Production (operations)

BPH_ABEC

Total: $198B

Employed in various sectors of employment

TERTIARY ACTIVITIES

DEINDUSTRIALIZATION

SECONDARY ACTIVITIES

QUATERNARY ACTIVITIES

PRIMARY ACTIVITIES

Time

USA

2%
23%
75%

Brazil

23%
24%
53%

Nepal

3%
16%
81%

Legend:
- Primary
- Secondary
- Tertiary
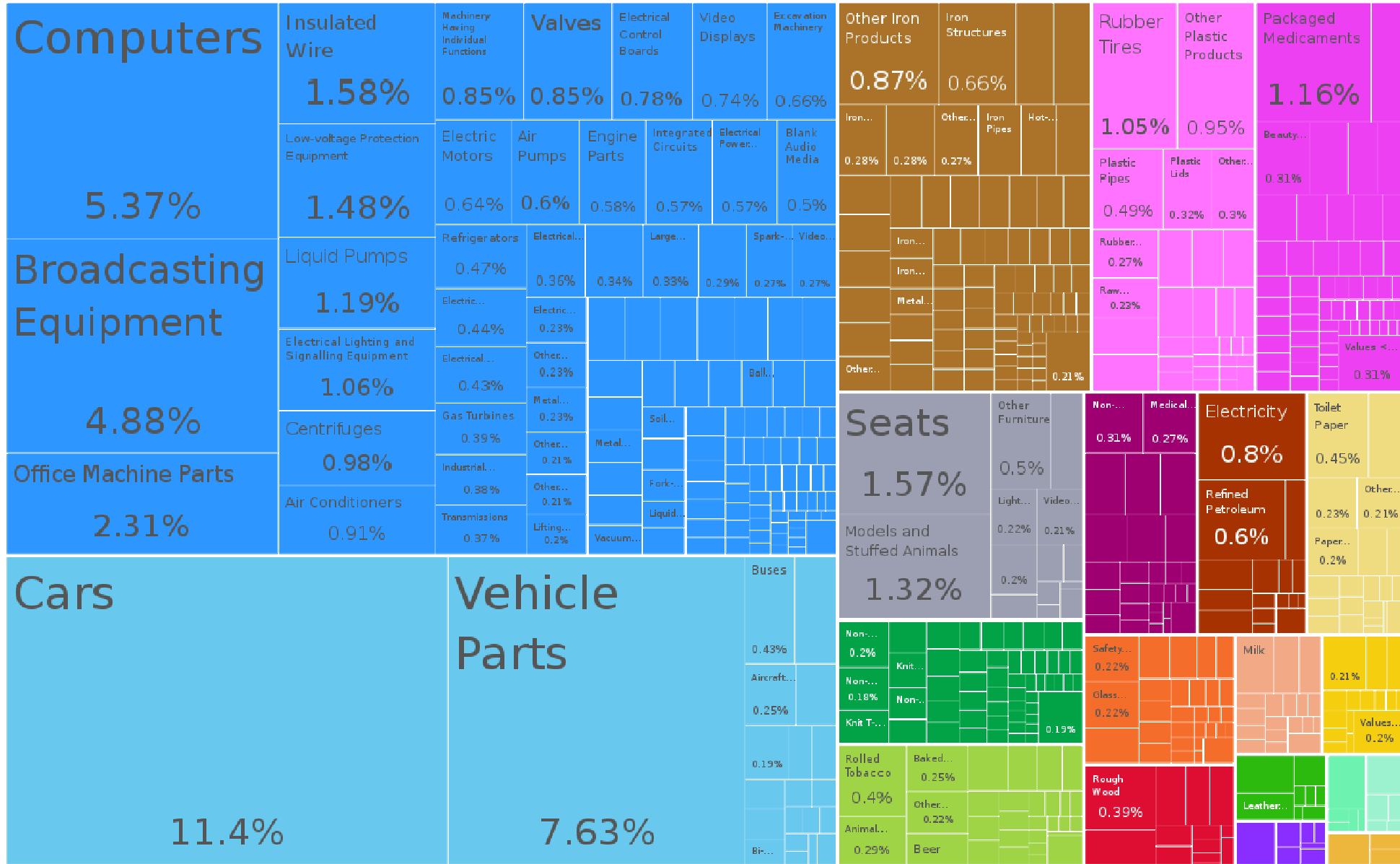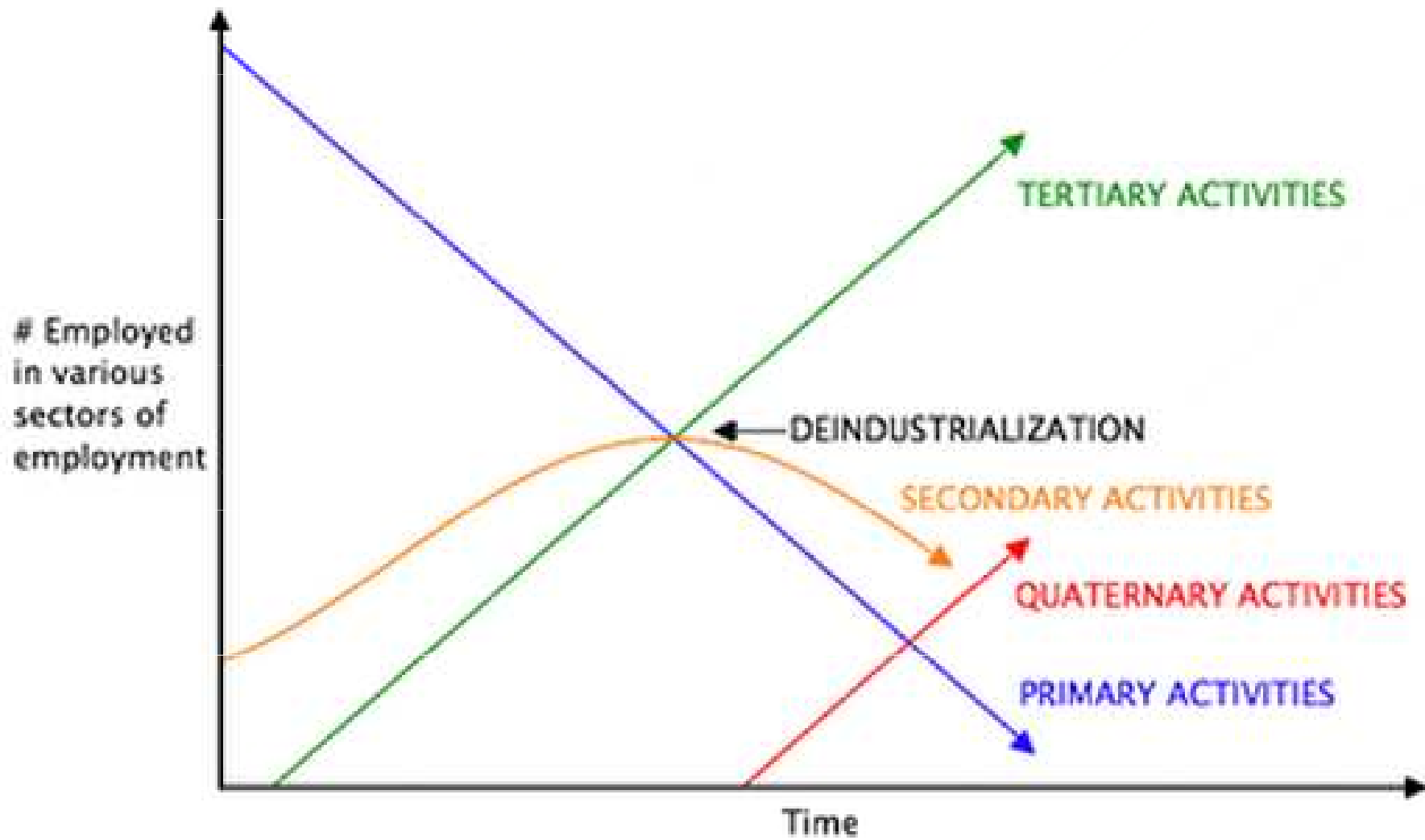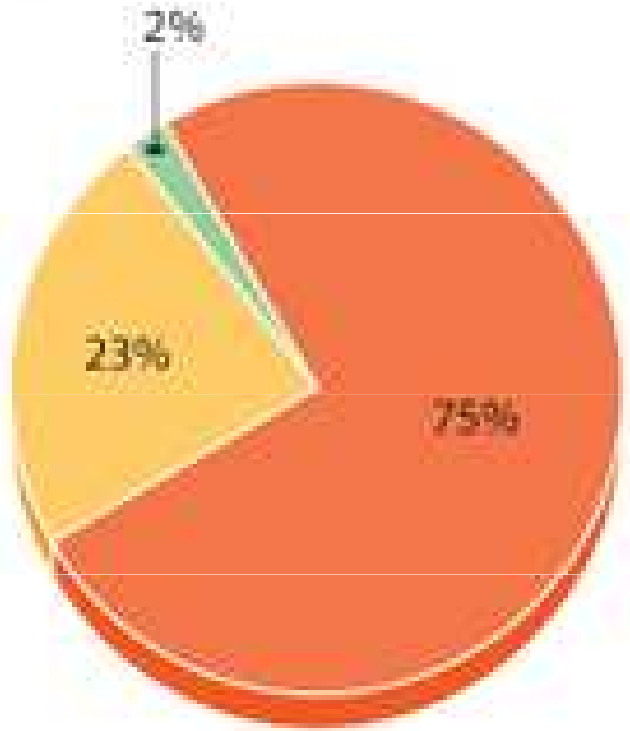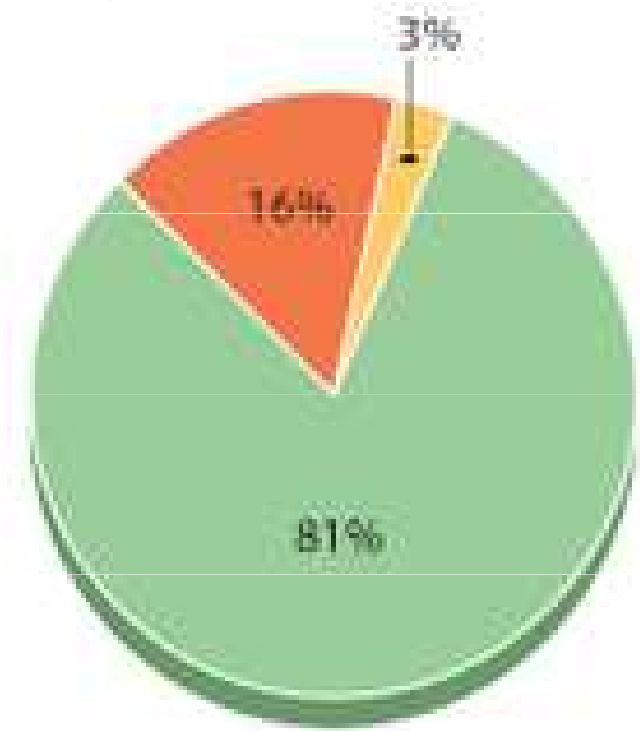
The Role of Agriculture in the World Economy
Agriculture as Share of Total GDP (%)

Agriculture (% of GDP)

- 50% and More
- 20% - 49.9%
- 10% - 19.9%
- 5% - 9.9%
- Less than 5%
- Not ranked

