can easily become complex decisions
- Small businesses will often keep track of stock manually and determine reorder points and quantities using Excel formulas. Larger businesses will use specialized enterprise resource planning (ERP) software. The largest corporations use highly customized software as a service (SaaS) applications
- Appropriate inventory management strategies vary depending on the industry.

Reasons for keeping an inventory

- **Time** - The time lags present in the supply chain, from supplier to user at every stage, requires that you maintain certain amounts of inventory to use in this lead time. However, in practice, inventory is to be maintained for consumption during 'variations in lead time'. Lead time itself can be addressed by ordering that many days in advance.
- **Seasonal Demand** - demands varies periodically, but producers capacity is fixed. This can lead to stock accumulation, consider for example how goods consumed only in holidays can lead to accumulation of large stocks on the anticipation of future consumption.
- **Uncertainty** - Inventories are maintained as buffers to meet uncertainties in demand, supply and movements of goods.
- **Economies of scale** - Ideal condition of "one unit at a time at a place where a user needs it, when he needs it" principle tends to incur lots of costs in terms of logistics. So bulk buying, movement and storing brings in economies of scale, thus inventory.
- **Appreciation in Value** - In some situations, some stock gains the required value when it is kept for some time to allow it reach the desired standard for consumption, or for production. For example; beer in the brewing industry

Inventory costs

- Ordering cost
- Setup cost
- Holding Cost
- Shortage Cost

Planning inventory investment – start-up

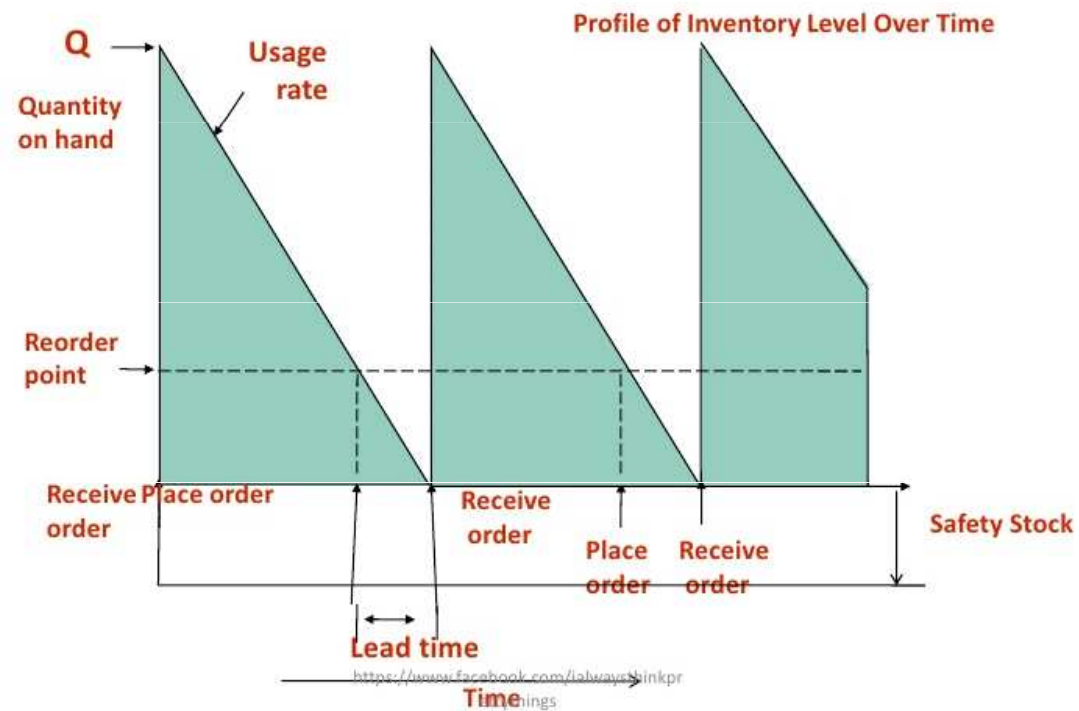
- Calculating inventory level for business start –up- do not have previous sales data on which to base inventory-level decision.
- For start-up entrepreneurs conduct market research, analyse their competition and develop a marketing plan and pricing strategy before they go into business. Proper planning allows new business owners to make reasonable estimates about expected sales during the first weeks or months after start-up.
- They also know how much cash and storage space they can devote to inventory.
- From all this information, they can estimate how much inventory they should have for opening day.

Planning inventory investment - ongoing business

- Ongoing business keeps good records that rely on many data-sources for inventory-planning purposes. These include sales and cost data, vendor lead times, and losses of inventory due to damage or other reasons.
- Inventory managers can use this data to predict how inventory levels are going to decrease over time and decide when to reorder merchandise.

Inventory management

The Inventory Cycle



Inventory management

	Fixed order quantity "Q"	Variable order quantity made up to "S"
Ordering at variable moments	System B, Q: variable order moment, fixed order quantity "Q"	System B, S: Variable order moment, ordering up to target level "S"
Ordering in fixed moments	System s, Q: fixed order moment, fixed order quantity	System s, S: fixed point of order, replenishment to target level "S"

Safety stock

- a level of extra stock that is maintained to mitigate risk of stockouts (shortfall in raw material or packaging) due to uncertainties in supply and demand. Adequate safety stock levels permit business operations to proceed according to their plans. Safety stock is held when there is uncertainty in demand, supply, or manufacturing yield; it serves as an insurance against stockouts.

Reorder point

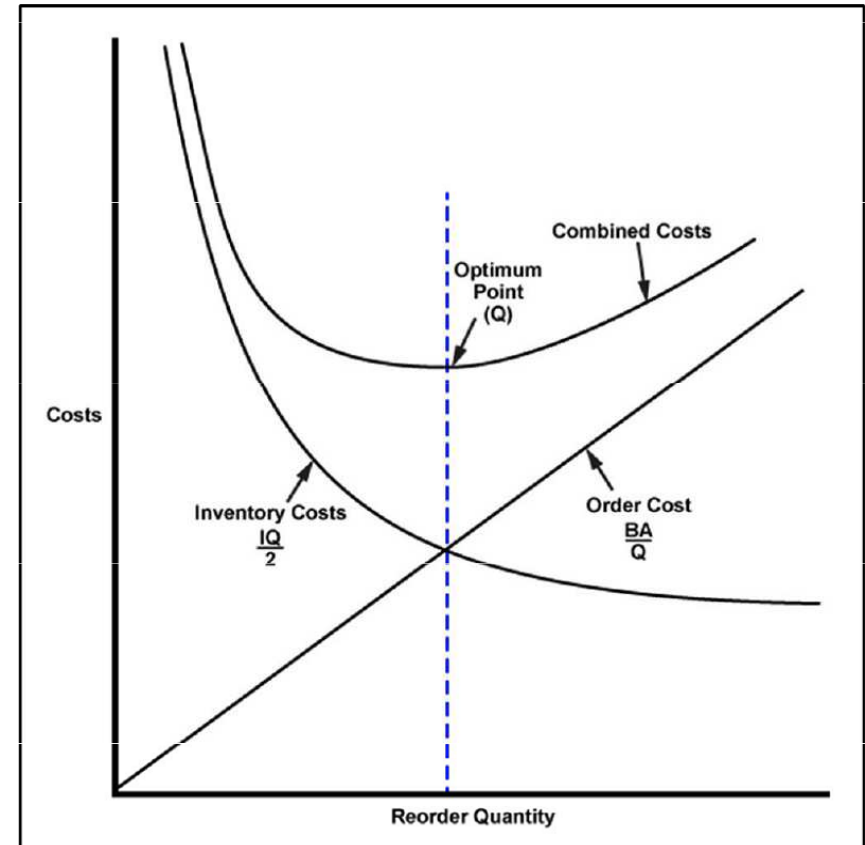
- The reorder point (ROP, reorder level) is the level of inventory which triggers an action to replenish that particular inventory stock. It is a minimum amount of an item which a firm holds in stock, such that, when stock falls to this amount, the item must be reordered. It is normally calculated as the forecast usage during the replenishment lead time plus safety stock.

Lead time

- Time needed for your supplier to deliver stocks.
- By the time of supplier arrival, you should go to the safety stock.
- This should be in the balance with
 - Operations procedures (lead time)
 - Outbound logistics (lead time of delivery)

EOQ

- EOQ concerns the inventory costs of a single item
- EOQ does not provide varying lot sizes to match projected variations in demand
- EOQ is based on average demand

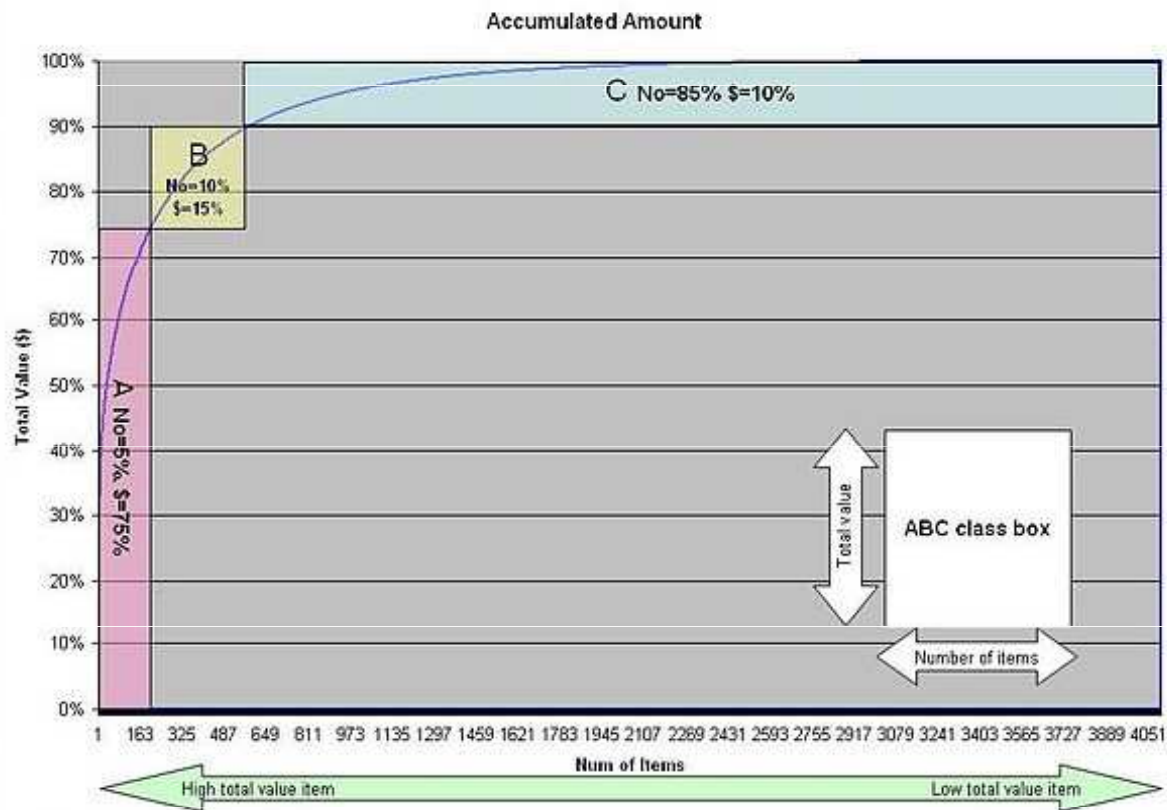


EOQ

- c = cost of production or purchase of a unit (20Kč per kilo of rice)
- Q = order quantity
- Q^* = optimal order quantity
- D = consumption per unit time (year)
- K = cost of ordering/setting up the delivery (petrol to the rice truck)
- h = cost of holding 1 kg of rice (storage, opportunity cost, refrigeration, insurance)
- $TC = c \cdot D + D \cdot K / Q + h \cdot Q / 2$

$$- Q^* = \sqrt{\frac{2 \times D \times K}{h}}$$

ABC analysis - for planning



Group	Value share (%)	Quantitative share (%)
A	approx. 80 %	approx. 10 %
B	approx. 15 %	approx. 20 %
C	approx. 5 %	approx. 70 %

ABC XYZ analysis

- ABC shows the value share of inventory turnover
- XYZ represents the frequency(regularity) of use in production
- X - groups of items with constant consumption (only occasional fluctuations) and therefore with high predictive ability
- Y - groups of items with stronger fluctuations in consumption (medium predictive ability)
- Z - items with completely irregular consumption (high degree of uncertainty)

ABC XYZ

Consumption driven

Menge	A	B	C
X	Just-In-Time	Verbrauchsgesteuert	
Y	Bedarfsgesteuert	Bereinigung	
Z			

Demand driven

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Production (operations)

BPH_ABEC

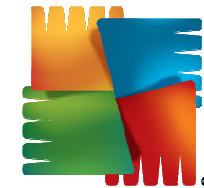
 **TON**
The Czech Republic



Avast



Budvar



AVG



Bata

ZOOT.



kofola
original



ŠKODA



era



HOME CREDIT
Now you can!