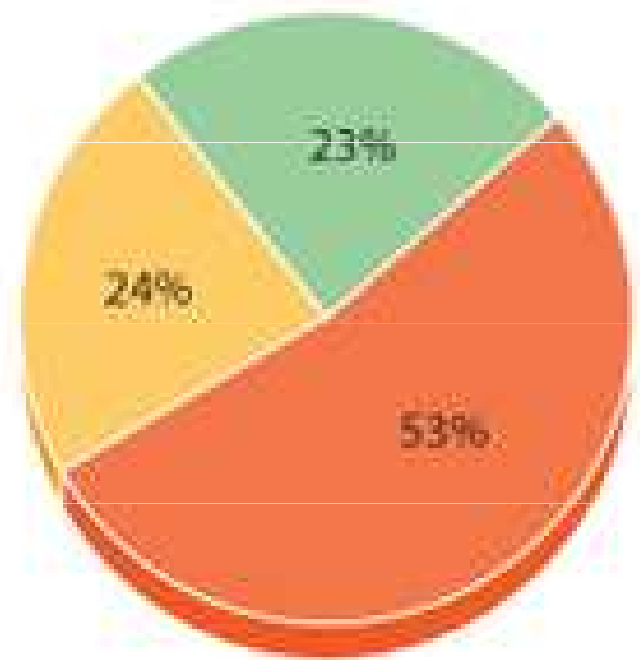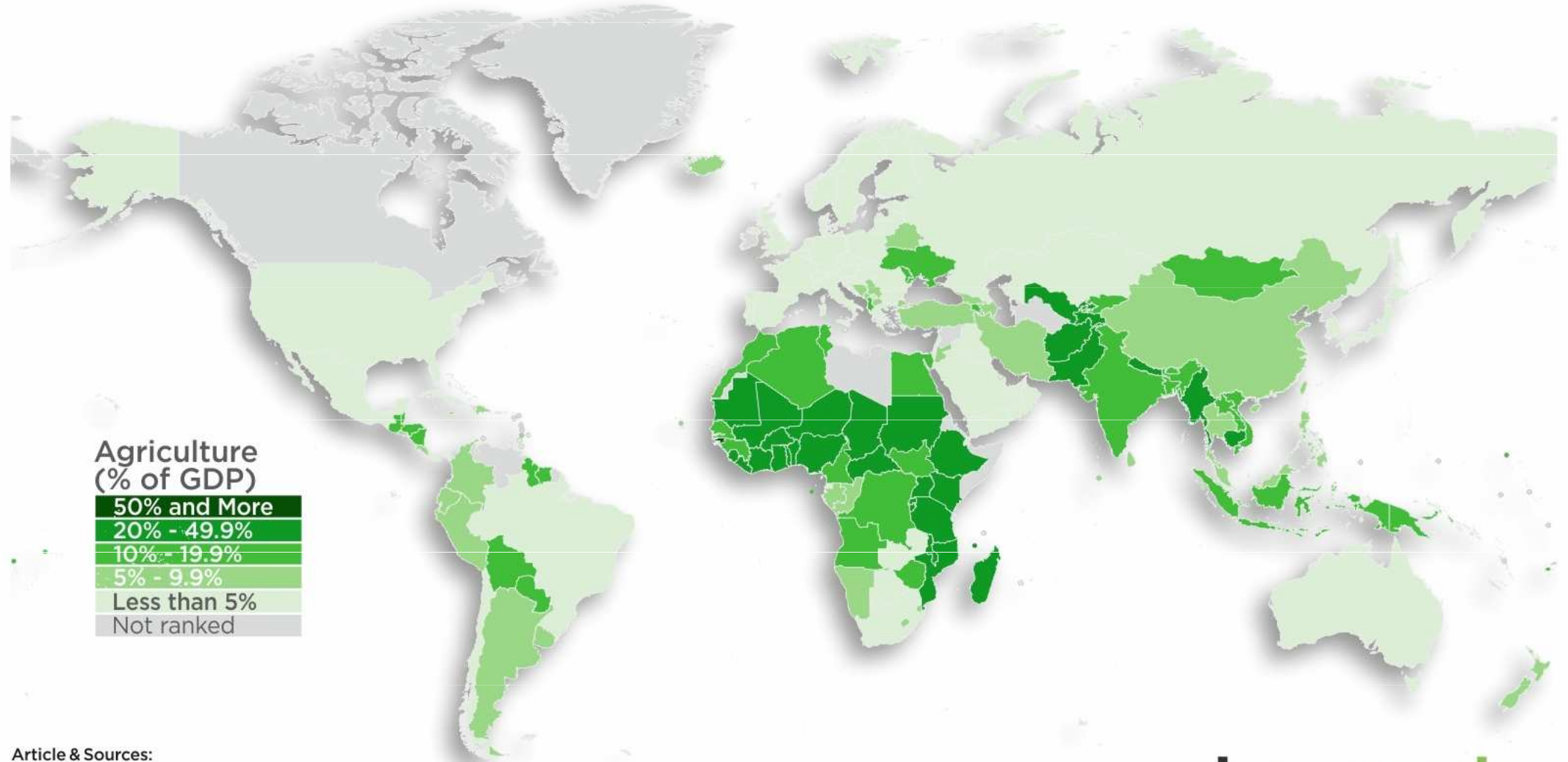# The Role of Industry in the World Economy
Industry as Share of Total GDP (%)

**Industry
(% of GDP)**

- 50% and More
- 40% - 49.9%
- 30% - 39.9%
- 20% - 29.9%
- 10% - 19.9%
- Less than 10%
- Not ranked

howmuch **net**
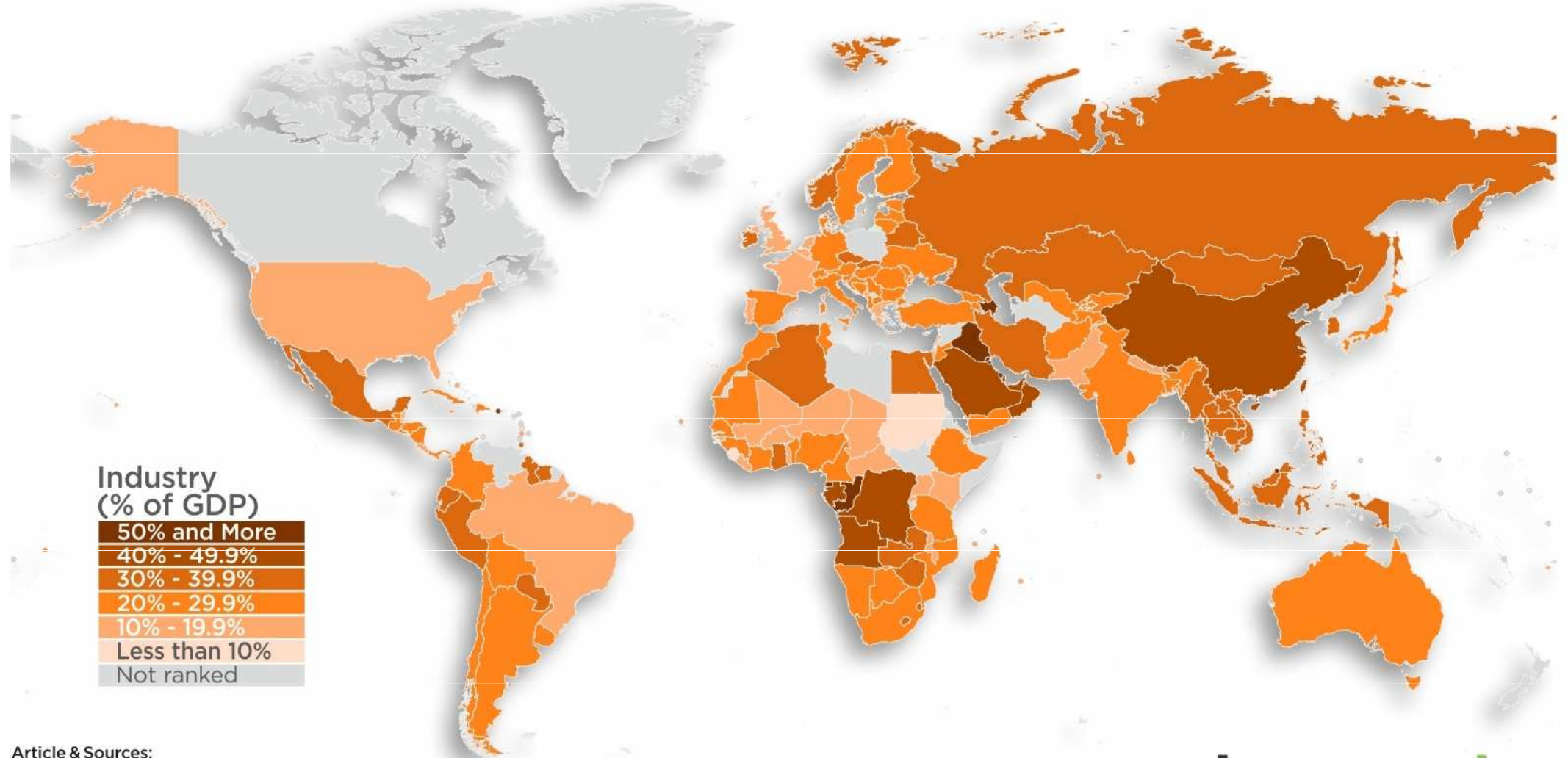
The Role of Agriculture in Europe

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

Agricultural Output
(as % of total employment)

- 30% - 49.9%
- 10% - 29.9%
- Less than 10%

Iceland
$1.3B

Norway
$8.7B

United Kingdom
$28.3B

Finland
$5.5B

Sweden
$5.5B

Estonia
$606M

Ireland
$3.8B

Denmark
$3.5B

Latvia
$1B

Poland
$11.7B

Lithuania
$1.6B

Belarus
$3.6B

Ukraine
$13.1B

Netherlands
$18.3B

Belgium
$5.3B

Germany
$40B

Slovakia
$3.2B

Czech Rep.
$4.9B

Hungary
$6.2B

Austria
$4.6B

Moldova
$1.1B

Georgia
$1.1B

France
$55.6B

Slovenia
$1.1B

Romania
$9.6B

Armenia
$1.7B

Azerbaijan
$2.4B

Switzerland
$7.1B

Croatia
$1.8B

Bosnia and Herz.
$1.2B

Serbia
$3B

Bulgaria
$2.6B

Montenegro
$385M

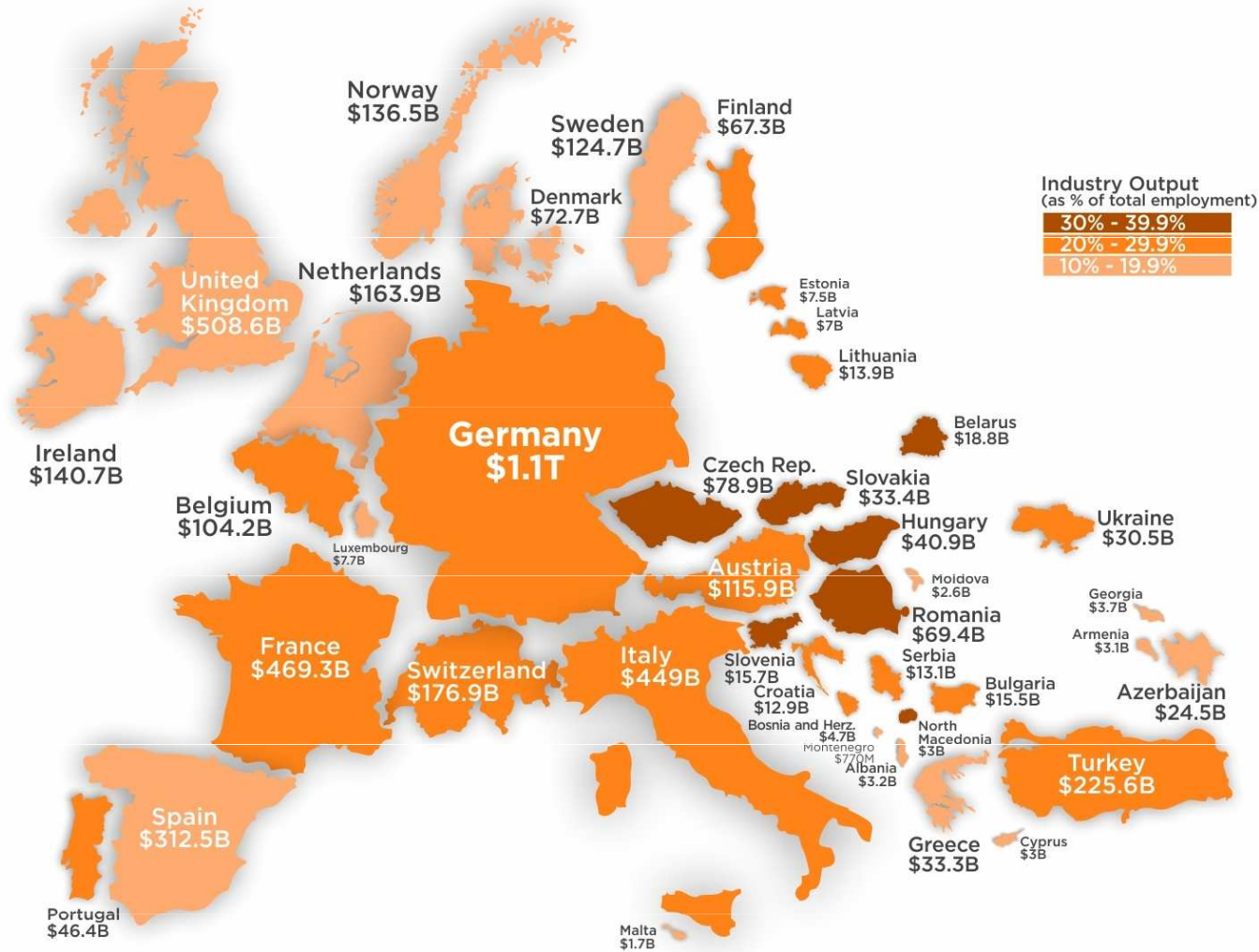North Macedonia
$889M

Turkey
$46B

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.

Portugal
$4.8B

Spain
$42.8B

Italy
$41.5B

Albania
$2.7B

Greece
$8.7B

Cyprus
$490M

Malta
$145M

Article & Sources:
https://howmuch.net/articles/role-agriculture-around-the-world
World Bank - https://worldbank.org

The Role of Industry in Europe
Industry as GDP Value Added ($) & as Share of Total Employment (%)

Norway
$136.5B

Sweden
$124.7B

Finland
$67.3B

Denmark
$72.7B

Industry Output
(as % of total employment)
30% - 39.9%
20% - 29.9%
10% - 19.9%

United
Kingdom
$508.6B

Netherlands
$163.9B

Estonia
$7.5B

Latvia
$7B

Lithuania
$13.9B

Ireland
$140.7B

Germany
$1.1T

Belarus
$18.8B

Czech Rep.
$78.9B

Slovakia
$33.4B

Ukraine
$30.5B

Belgium
$104.2B

Hungary
$40.9B

Luxembourg
$7.7B

Austria
$115.9B

Moldova
$2.6B

Georgia
$3.7B

Armenia
$3.1B

Romania
$69.4B

France
$469.3B

Switzerland
$176.9B

Italy
$449B

Slovenia
$15.7B

Serbia
$13.1B

Croatia
$12.9B

Bulgaria
$15.5B

Azerbaijan
$24.5B

Bosnia and Herz.
$4.7B

Montenegro
$770M

North
Macedonia
$3B

Albania
$3.2B

Turkey
$225.6B

Spain
$312.5B

Greece
$33.3B

Cyprus
$3B

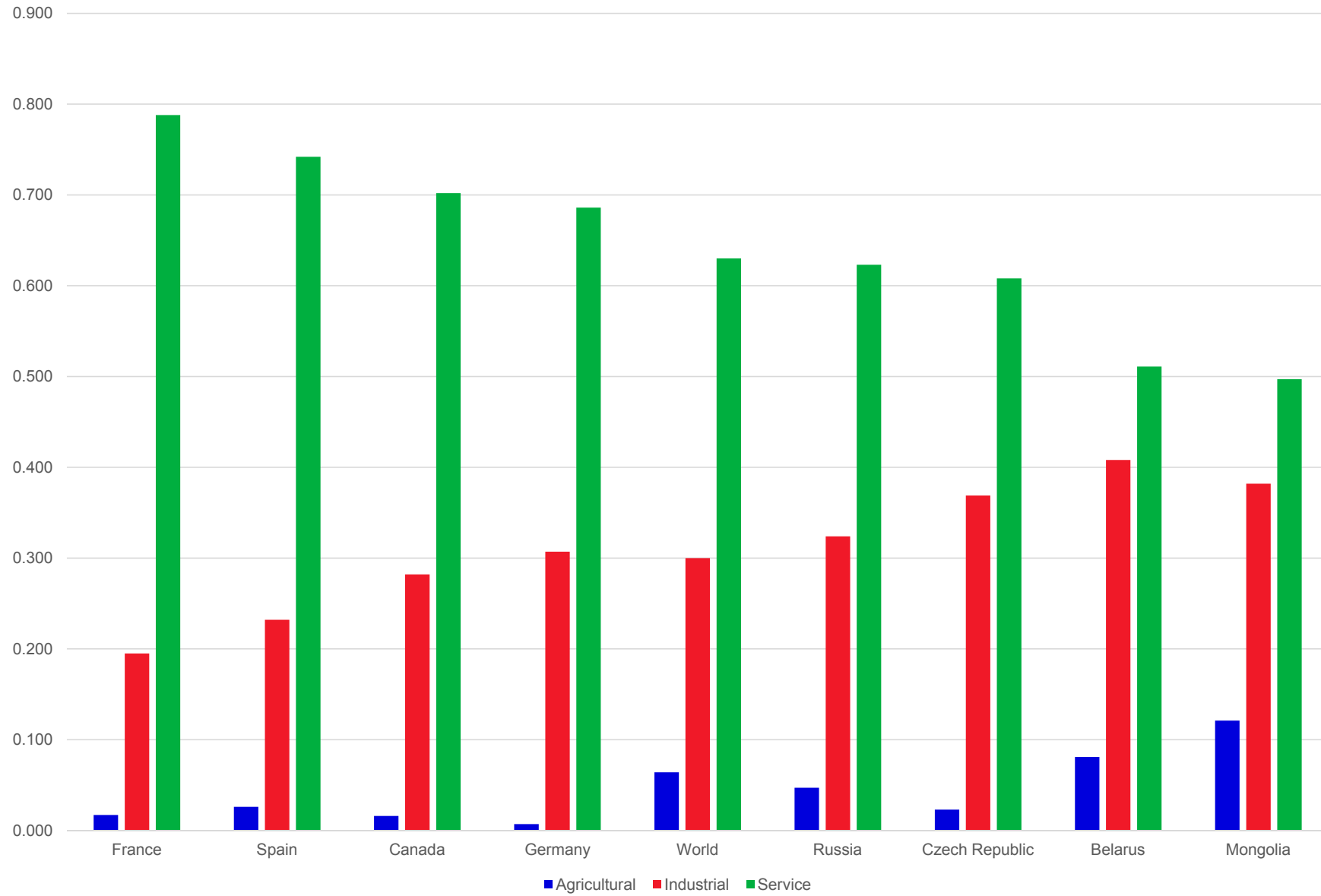Portugal
$46.4B

Malta
$1.7B

How to read this map: Countries are scaled based on their total industrial production, as part of their GDP. Countries appear bigger as their industrial production is higher e.g. Germany. Conversely, countries with lower industrial output appear smaller e.g. Montenegro.
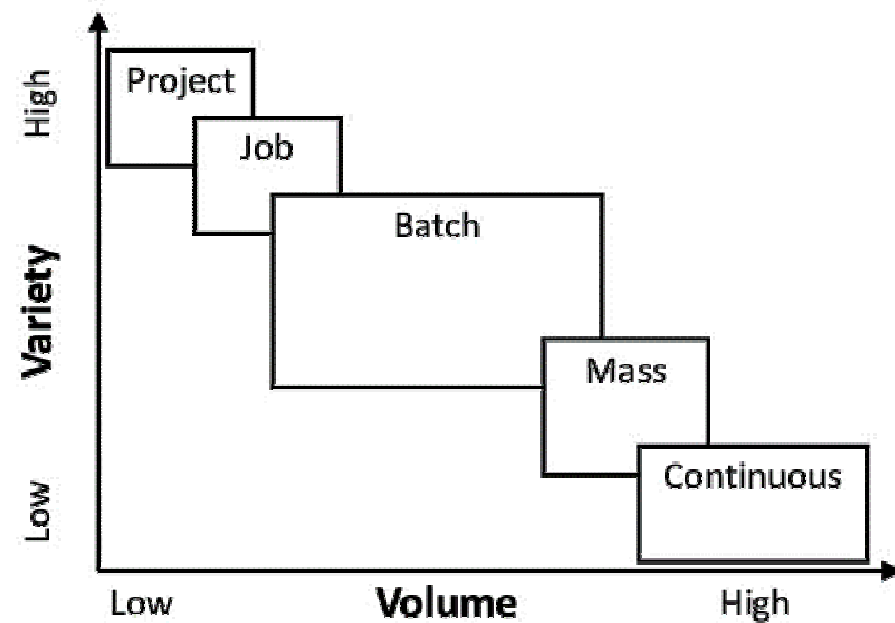
Article & Sources:
https://howmuch.net/articles/role-industry-around-the-world
World Bank - https://worldbank.org

howmuch.net

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Share on GDP

■ Agricultural ■ Industrial ■ Service

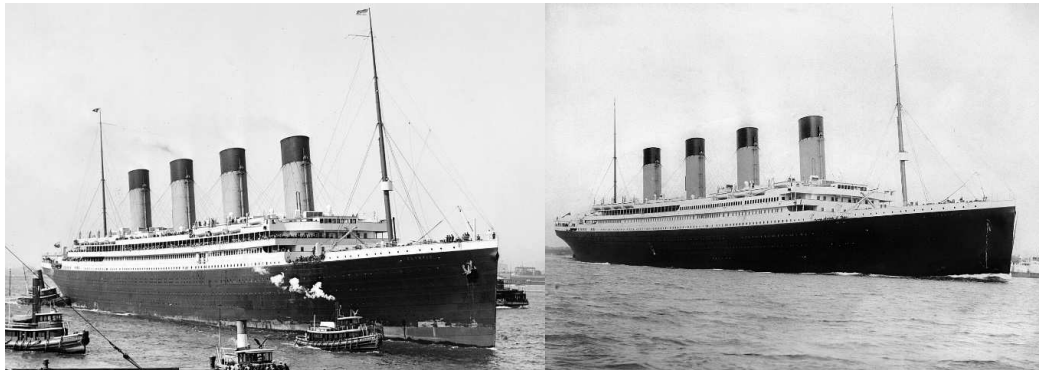# Types of output – production type

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

Process Types – Products
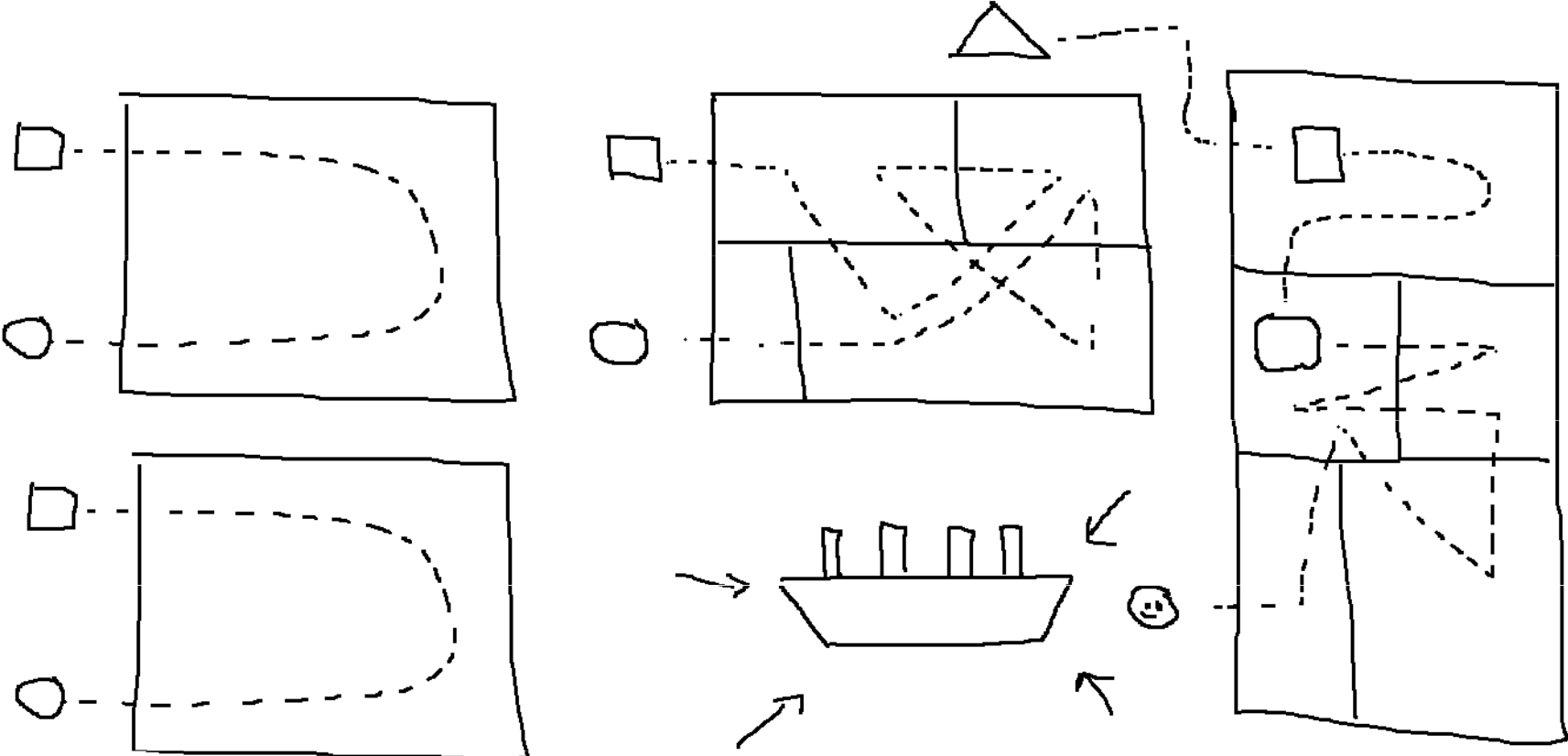
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Examples?