Pilsner Urquell

TON The Czech Republic



kofola
original

FERNET
STOCK
Londro Stock

Bata

Fetor


PETROF[®]
PIANOS SINCE 1864

Budvar

 CZ



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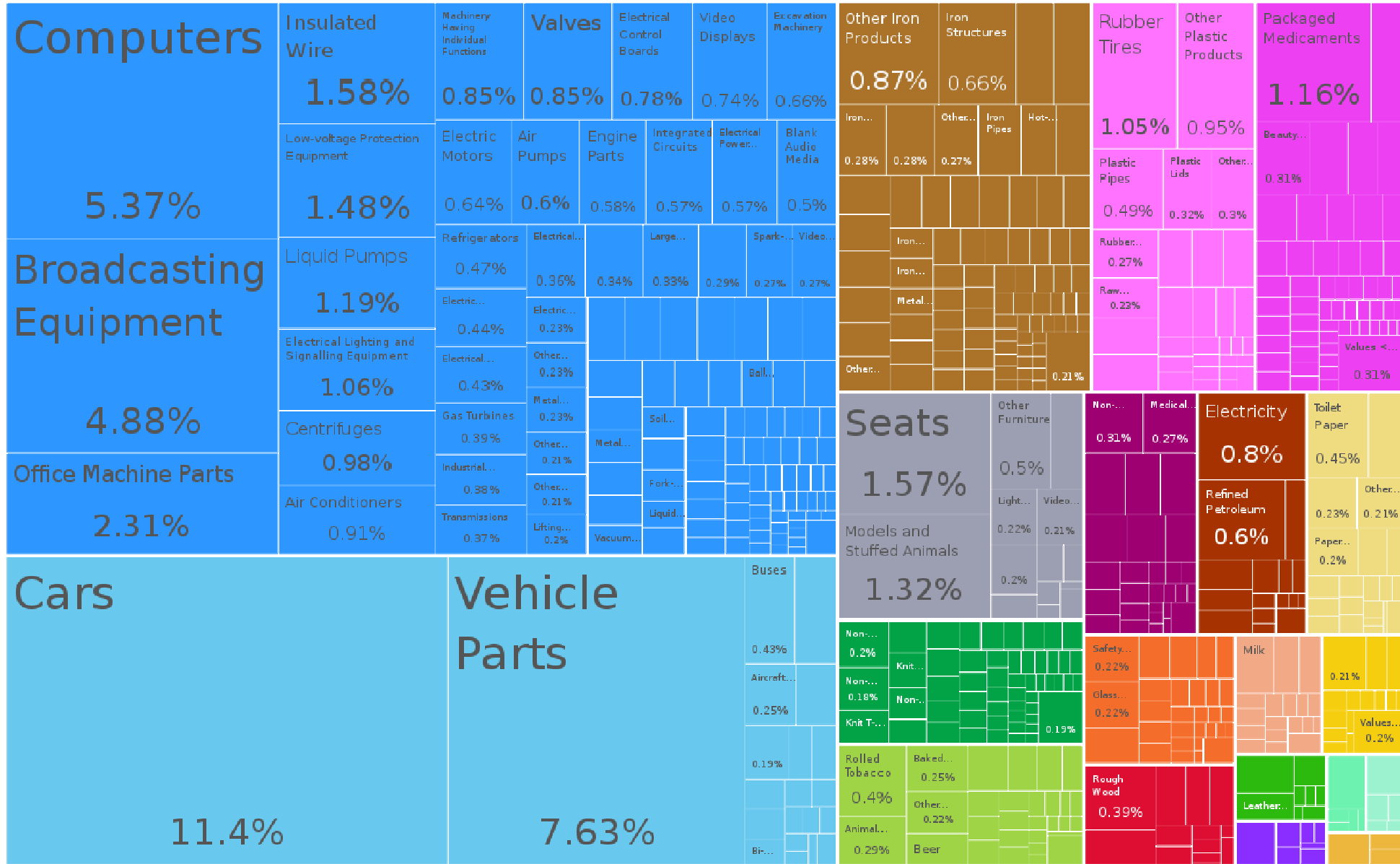


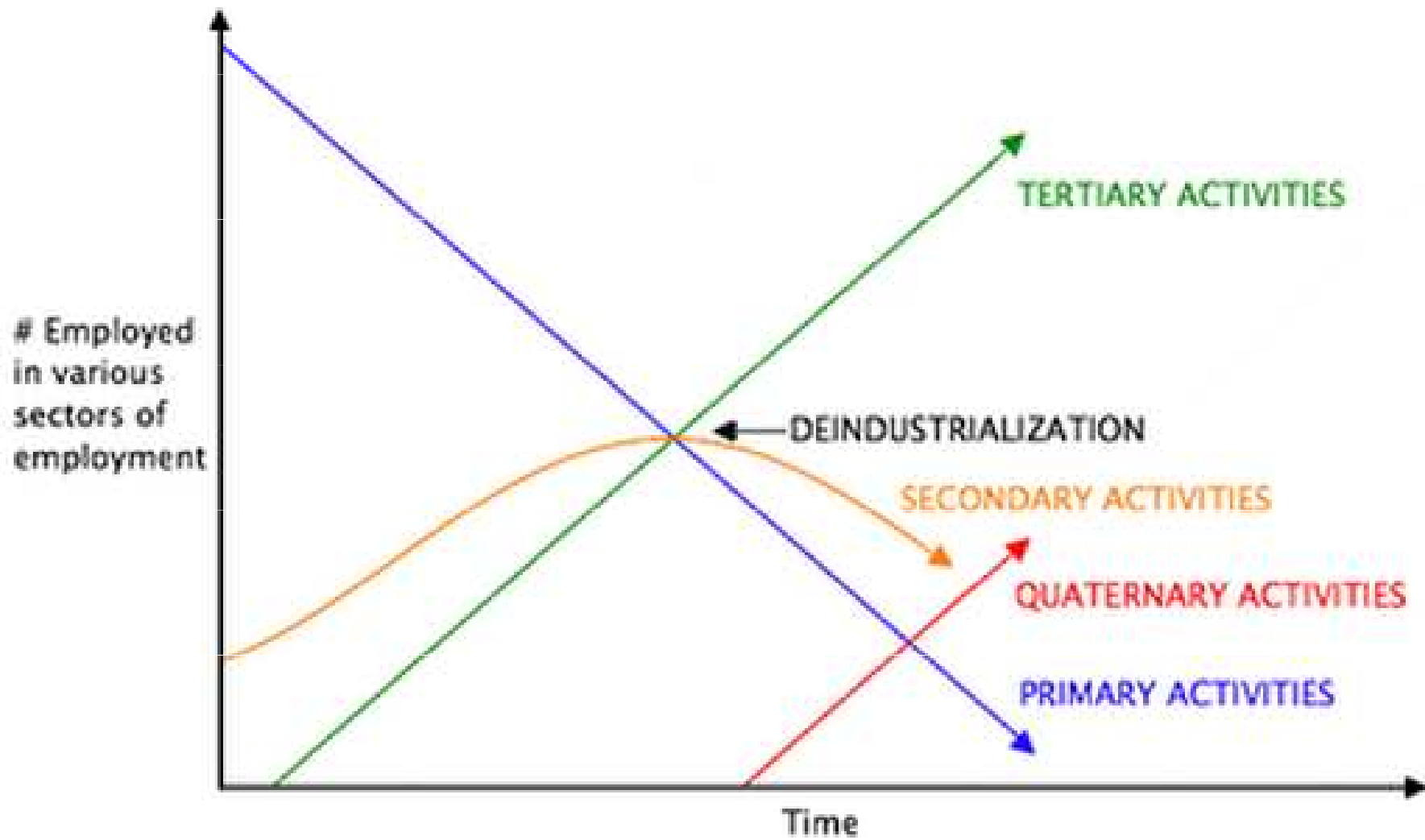
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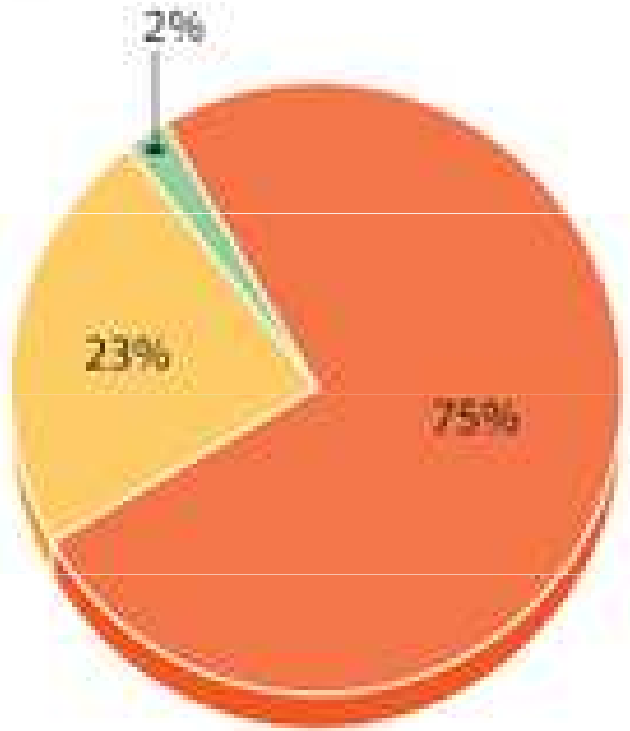
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Total: \$198B

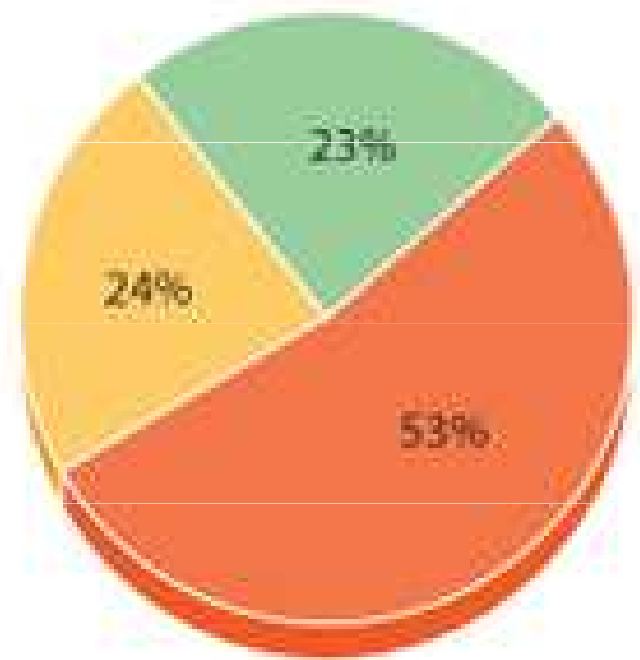




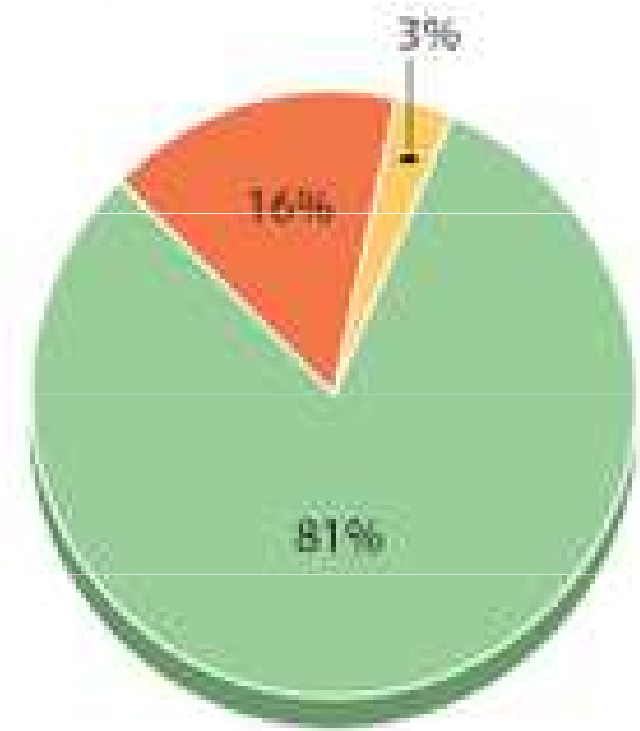
USA



Brazil

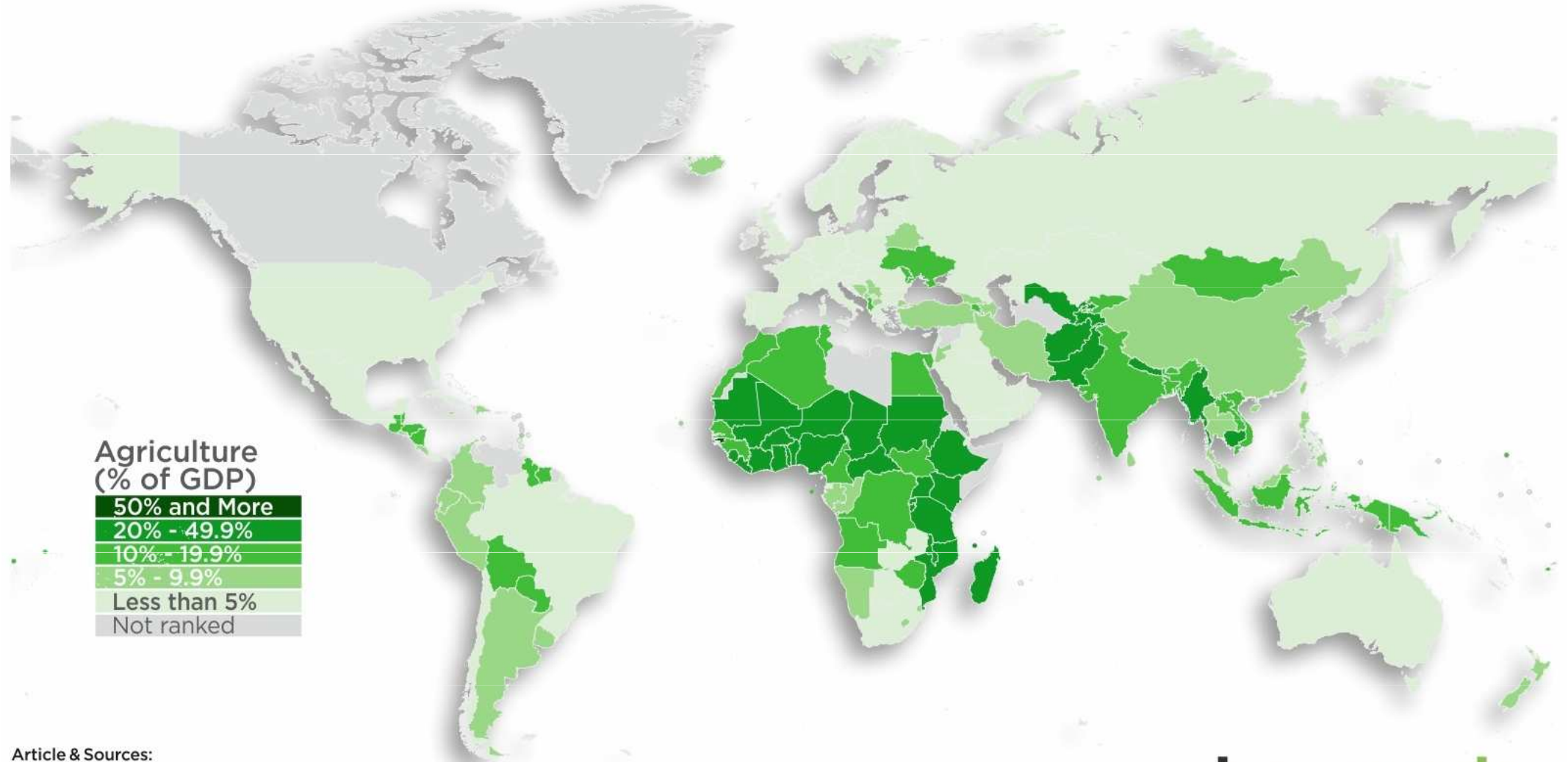


Nepal



The Role of Agriculture in the World Economy

Agriculture as Share of Total GDP (%)

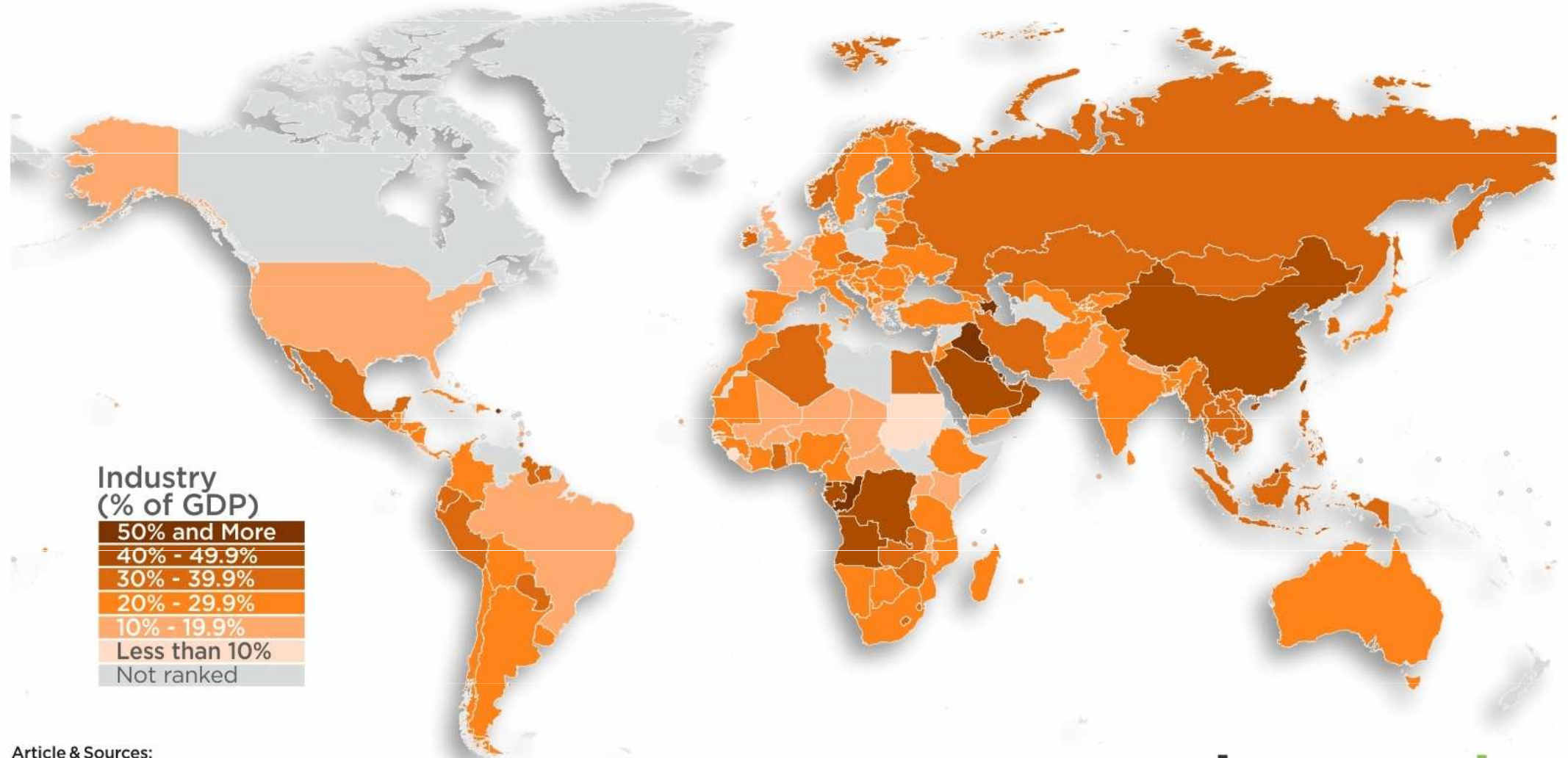


Article & Sources:

<https://howmuch.net/articles/role-agriculture-around-the-world>
World Bank - <https://worldbank.org>

The Role of Industry in the World Economy

Industry as Share of Total GDP (%)

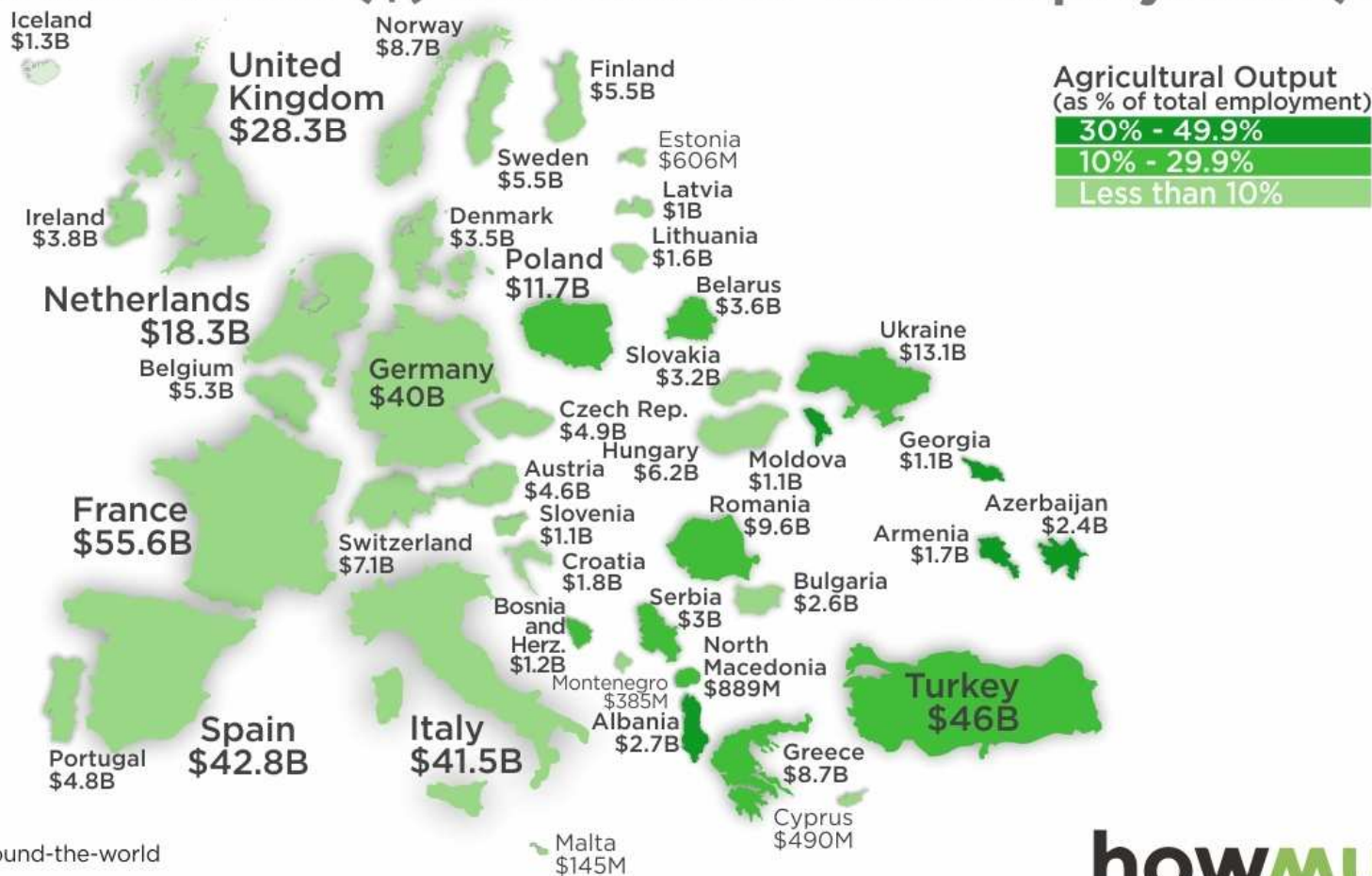


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The Role of Agriculture in Europe

Agriculture as GDP Value Added (\$) & as Share of Total Employment (%)



How to read this map: Countries are scaled based on their total agricultural output, as part of their GDP. Countries appear bigger as their agricultural output is higher e.g. France. Conversely, countries with lower agricultural output appear smaller e.g. Lithuania.