- 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
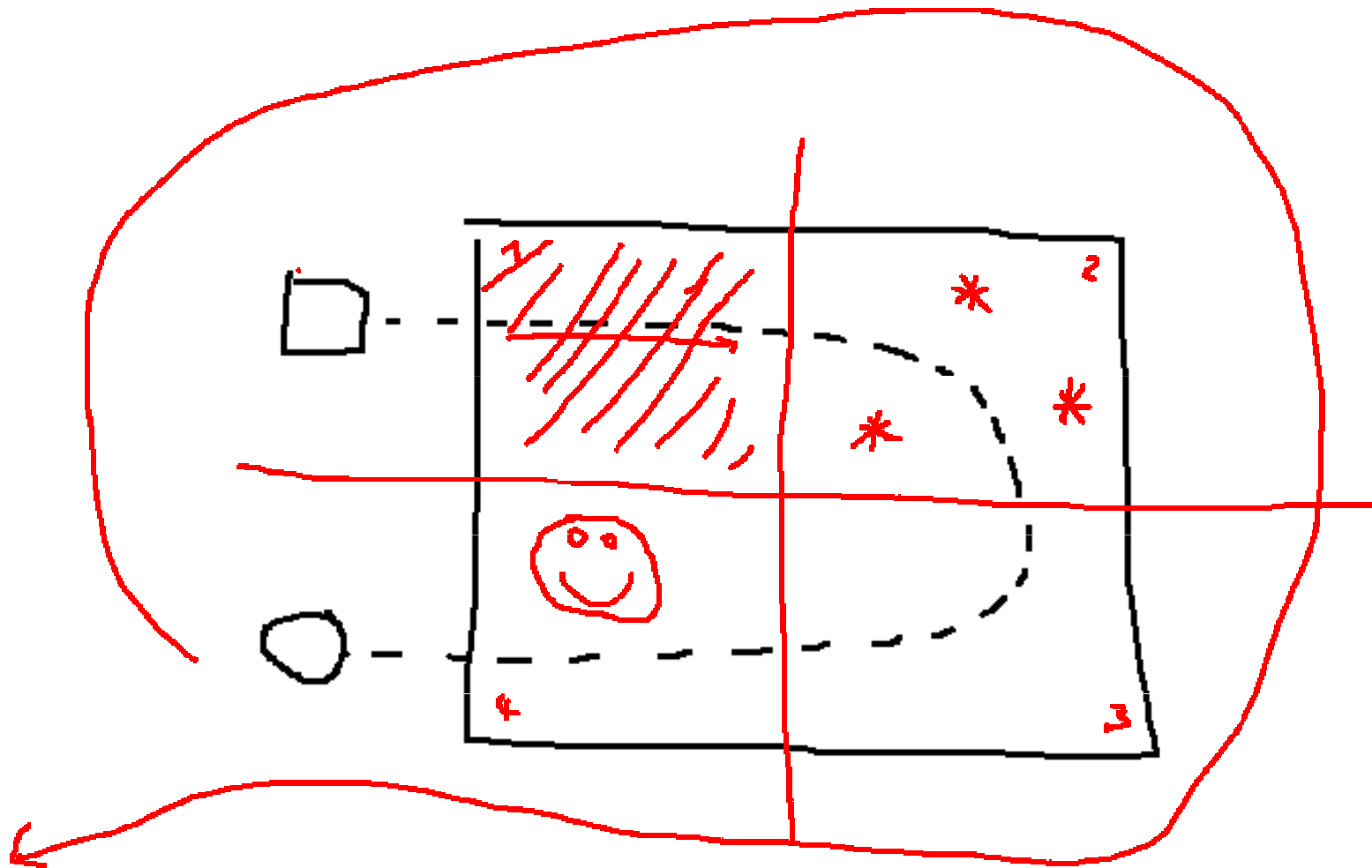

https://www.youtube.com/watch?v=YEJzW8rsIzo&app=desktop   (and study materials)

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Types of output – organizational type of production - hint

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 enlisted 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

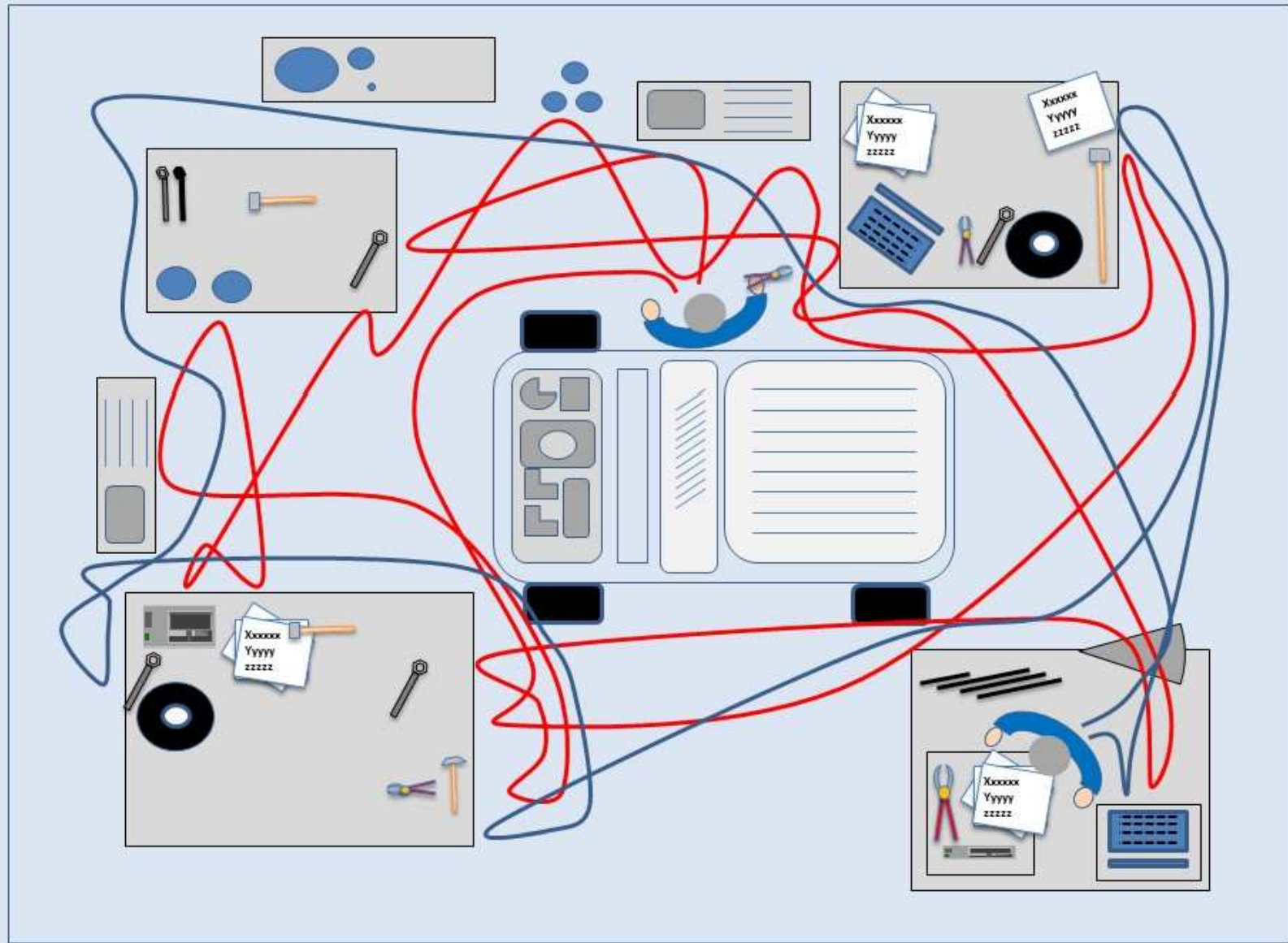All this leads to buildup of metrics / KPI allowing to improve processes.

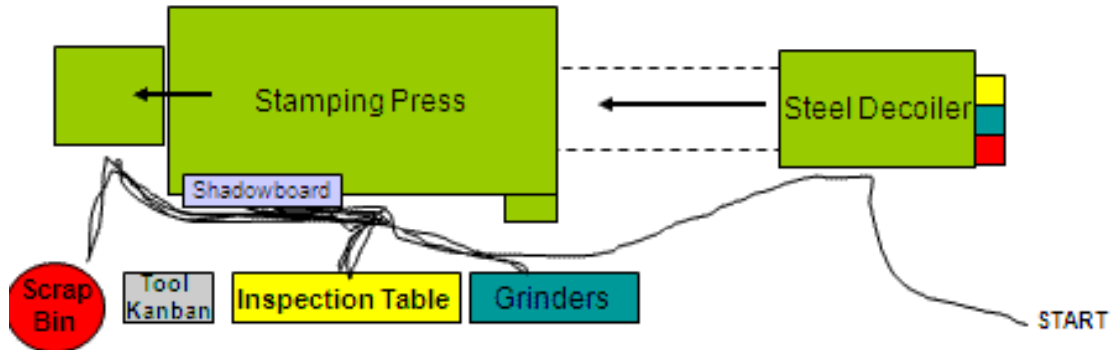# Optimization of workshops

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

Stamping Press

Steel Decoiler

Shadowboard

Scrap Bin

Tool Kanban

Inspection Table

Grinders

START

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
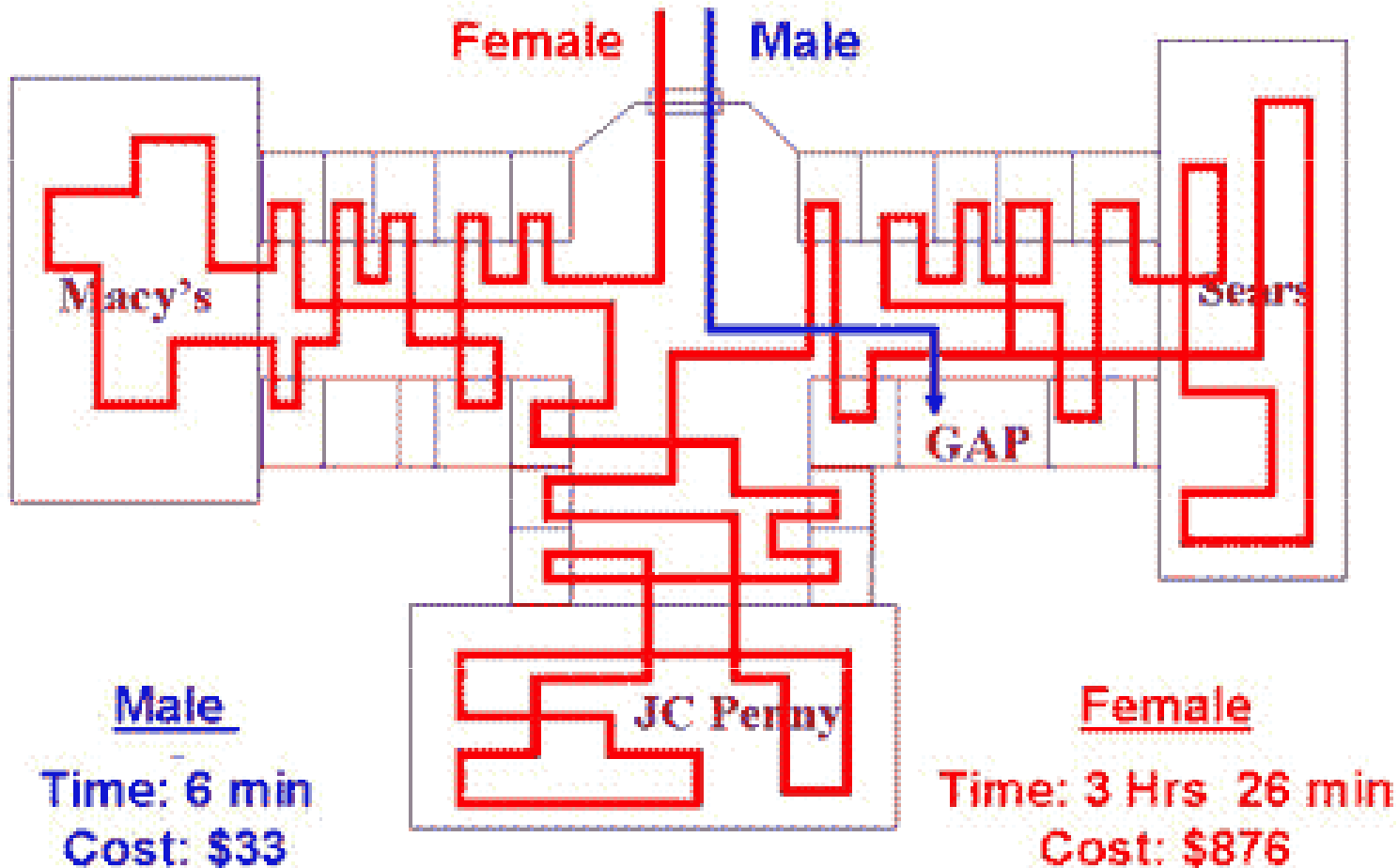### Spaghetti Diagram used to identify waste and achieve SMED

Stamping Press

Steel Decoiler

START

Tool / Die Bench

Grinders

Inspection Table

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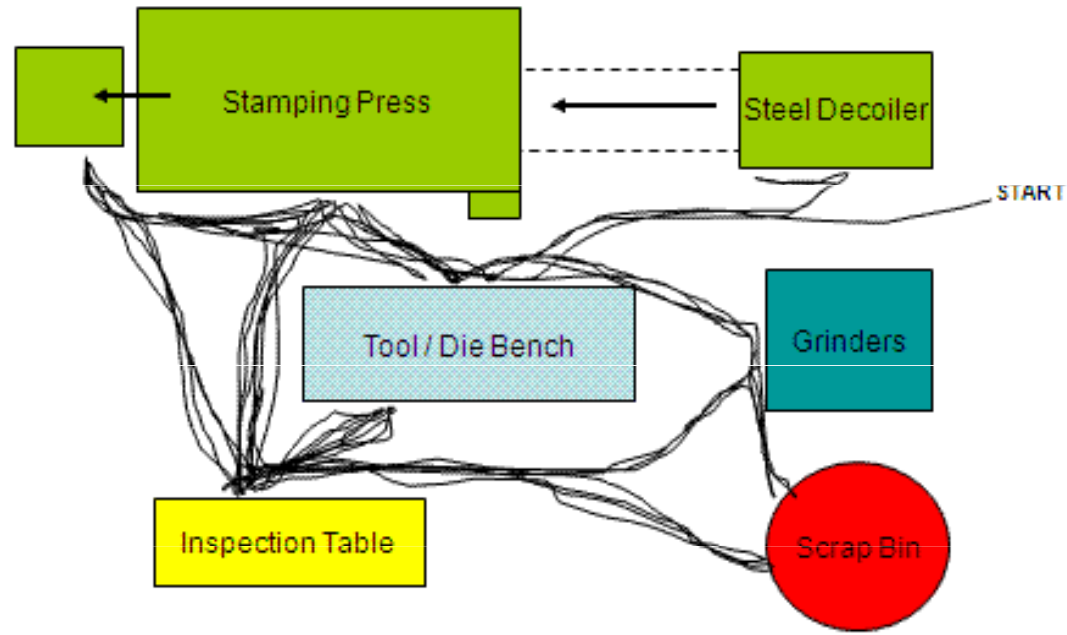
Operator traveled 3,215 ft to get first good piece.
98 minutes from last good piece of previous run to first good piece of this run

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Mission: Go to Gap, Buy a Pair of Pants

Female   Male

Macy's

Sears

GAP

JC Penny

Male
Time: 6 min
Cost: $33

Female
Time: 3 Hrs 26 min
Cost: $876

MUNI ECON

CORELAP – how to 1

– Describe processes / machines / workshop – area!
– Analyse processes
– Locate processes
– Analyse interconnection between processes analysis
  – 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

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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

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CORELAP – how to 3

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

- CREATE the layout!

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Quality and performance in production

What is quality?

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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)
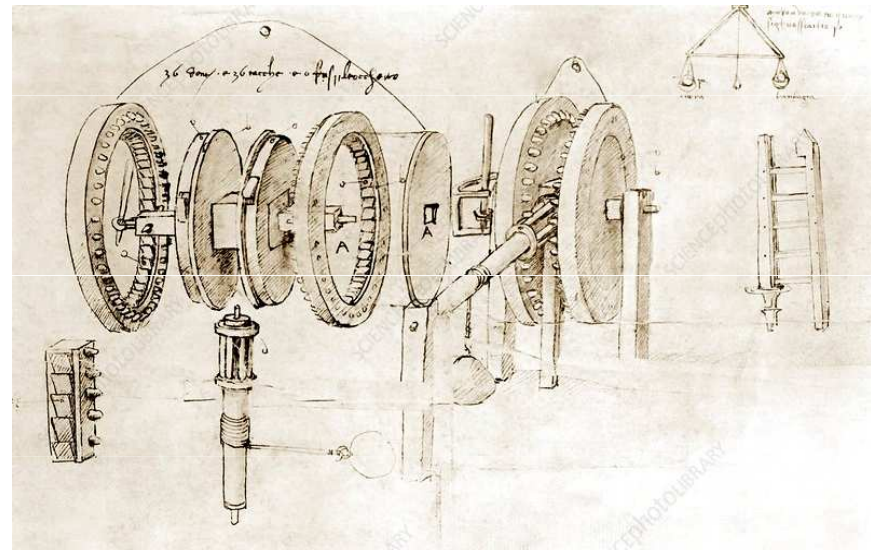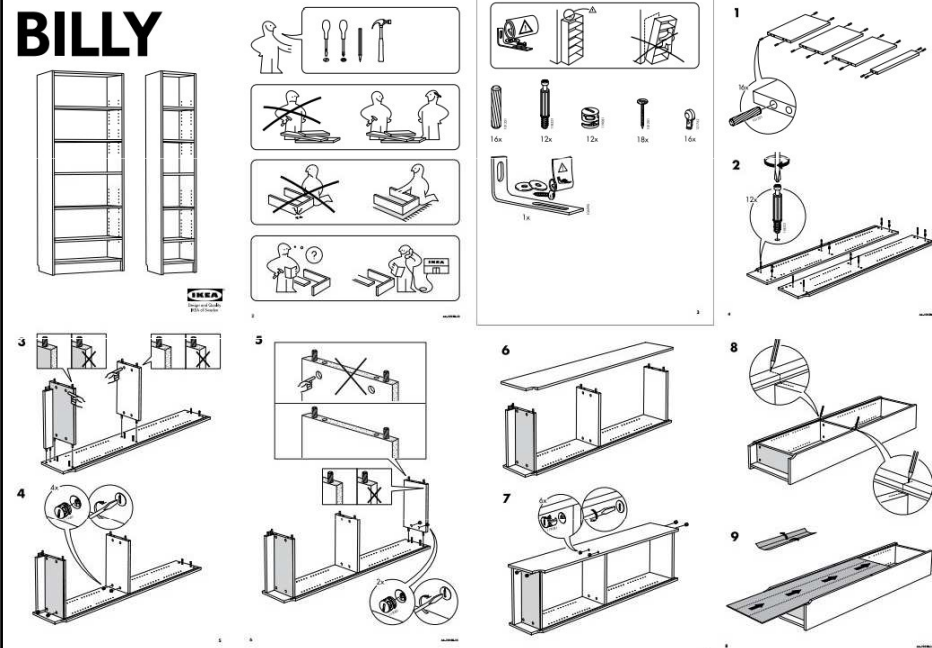
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How to achieve quality?
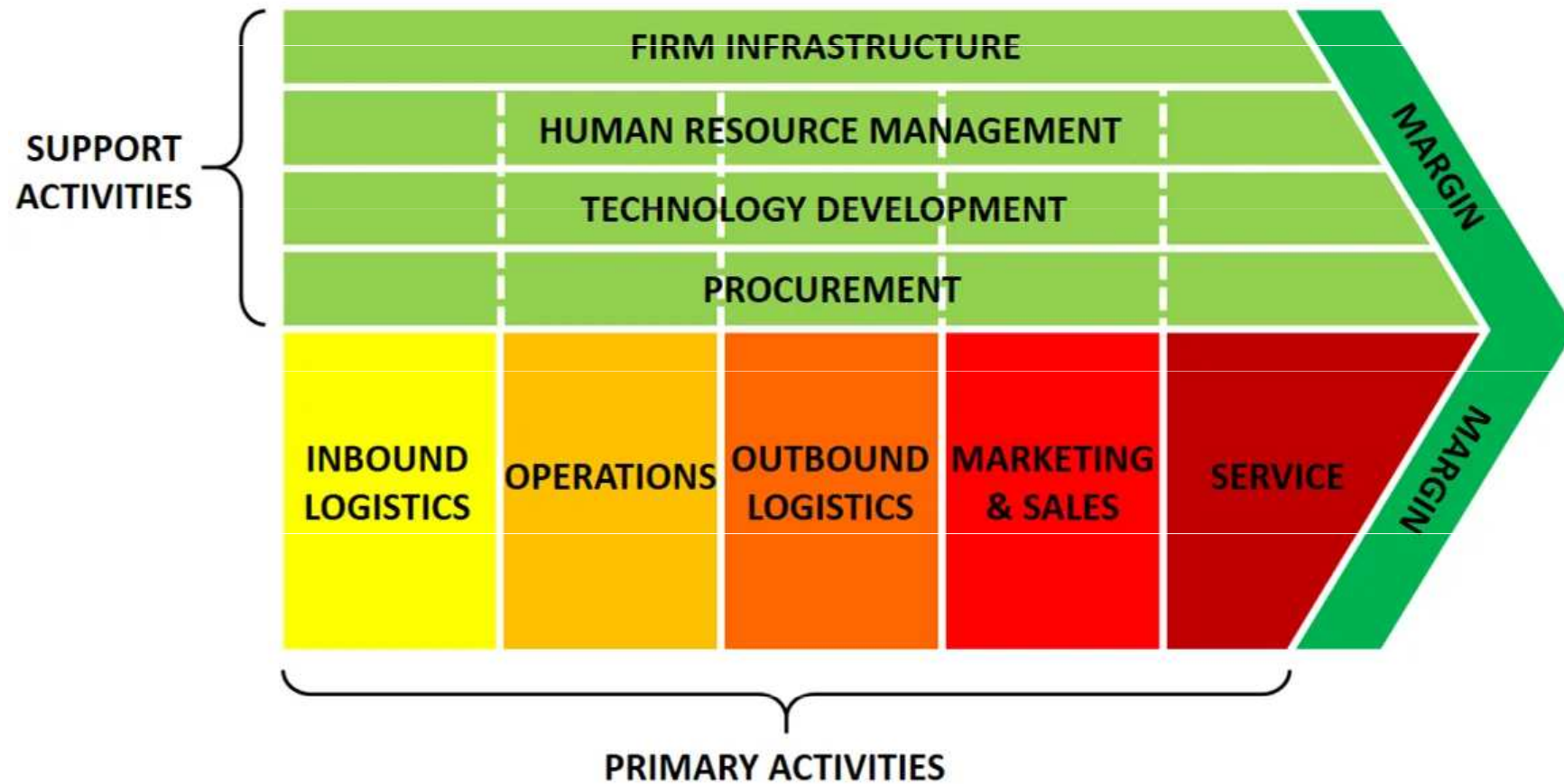
Proces mapping – where?

– BPMN is for business process mapping
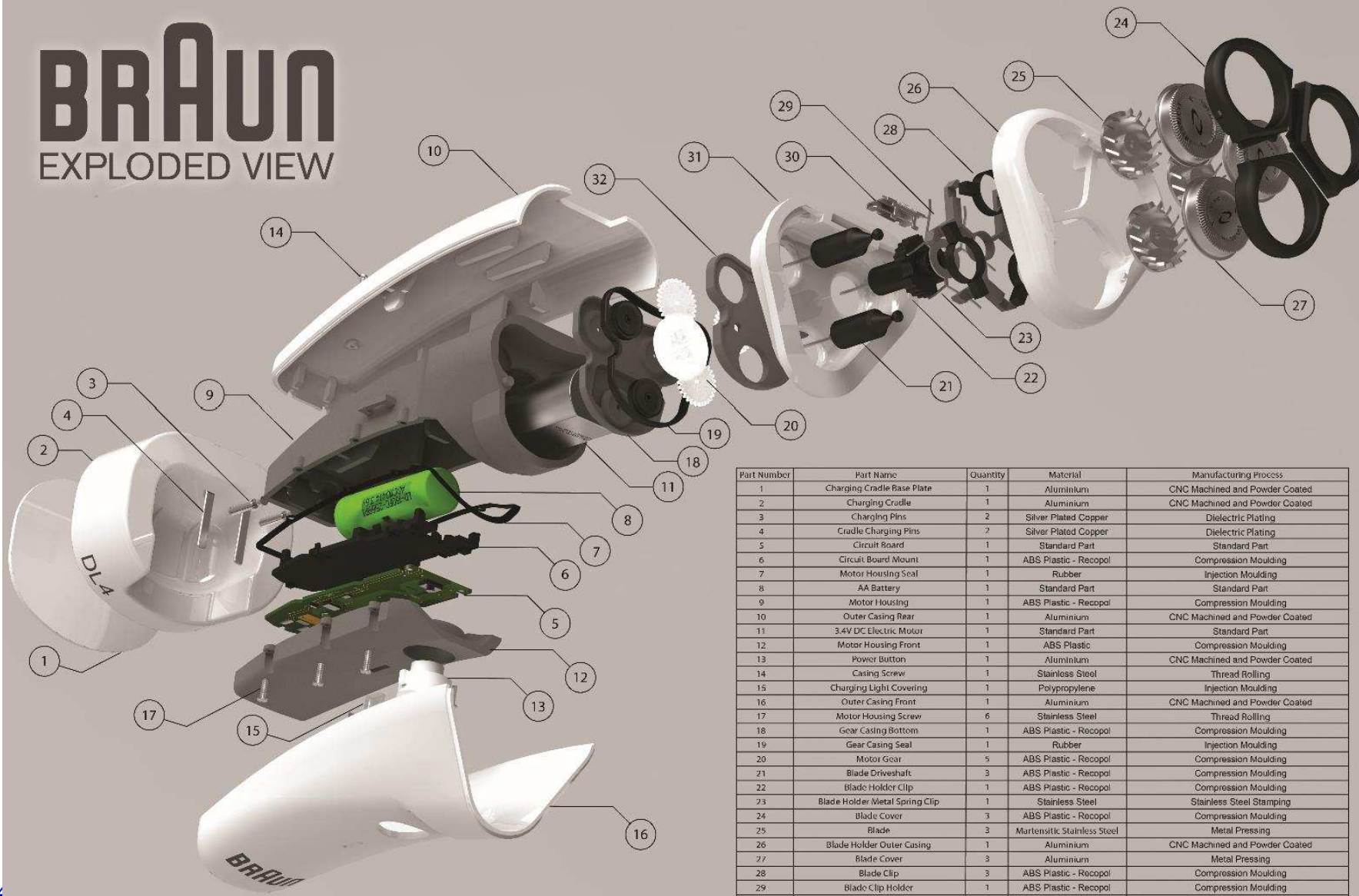– For production, the blue prints are needed…
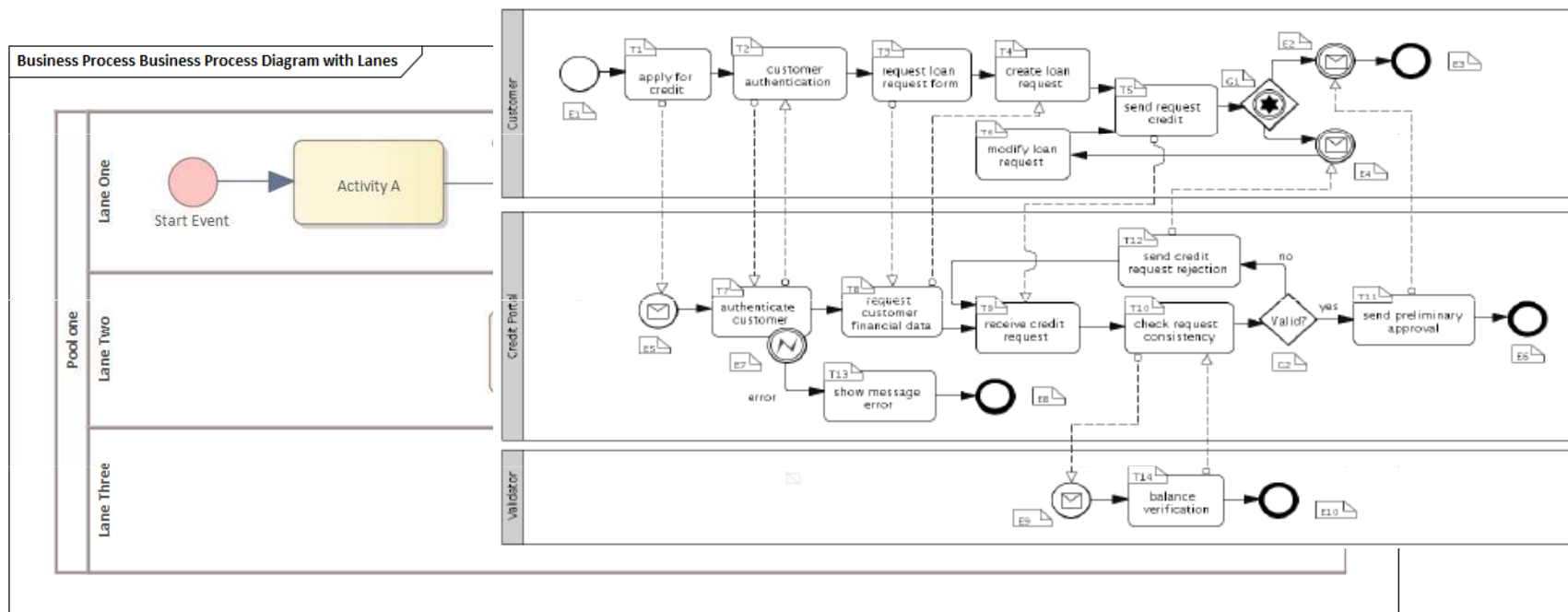
Bill of material