Article & Sources:
<https://howmuch.net/articles/role-agriculture-around-the-world>
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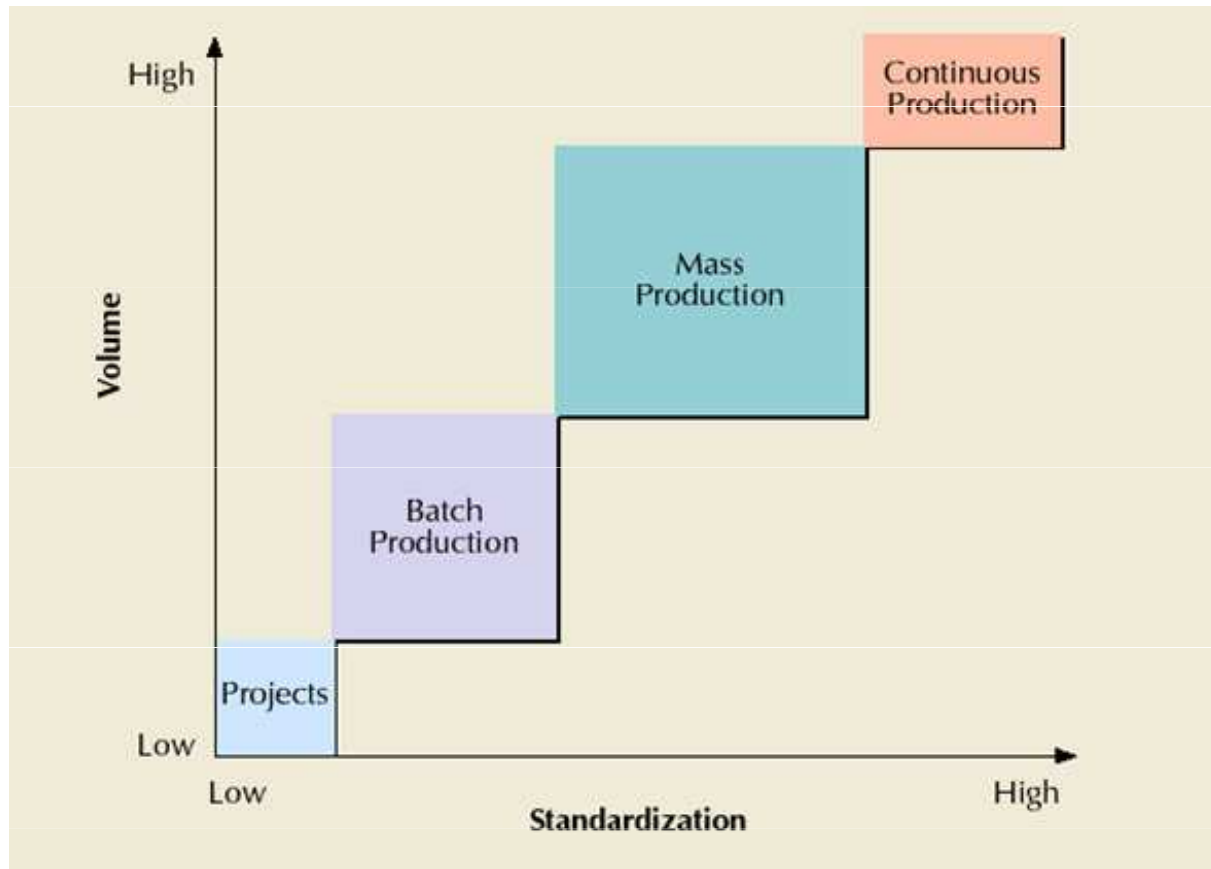
General planning scheme

		Planning	
		Short-term	Long term
Manufacturing	program	introduction of product variants, quantities of individual products (with regard to sales)	basic structure of the production programme, innovation, production process (type of HIM, personnel statistics)
	process	batch sizing (with respect to the technology and the process itself), scheduling, capacity planning	production type, organisational type of production

Long term process planning

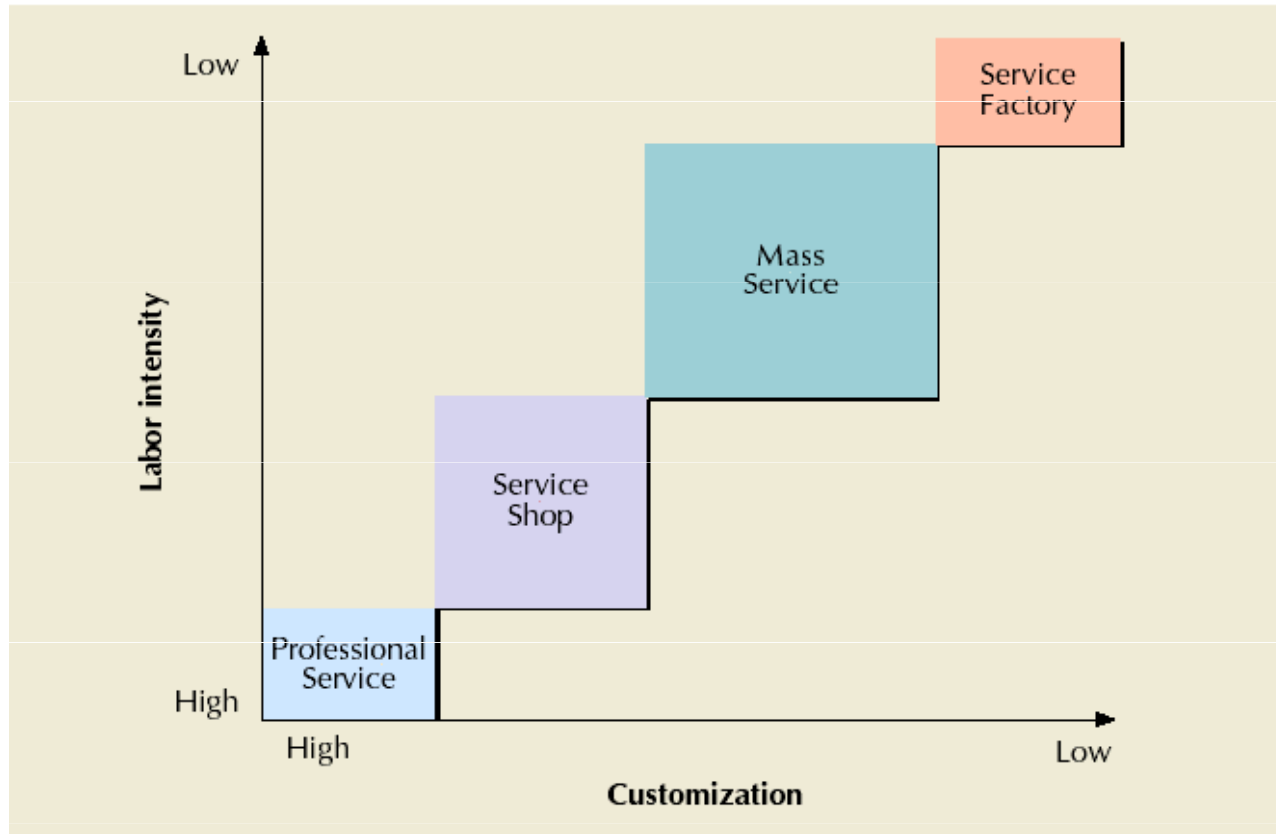
- production type, organisational type of production

Product-Process Matrix



Source: Adapted from Robert Hayes and Steven Wheelwright, *Restoring the Competitive Edge: Competing Through Manufacturing* (New York: John Wiley & Sons, 1984), p. 209

Service-Process Matrix

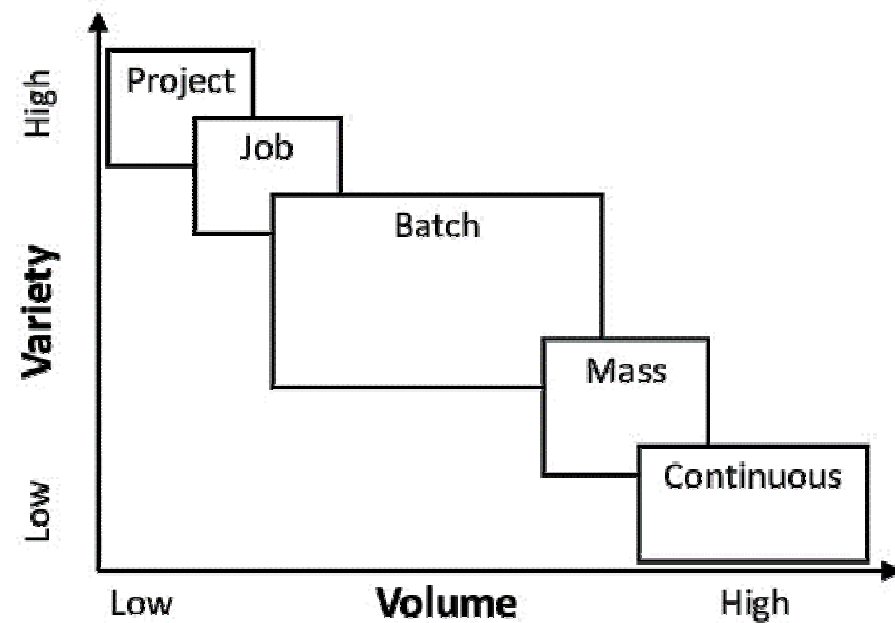


Source: Adapted from Roger Schmenner, "How Can Service Businesses Survive and Prosper?" *Sloan Management Review* 27(3):29

Types of output – production type

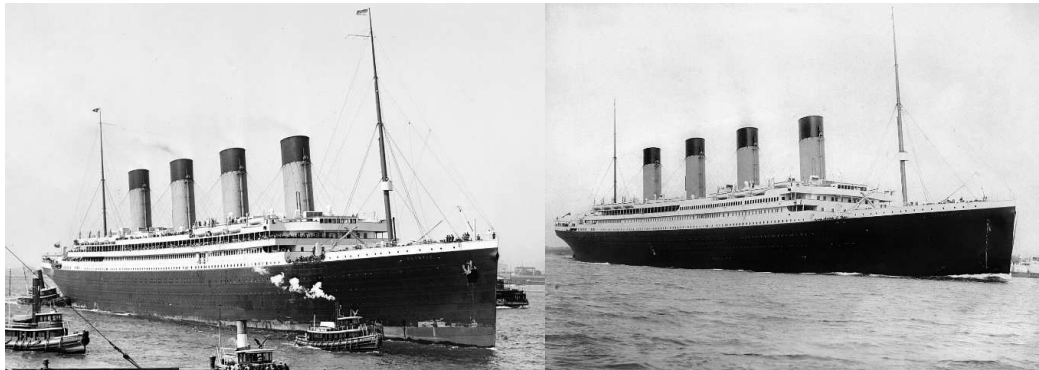
- Type of output production
 - production type:
 - organizational type of production: (next slide)

Process Types - Products



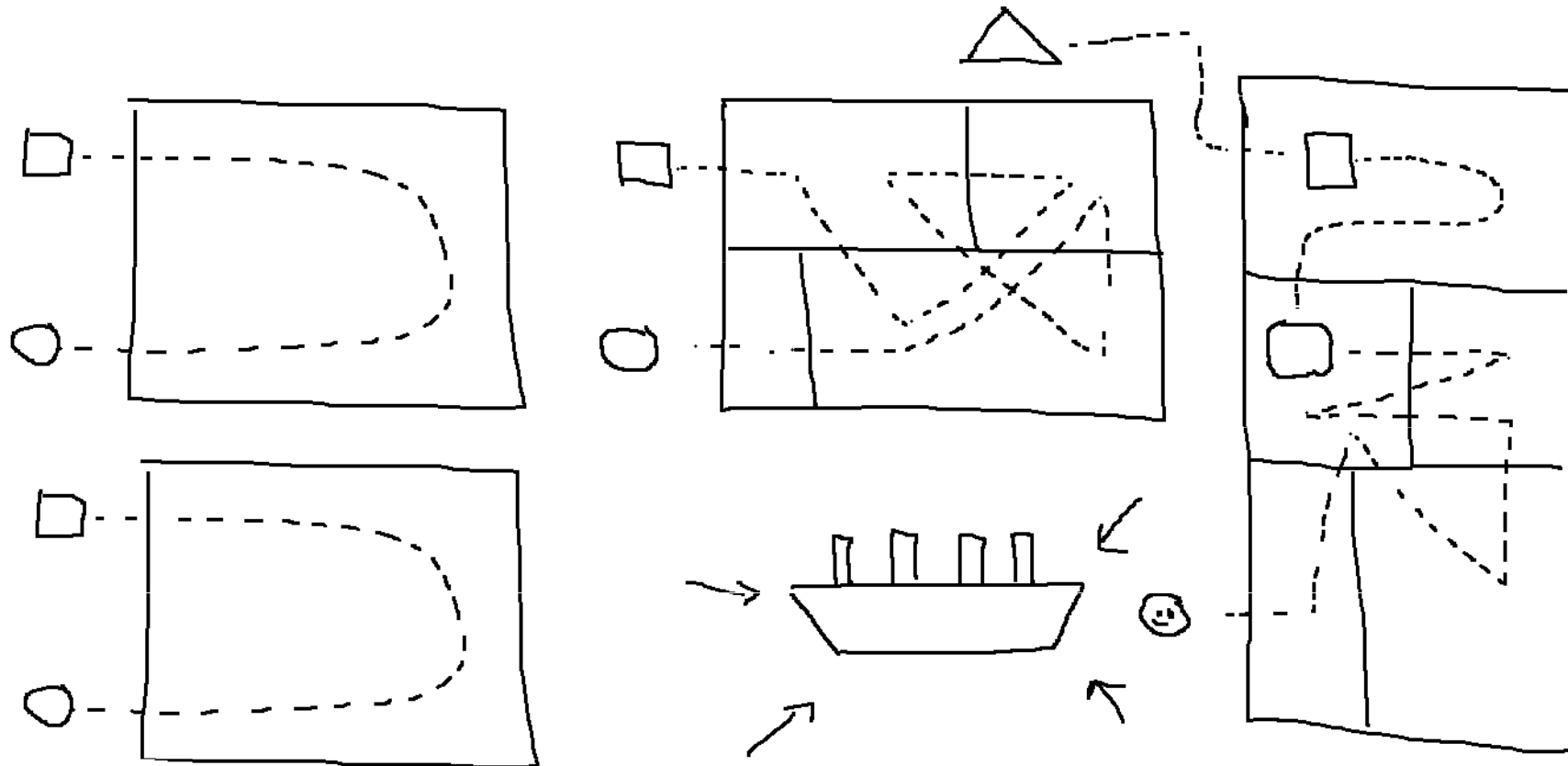
Examples?

- Project – unique, only one
- Job – custom made, bespoke
- Batch – serial number, bespoke, custom made, in lots
- Mass – serial number, higher volumes, customization limited from semi-finished products/parts
- Continuous – no serial numbers, „one type and process“ production



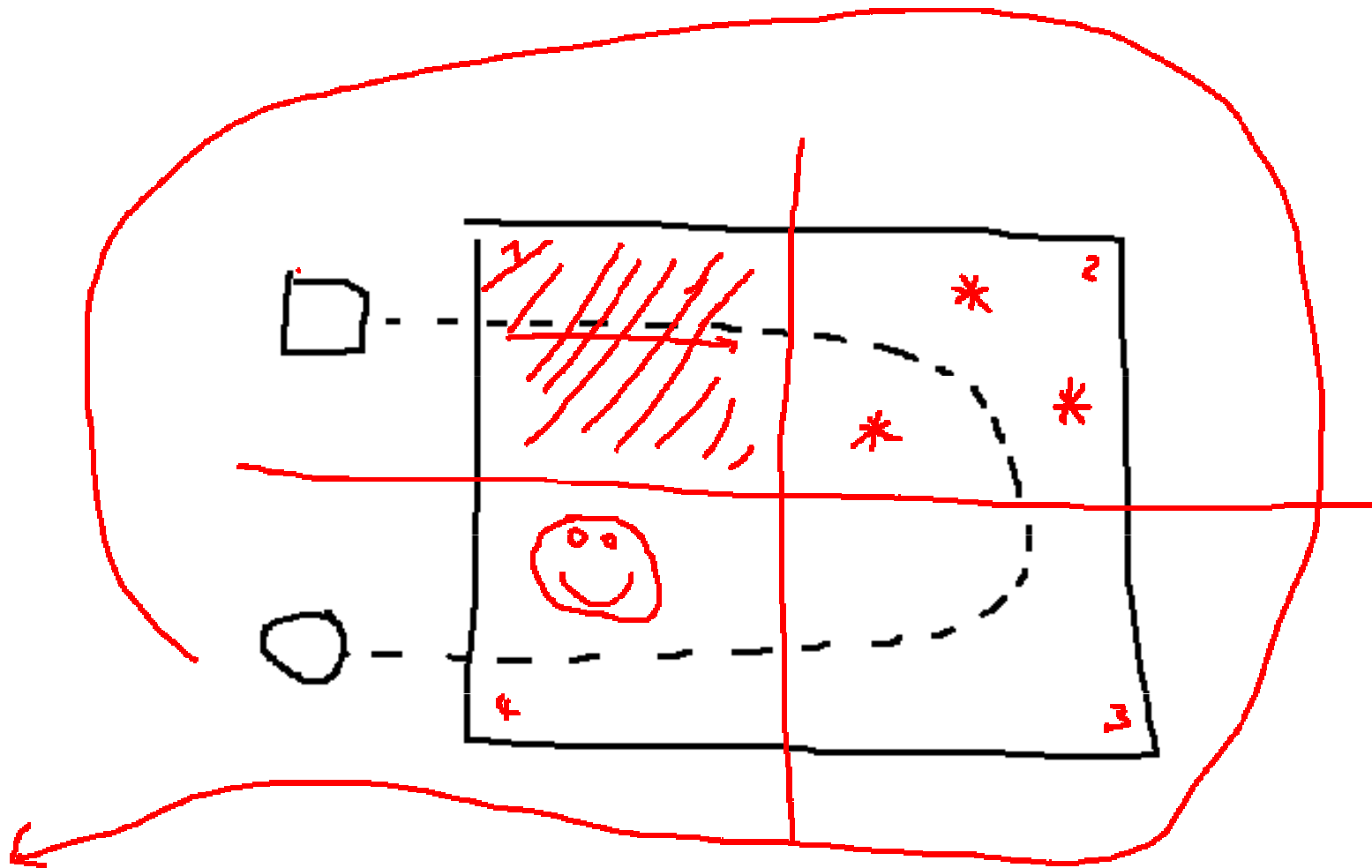
<https://www.youtube.com/watch?v=YEJzW8rsIzo&app=desktop> (and study materials)

Types of output – organizational type of production - hint





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Purple
Aviation Fuels [nickname: "Grapes"]

Blue
Plane Handlers
Aircraft elevator Operators
Tractor Drivers
Messengers and Phone Talkers

Green
Catapult and arresting gear crews
Air wing maintenance personnel
Cargo-handling personnel
Ground Support Equipment (GSE) troubleshooters
Hook runners
Photographer's Mates
Helicopter landing signal initiated personnel (LSE)

Yellow
Aircraft handling officers
Catapult and Arresting Gear Officers
Plane directors

Red
Ordnancemen
Crash and Salvage Crews
Explosive Ordnance Disposal (EOD)

Brown
Air wing plane captains
Air wing line leading petty officers

Rationality vs productivity v efficiency

- rationality of production – basis of economic principle (maximize output with stated input and vice versa)
- production productivity – economic activity (connected to business), stated as a quantitative rationality
- production efficiency – same as productivity, but inputs and output are valuated – therefore some KPI can be calculated

All this leads to buildup of metrics / KPI allowing to improve processes.

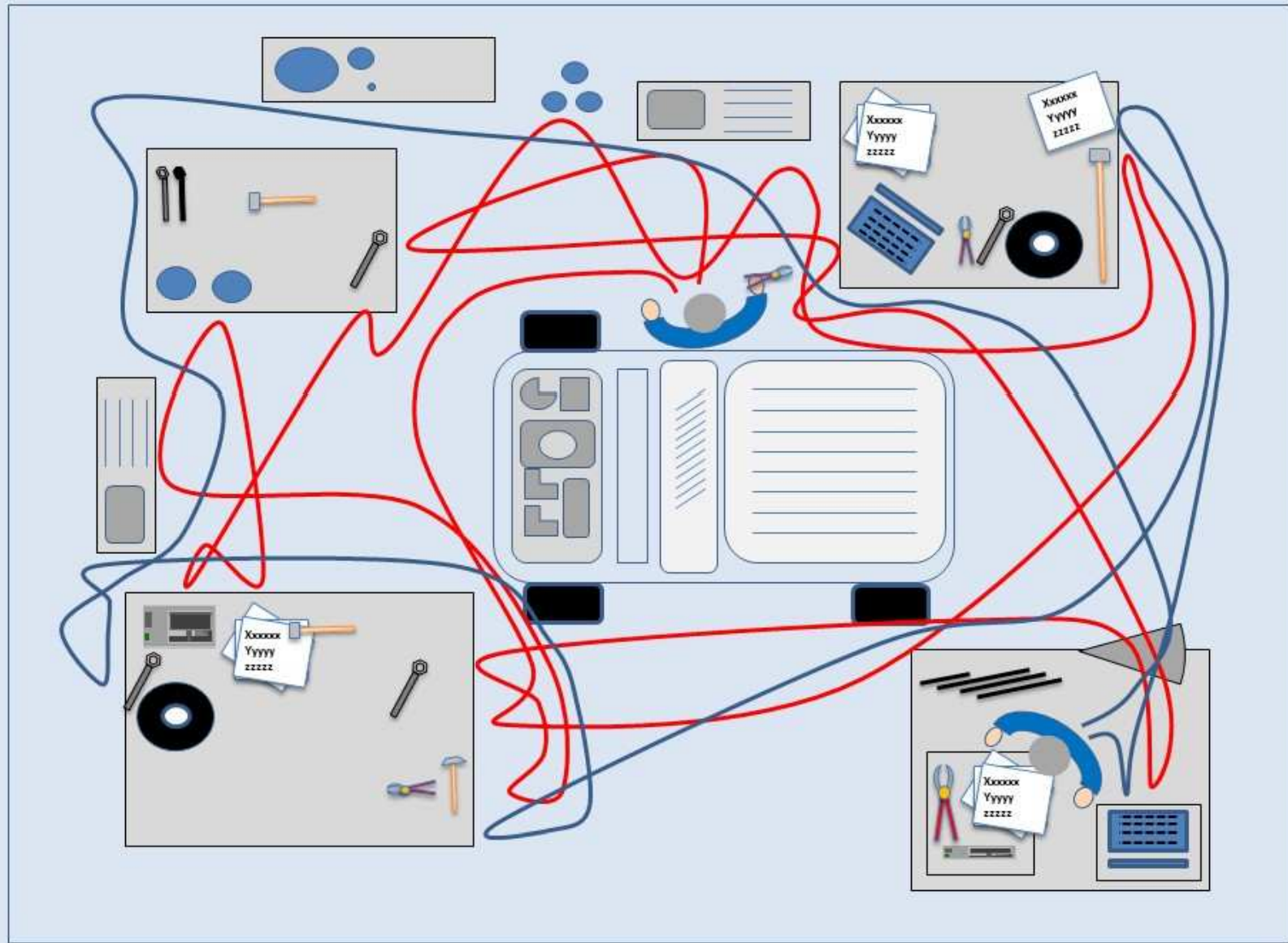
Optimization of workshops

Creation

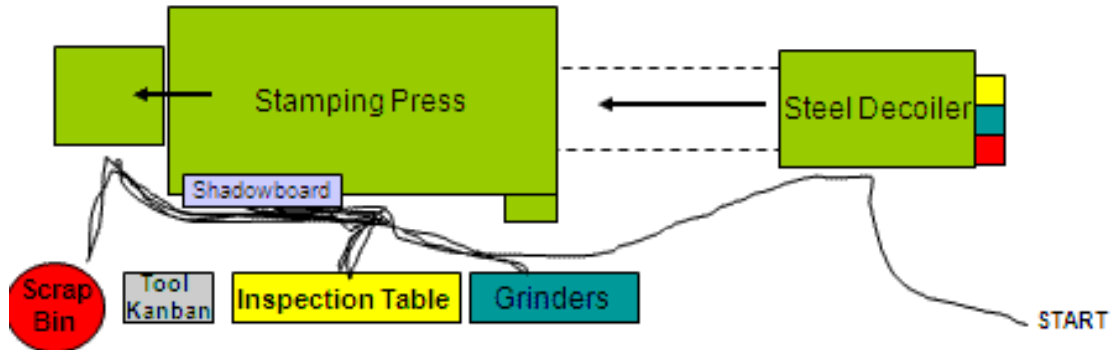
- Automated Layout Design Program (ALDEP)
- **Computerized Relationship Planning (CORELAP)**

Optimisation

- Computerized Relative Allocation of Facilities Technique (CRAFT)