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

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

34

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Power graph / Lorenz curve – What?
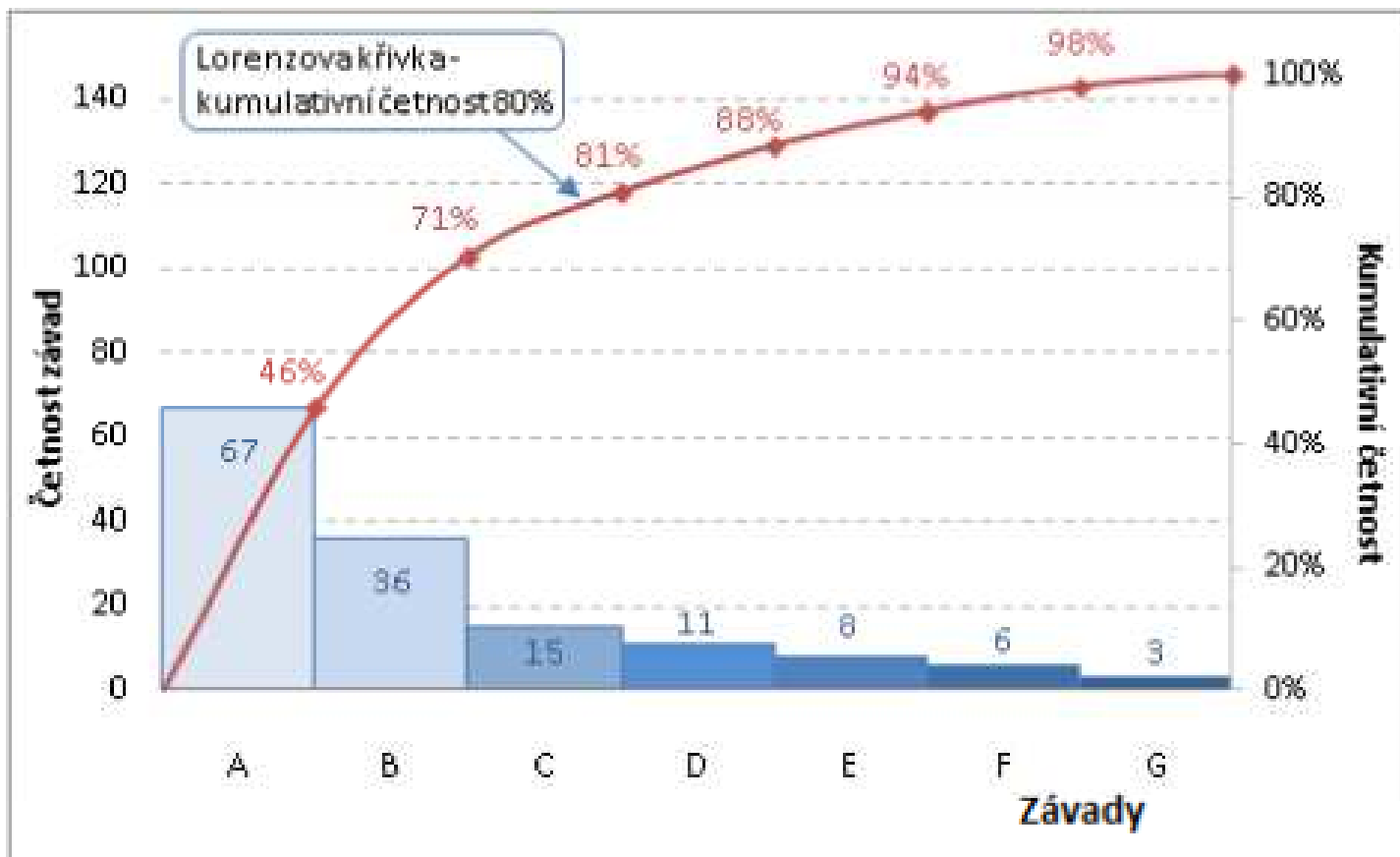
Process quality measurement

– PPM

– 6 Sigma

– HACCP Thresholds

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Root cause diagram / Ishikawa / Fishbone – Why?
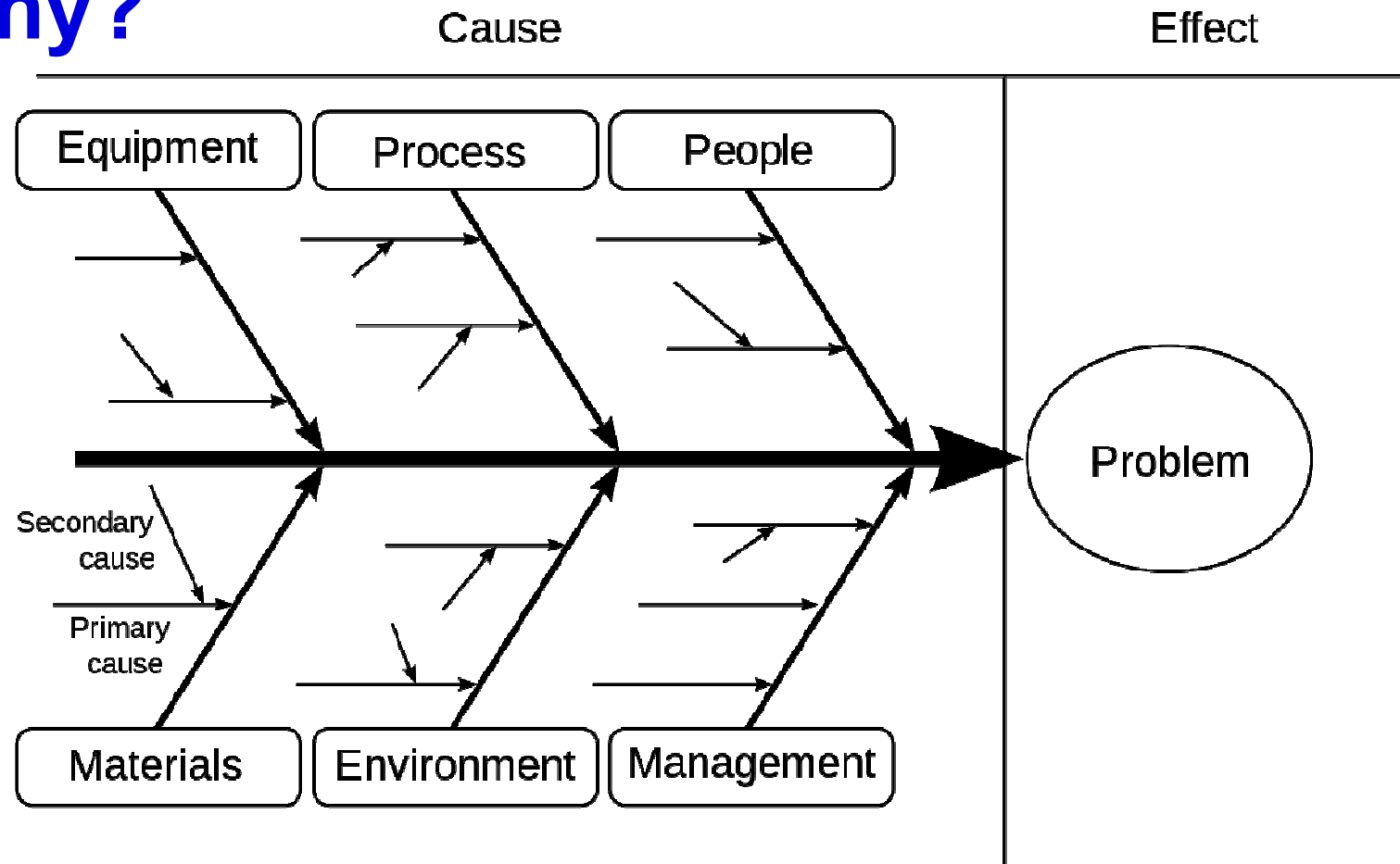
Lean management

Lean manufacturing
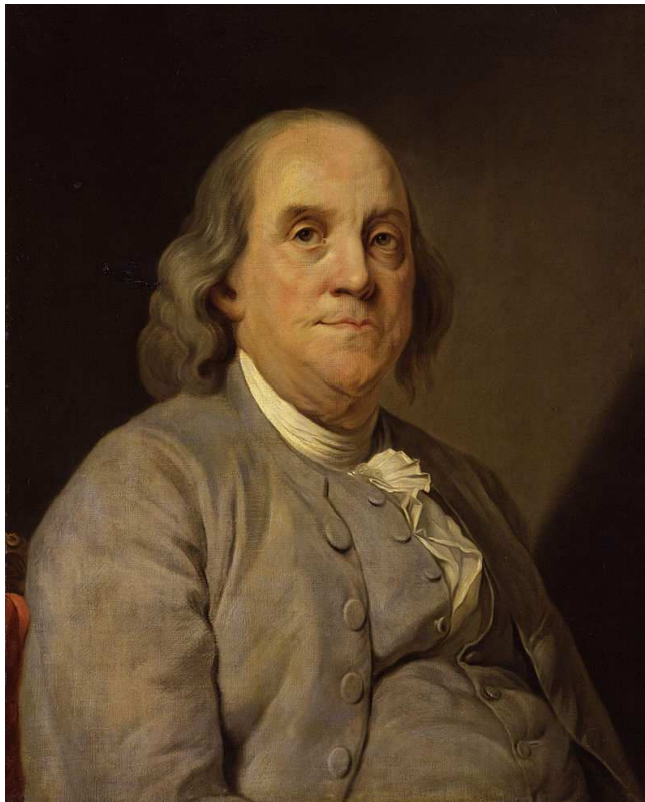
Tidy workplace

Performance

Numbers game

Performance

– Theory of contraints

– 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
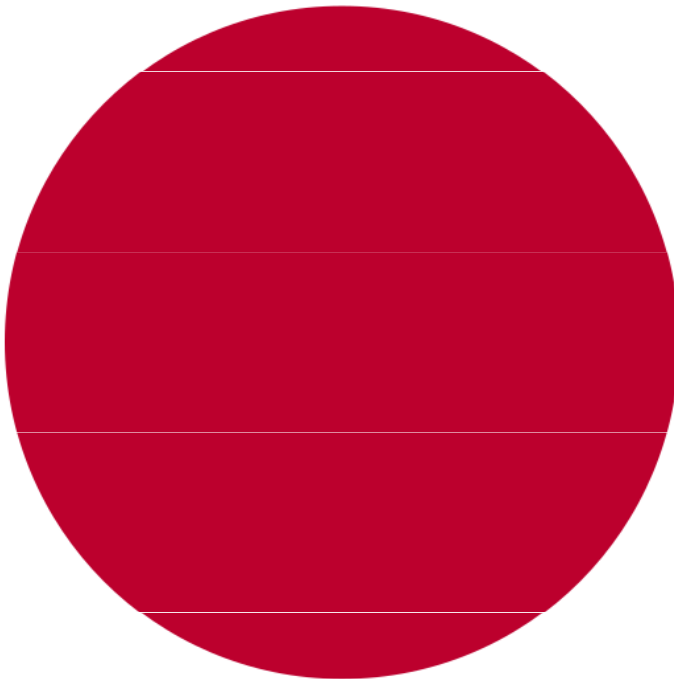
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ECON