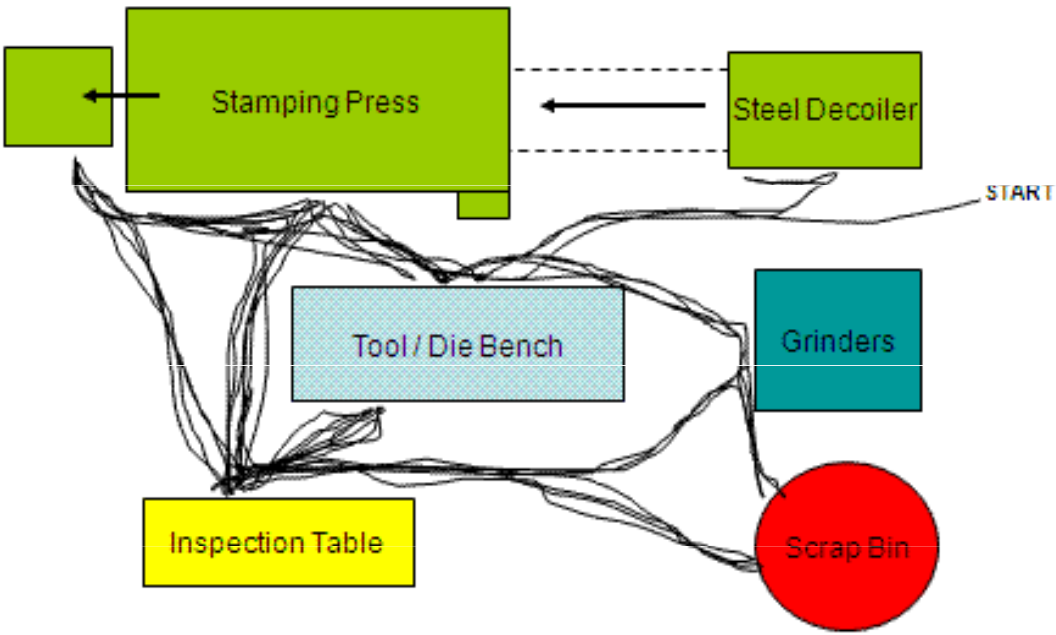


HEMMING SET-UP PROCESS
Spaghetti Diagram IMPROVED



Operator traveled 375 ft to get first good piece.
14.9 minutes from last good piece of previous run to first good piece of this run

HEMMING SET-UP PROCESS
Spaghetti Diagram used to identify waste and achieve SMED



Operator traveled 3,215 ft to get first good piece.
98 minutes from last good piece of previous run to first good piece of this run

CORELAP – how to 1

- Describe processes / machines / workshop – area!
- Analyse processes
- Locate processes
- Analyse interconnection between processes
 - A - the necessary proximity 5
 - E - very important proximity 4
 - I - important proximity 3
 - O - normal proximity 2
 - U - distance does not matter 1
 - X - proximity is undesirable 0

<https://www.youtube.com/watch?v=hXvMoGLgeds>

CORELAP – how to 2

- TCR (total closeness rating) score based on the relation matrix
- Sum of A, E, I, O, U and X for each workshop
- Select highest score and place first (if same select larger)
- If there is any X with the already placed workshops, the workshop will be assigned in the end! (the lower TCR moves to back)
- Select best connection to first one, if draw, select with higher TCL
- Select second one

CORELAP – how to 3

- Placement rating
- TCR * weight
- Weight – 1 if bordering, 0,5 if only corner touch

- CREATE the layout!

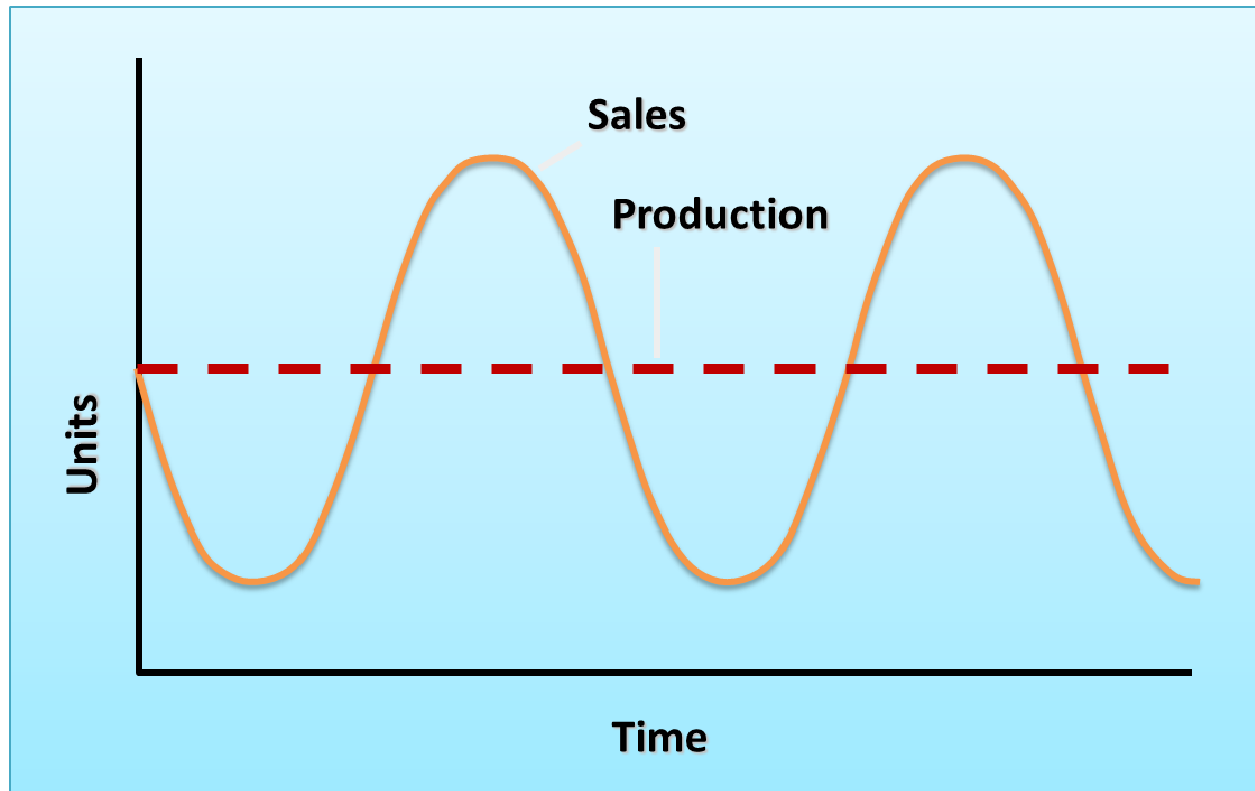
Short – term process planning

- batch sizing (with respect to the technology and the process itself), scheduling, capacity planning

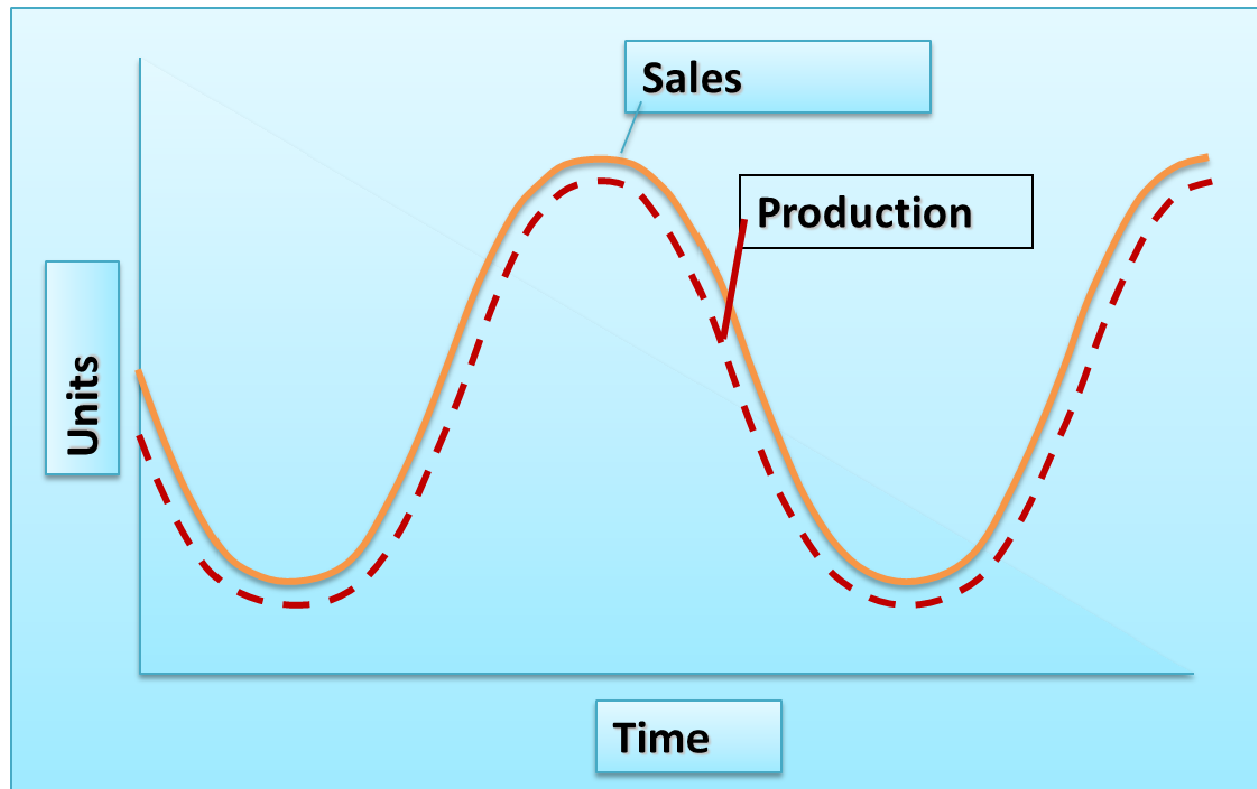
Capacity planning

- The size of monthly sales is constant (bakeries)
- The sales quantity regularly fluctuates seasonally (ice cream, drinks, bicycles):
 - production quantities adjust to fluctuations in sales (hiring and firing seasonal workers) + part-time employees
 - increasing or decreasing the number of working days (Škoda auto)
 - constant production is maintained (use of warehouses to compensate for irregularities in demand)
 - maintaining resources for periods of high demand (resource - material - cheaper and more liquid)
 - products whose seasonal sales fluctuations are phase-shifted relative to the original products are included in the production programme,
 - the possibility to produce for other companies in times of declining sales or, on the contrary, to outsource work to other companies in peak seasons - wage labour
- Seasonal fluctuations occur in purchasing (sugar mills) - warehouses, deliveries from abroad
- Cyclical fluctuations

Constant production



Anticipation of demand



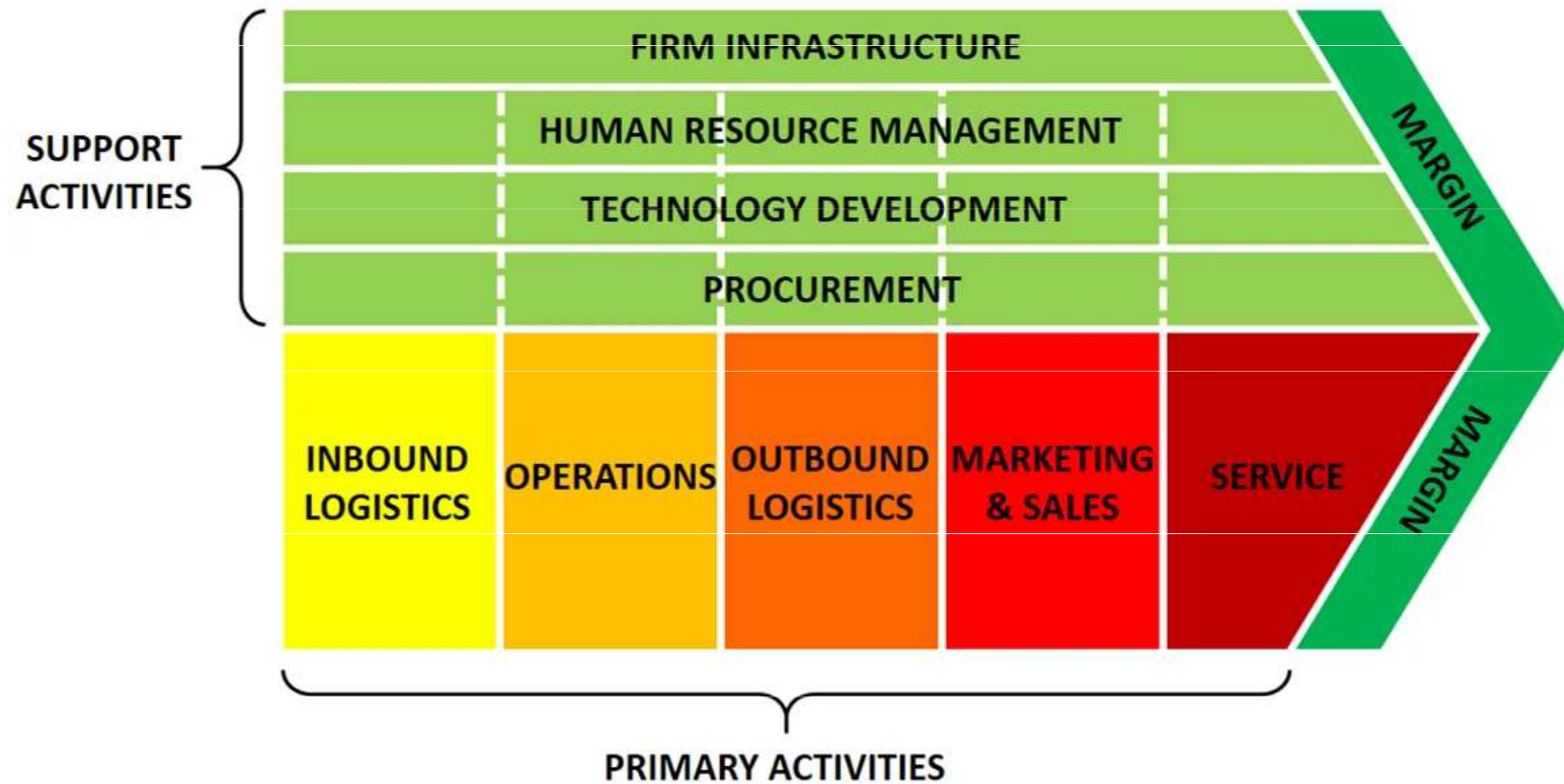
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Quality and performance in production

Quality by scientists

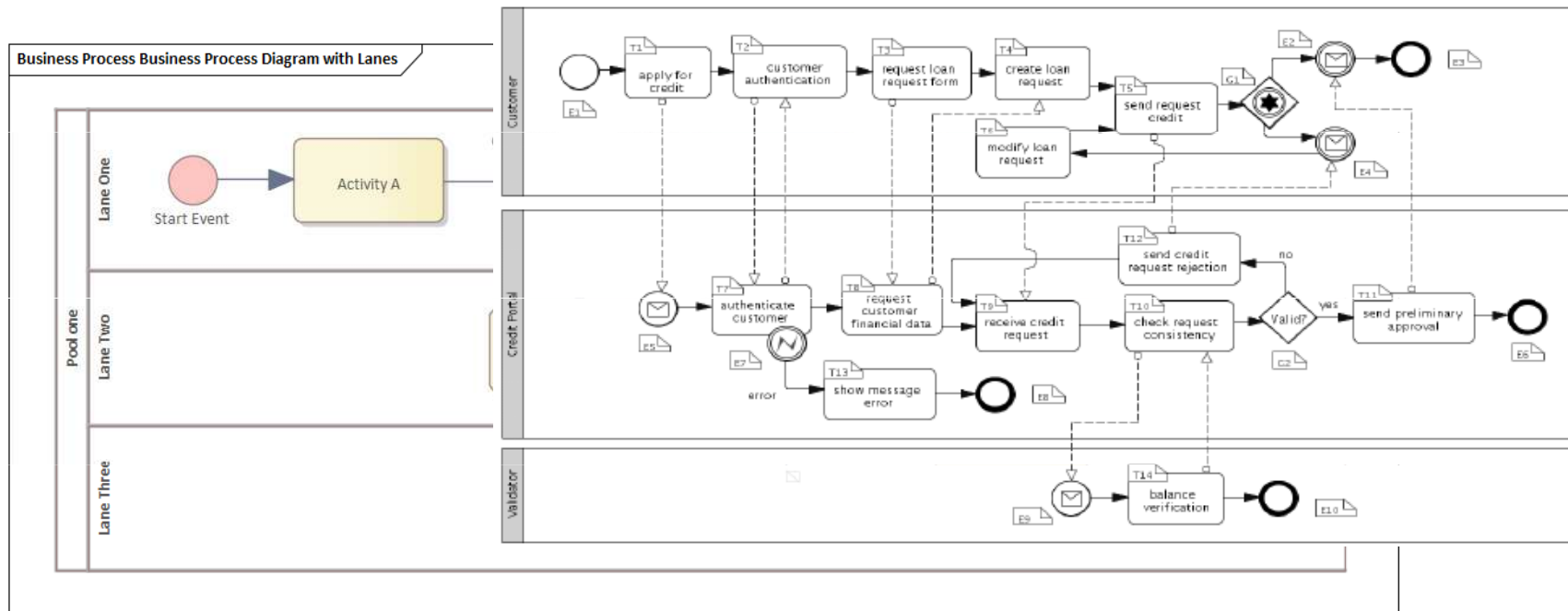
- "quality is compliance with demand." (Crosby)
- "eligibility to use - usable" (Juran and Godfrey 1999)
- "quality is inversely proportional to the losses that the product has caused to the manufacturer since its shipping". (Tagauchi in Dehnad 1989)
- "is the fulfilment of flawlessness, stability and qualitative parameters". Veber (2002, pp. 18-19)
- "degree of fulfilment of requirements by set of inherent characteristics" ČSN ISO 9000: 2005 (2006)

How to achieve quality?



Proces mapping – where?

- BPMN is for business process mapping
- For production, the blue prints are needed...

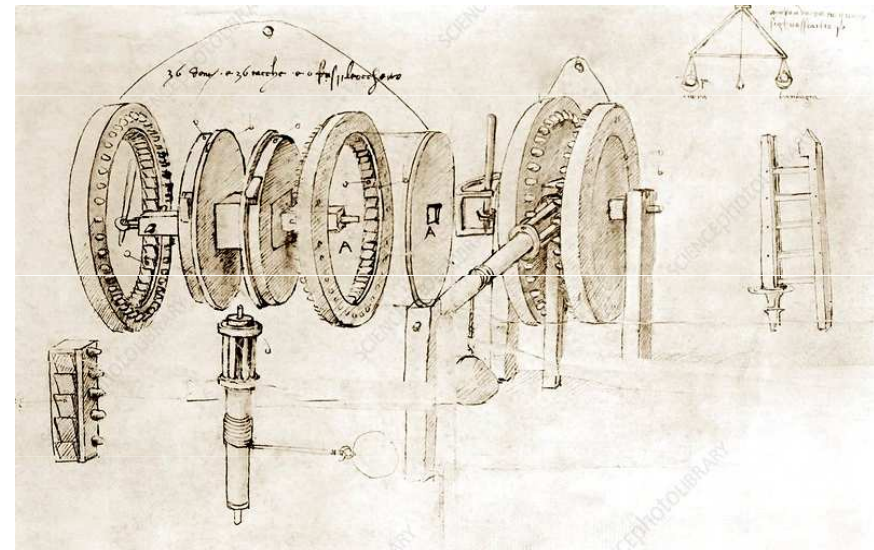
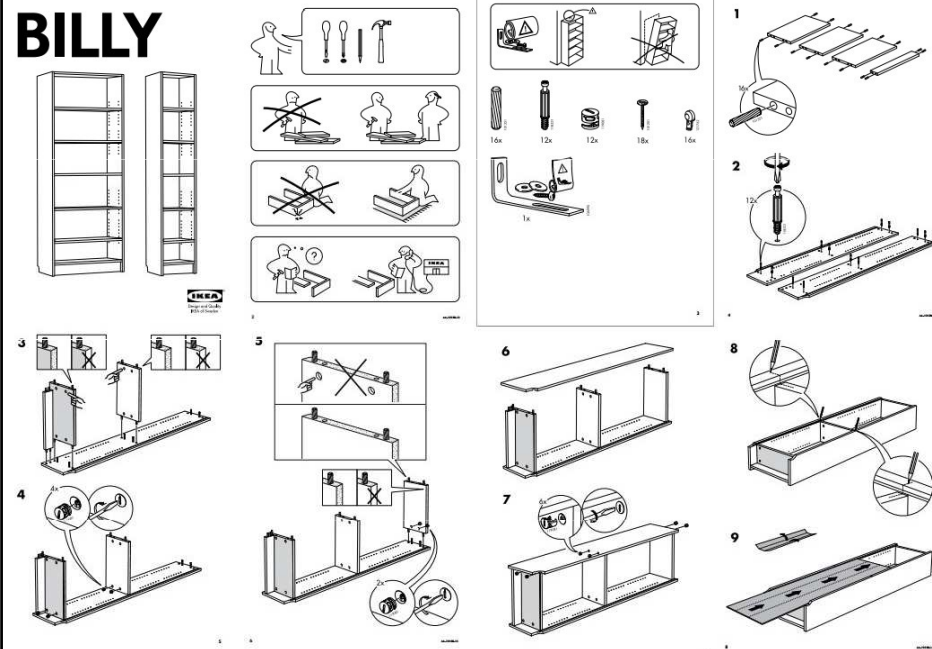


Bill of material

- Gravely important for production process planning!
- summary, assembly, structural
- Shopping list, IKEA manual, WBS/PBS – exploded-view drawing