Benjamin Franklin (1706 - 1790)

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

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日本国

MUNI
ECON

Waste

MUDA
– Waste…
MURA
– Imbalance, unevenness…
MURI
– Inadequacy…
(MUCHI ignorance (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.
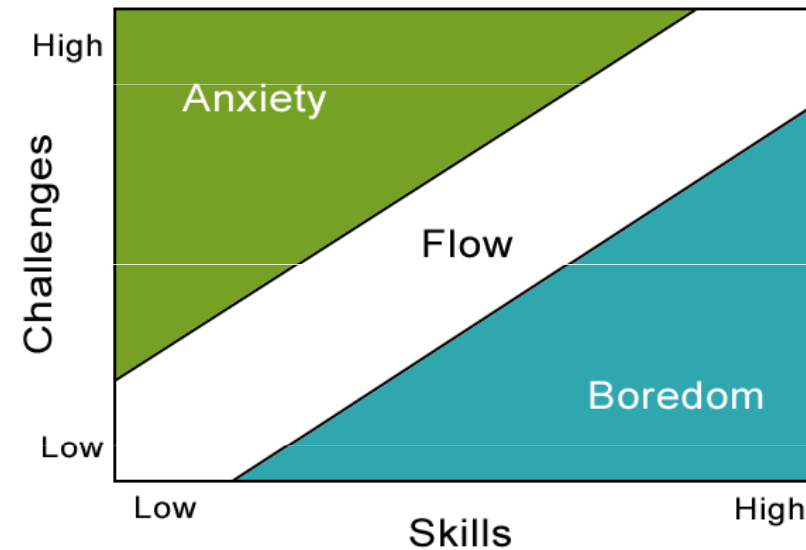
MURI

People
- Work taking too long
- Lifting heavy objects
- Improper posture or insufficient ergonomics
- Noise
- Too demanding tasks
- Tasks too easy (can be boring or mentally tiring)
- Excessive stress
- Anything that leads to burnout, exhaustion, or repeated injury
- Lack of training Humiliation (possibly excessive praise)

Organization
- We want the supplier to deliver what we want, whenever we want, without any signal from us that we want it
- Abuse of market power vis - à - vis suppliers or customers

Machines and materials
- Driving the performance of machines and tools to the maximum limits of their capabilities, which leads to greater wear
- Skip maintenance (try to skip it, machines will definitely not like it)
- Improper handling of materials, storage of parts in unsuitable conditions
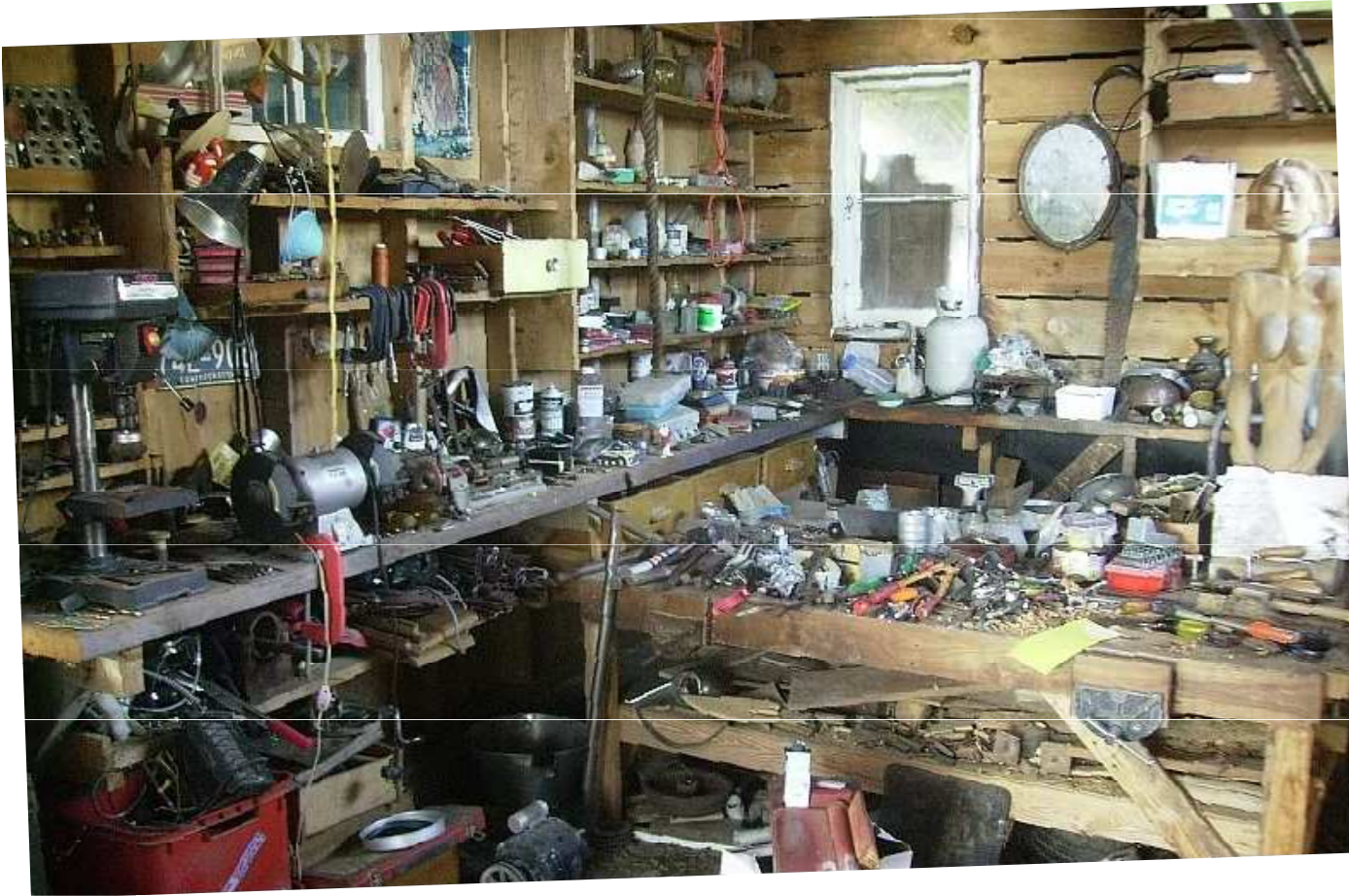- Loading a truck or container beyond its weight limits
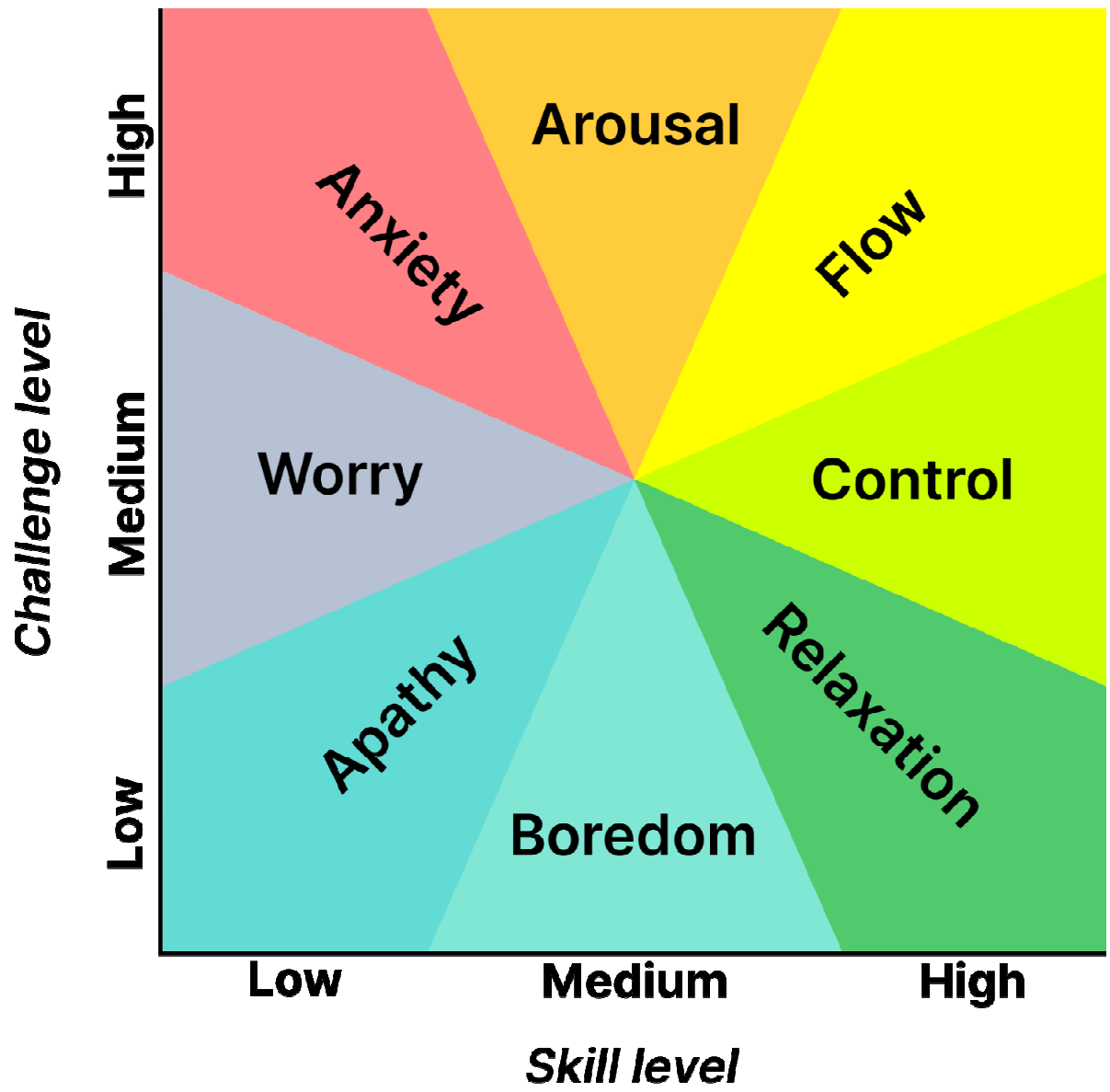
Muri = overburdened

Mura = unevenness, fluctuation, variation
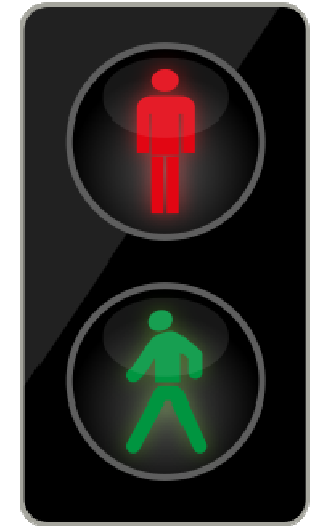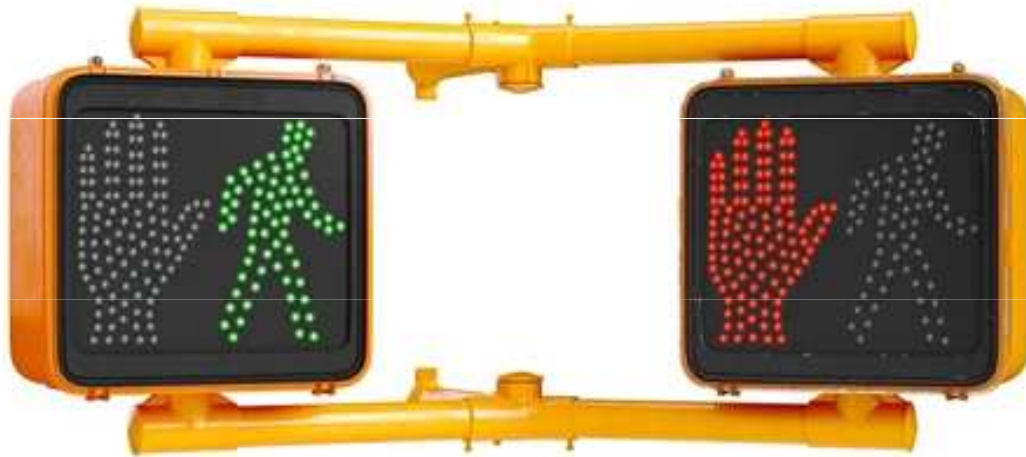
Muda = waste