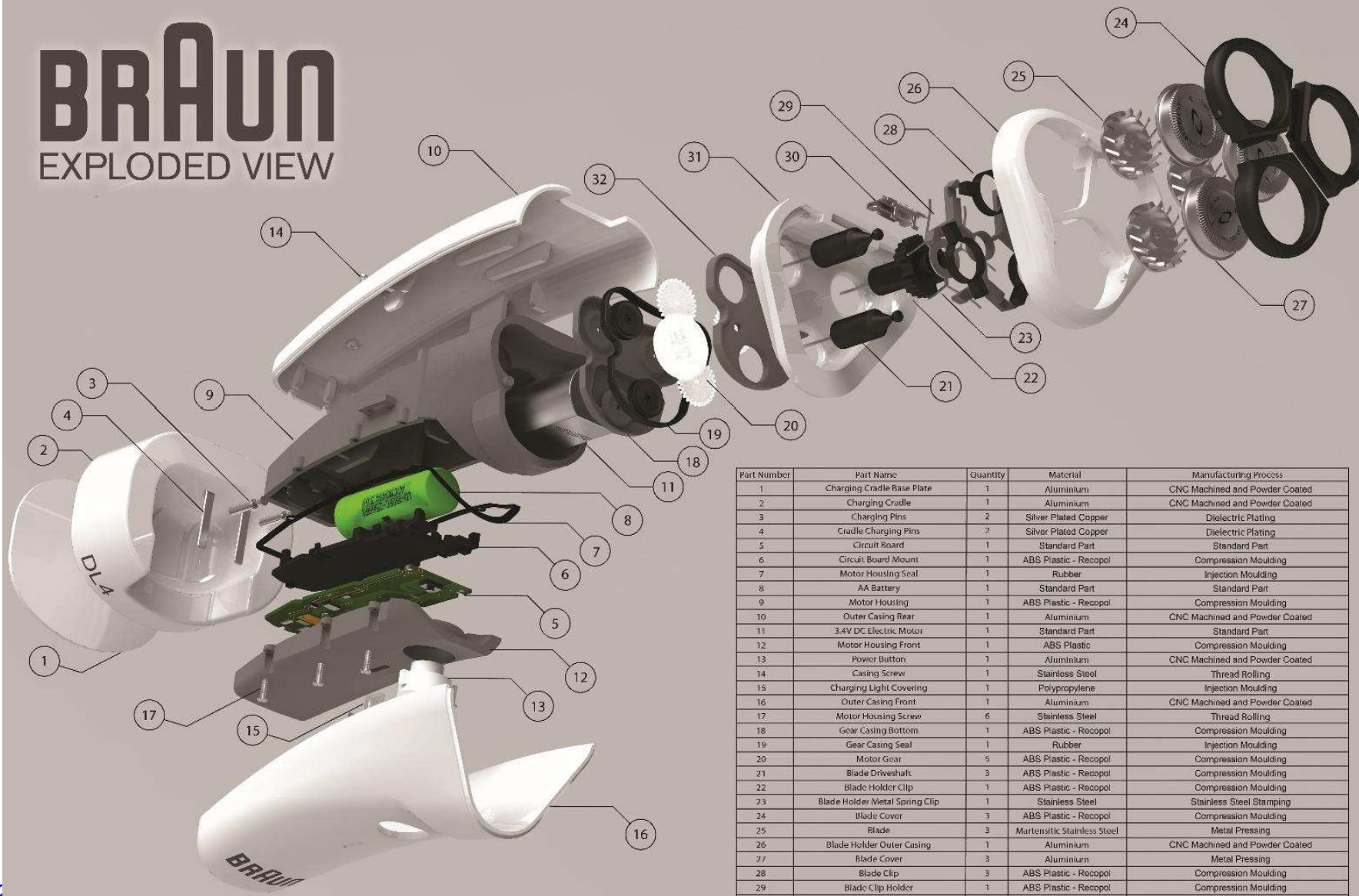


BILLY



BRAUN

EXPLODED VIEW

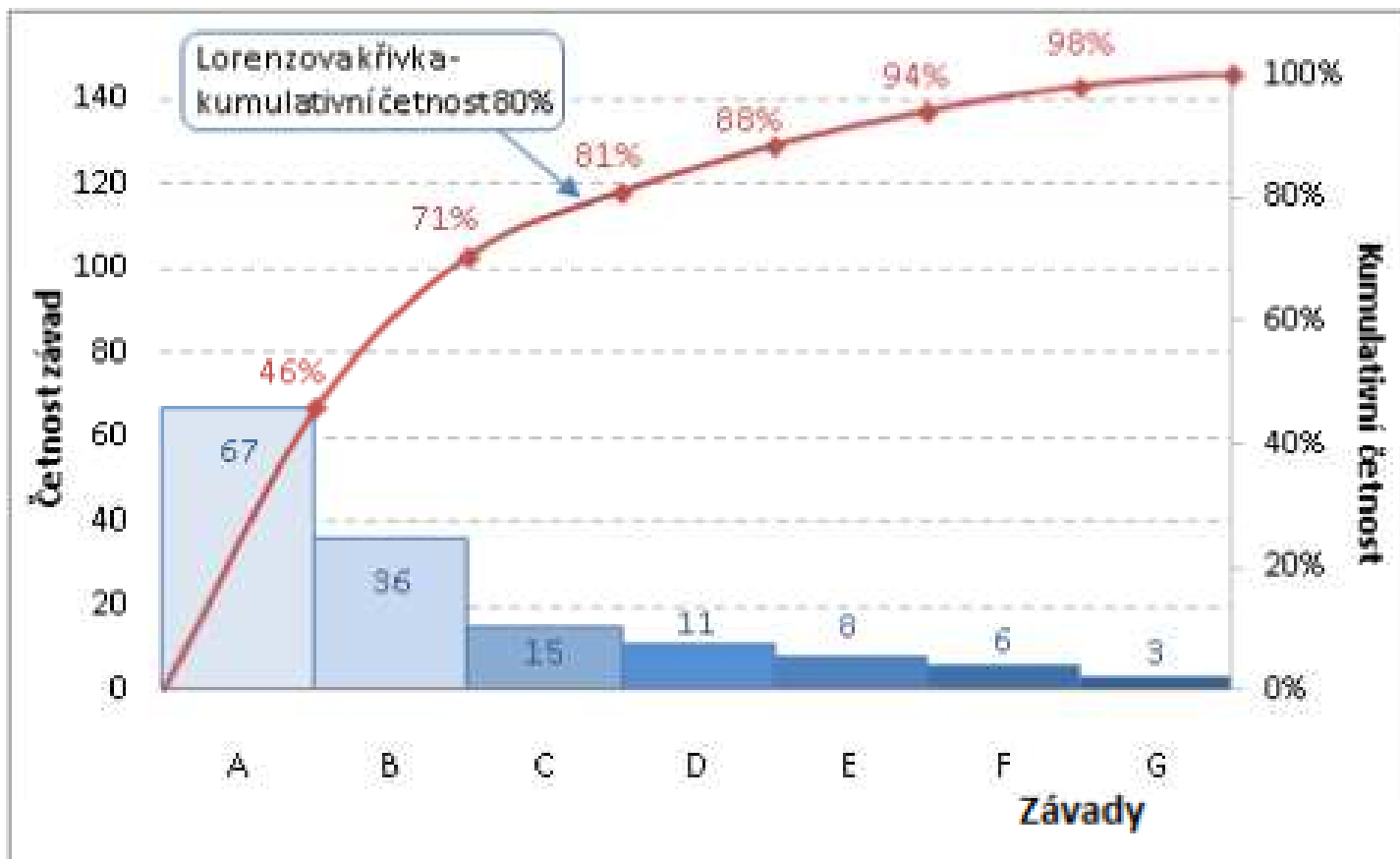


Part Number	Part Name	Quantity	Material	Manufacturing Process
1	Charging Cradle Base Plate	1	Aluminium	CNC Machined and Powder Coated
2	Charging Cradle	1	Aluminium	CNC Machined and Powder Coated
3	Charging Pins	2	Silver Plated Copper	Dielectric Plating
4	Cradle Charging Pins	2	Silver Plated Copper	Dielectric Plating
5	Circuit Board	1	Standard Part	Standard Part
6	Circuit Board Mount	1	ABS Plastic - Recopol	Compression Moulding
7	Motor Housing Seal	1	Rubber	Injection Moulding
8	AA Battery	1	Standard Part	Standard Part
9	Motor Housing	1	ABS Plastic - Recopol	Compression Moulding
10	Outer Casing Rear	1	Aluminium	CNC Machined and Powder Coated
11	3.4V DC Electric Motor	1	Standard Part	Standard Part
12	Motor Housing Front	1	ABS Plastic	Compression Moulding
13	Power Button	1	Aluminium	CNC Machined and Powder Coated
14	Casing Screw	1	Stainless Steel	Thread Rolling
15	Charging Light Covering	1	Polypropylene	Injection Moulding
16	Outer Casing Front	1	Aluminium	CNC Machined and Powder Coated
17	Motor Housing Screw	6	Stainless Steel	Thread Rolling
18	Gear Casing Bottom	1	ABS Plastic - Recopol	Compression Moulding
19	Gear Casing Seal	1	Rubber	Injection Moulding
20	Motor Gear	5	ABS Plastic - Recopol	Compression Moulding
21	Blade Driveshaft	3	ABS Plastic - Recopol	Compression Moulding
22	Blade Holder Clip	1	ABS Plastic - Recopol	Compression Moulding
23	Blade Holder Metal Spring Clip	1	Stainless Steel	Stainless Steel Stamping
24	Blade Cover	3	ABS Plastic - Recopol	Compression Moulding
25	Blade	3	Martensitic Stainless Steel	Metal Pressing
26	Blade Holder Outer Casing	1	Aluminium	CNC Machined and Powder Coated
27	Blade Cover	3	Aluminium	Metal Pressing
28	Blade Clip	3	ABS Plastic - Recopol	Compression Moulding
29	Blade Clip Holder	1	ABS Plastic - Recopol	Compression Moulding
30	Blade Casing Hinge	1	Stainless Steel	Stainless Steel Stamping
31	Blade Holder Bottom	1	Aluminium	CNC Machined and Powder Coated
32	Gear Housing Case Top	1	ABS Plastic - Recopol	Compression Moulding

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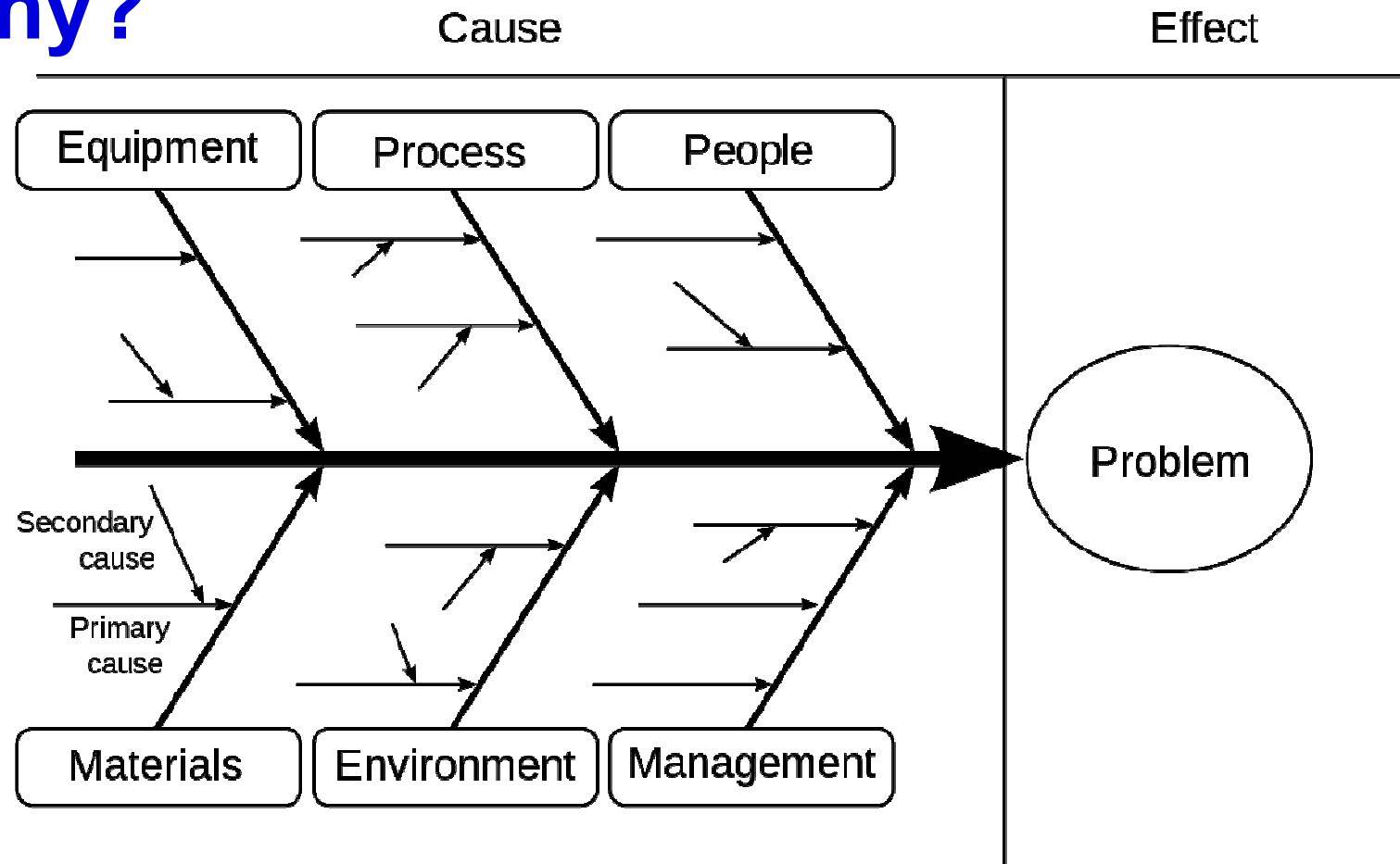
Power graph / Lorenz curve – What?



Process quality measurement

- PPM
- 6 Sigma
- HACCP Thresholds

Root cause diagram / Ishikawa / Fishbone – Why?



**MUNI
ECON**

Lean management

Lean manufacturing

Tidy workplace

Performance

Numbers game

Performance

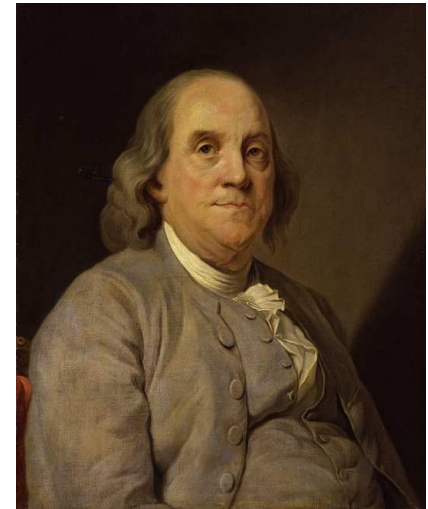
- Theory of constraints

- 5 steps
 1. Identify (identify constraint blocking fulfilling the plan)
 2. Utilise (maximise utilisation of constraint)
 3. Synchronize (subordinate everything to constraint)
 4. Remove limitation (investment)
 5. Return – to step 1

History

- The principles described by Benjamin Franklin since 1732 in the story Poor Richard or The Road to Prosperity - the core and foundations thus originated in the USA
- Developed and especially introduced on a larger scale in Japan after 1945 as Toyota production systems (since 1948)
- In the context of globalization, transferred to the whole world
- Named in 1988 as LEAN Production

Avoiding MUDA (waste)
Cost + Profit = Price
changes to: Price - Cost = Profit



(1706 - 1790)

MUNI
ECON

Waste

MUDA

- Waste...

MURA

- Imbalance, unevenness...

MURI

- Inadequacy...

(MUCHI lack of knowledge and MUSCHI ignorance)

MUDA

Muda means waste, vanity, futility or even pointlessness. This is the most famous evil in the production of the three. They are usually divided into seven types of waste.

- Transport
- Unnecessary movements
- Waiting
- Excess processing
- Defects and repairs
- Stocks
- Overproduction

MURA

Mura means unevenness, unevenness, imbalance, irregularity, imbalance or lack of uniformity. This is any unevenness or irregularity. And although it is often related primarily to material flow, it is a problem of many other cases outside the material flow. Below is a list of examples of when we may encounter mura and when it can cause problems.

- Uneven customer demand
- Inventory fluctuations - too much, too little
- Uneven production speed or change in production volumes
- Irregularities in the quality of good pieces
- Irregular work rhythm
- Unbalanced staff training
- Uneven distribution of workload

MURI

- Muri means overloading resources, inadequacy, impossibility, exaggeration, beyond one's strength, excessive difficulty. Muri is any overloading and doing anything that is too difficult. The main focus here is, of course, on people. However, Muri can also apply to materials, machines and organizations.



Muri = overburdened



Mura = unevenness, fluctuation, variation



Muda = waste



No Muri, Mura, or Muda

– Thank you