No Muri, Mura, or Muda
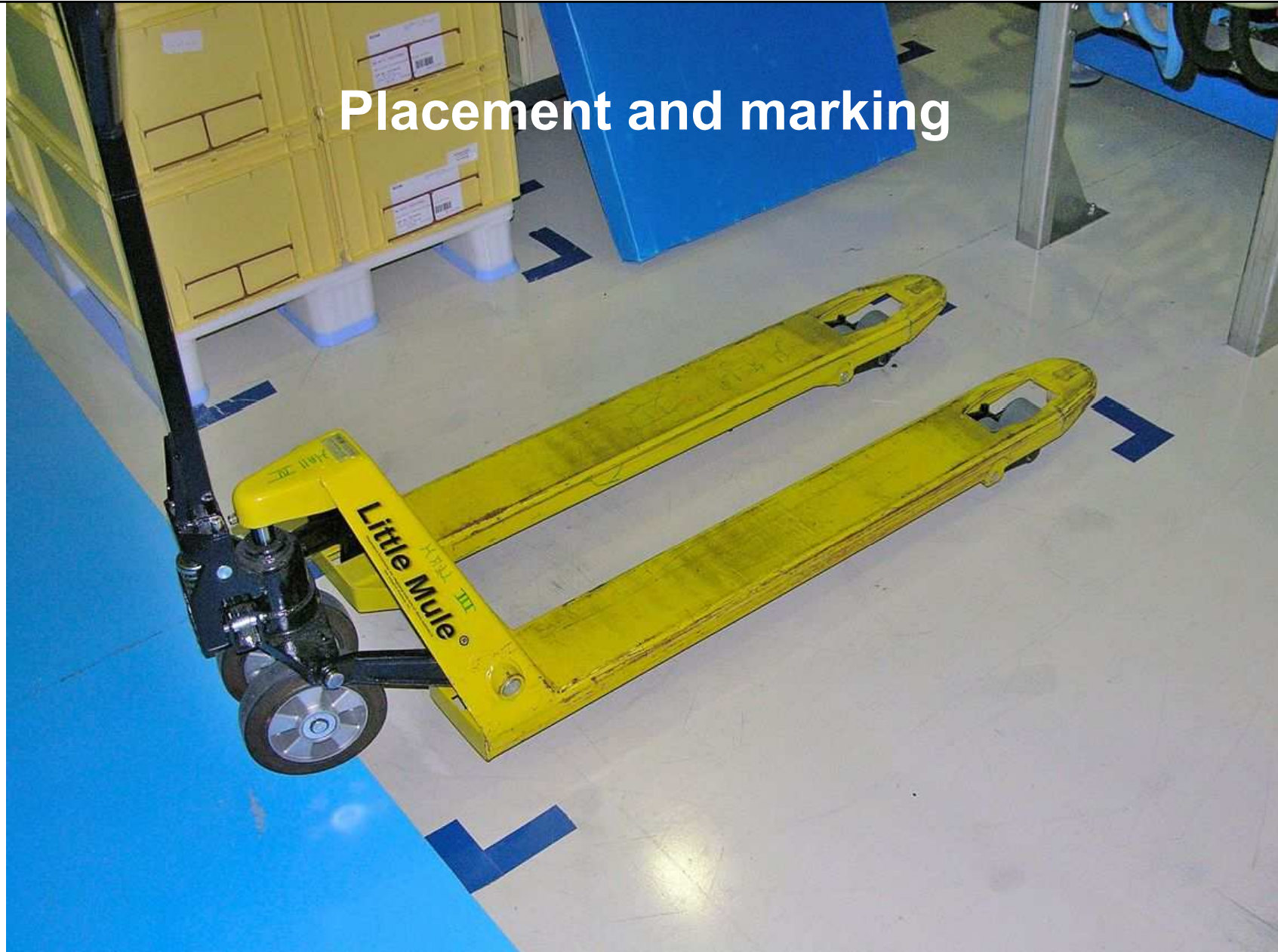
Praxis – visual managem ent

Your experience with visual management?

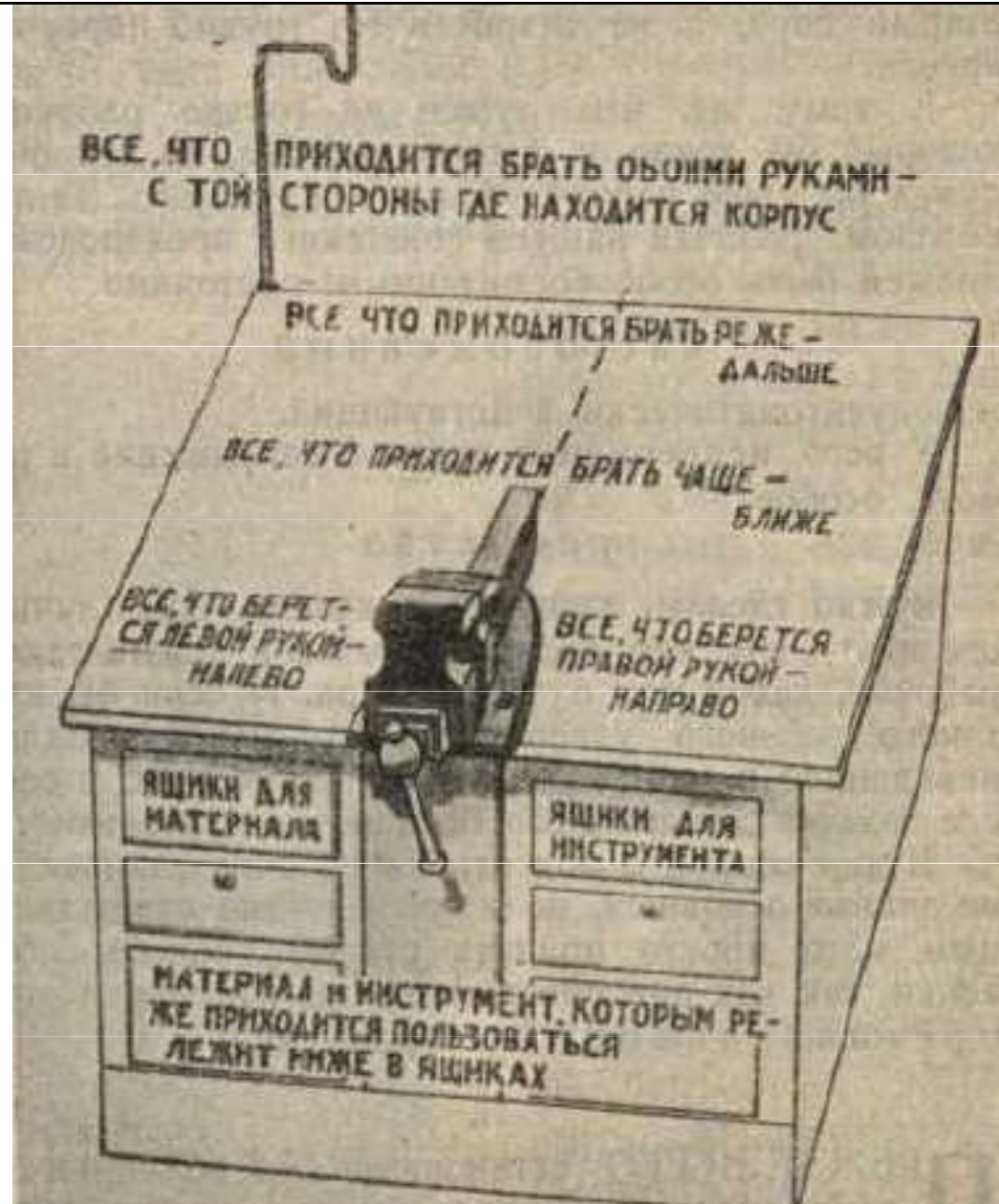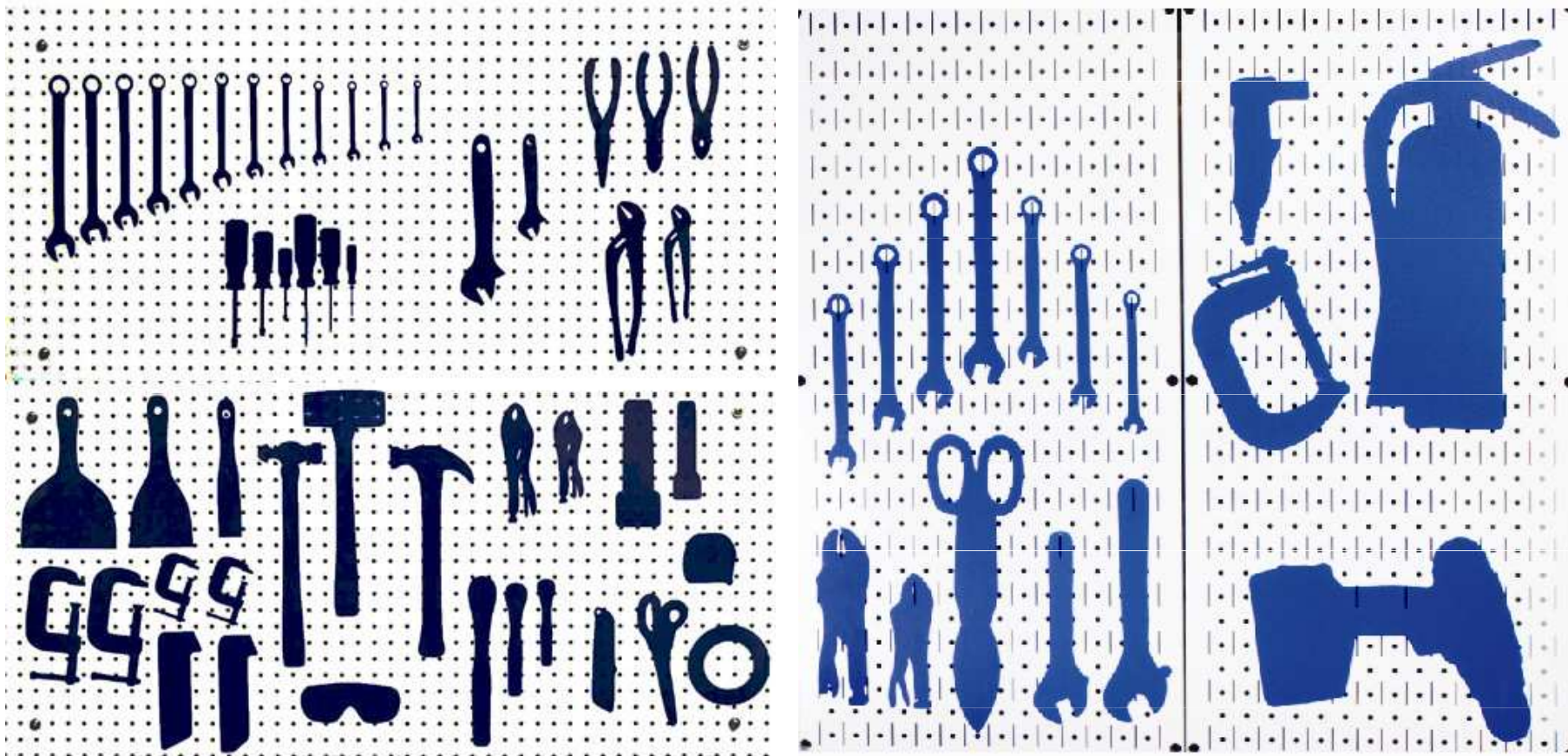– Do you have any?

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Better or not?

Placement and marking

Job placement history

Shadow map

Tool placement

5S

- *Seiri - Divide - Go through and check the workplace and sort out unnecessary items.*
- *Seiton - Sort - Designation of items used in manufacture by a reasonable number or name.*
- *Seiso - Arrange - The logical arrangement of the items used in production as they follow in the sequential production process.*
- *Seiketsu - Document - Document and standardize all procedures.*
- *Shitsuke - Follow - Systematize and follow identified procedures and plans.*

LM (5S), TOC Summary

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5S
Number game

•This sheet represents our current work place.

•Your job during a 20 second shift, is to strike out the numbers 1 to 49 in correct sequence.   Example: 1 2 3

•Give the sheets out face down time from turning will be watched.

•Each team will tell score.

END

MUNI
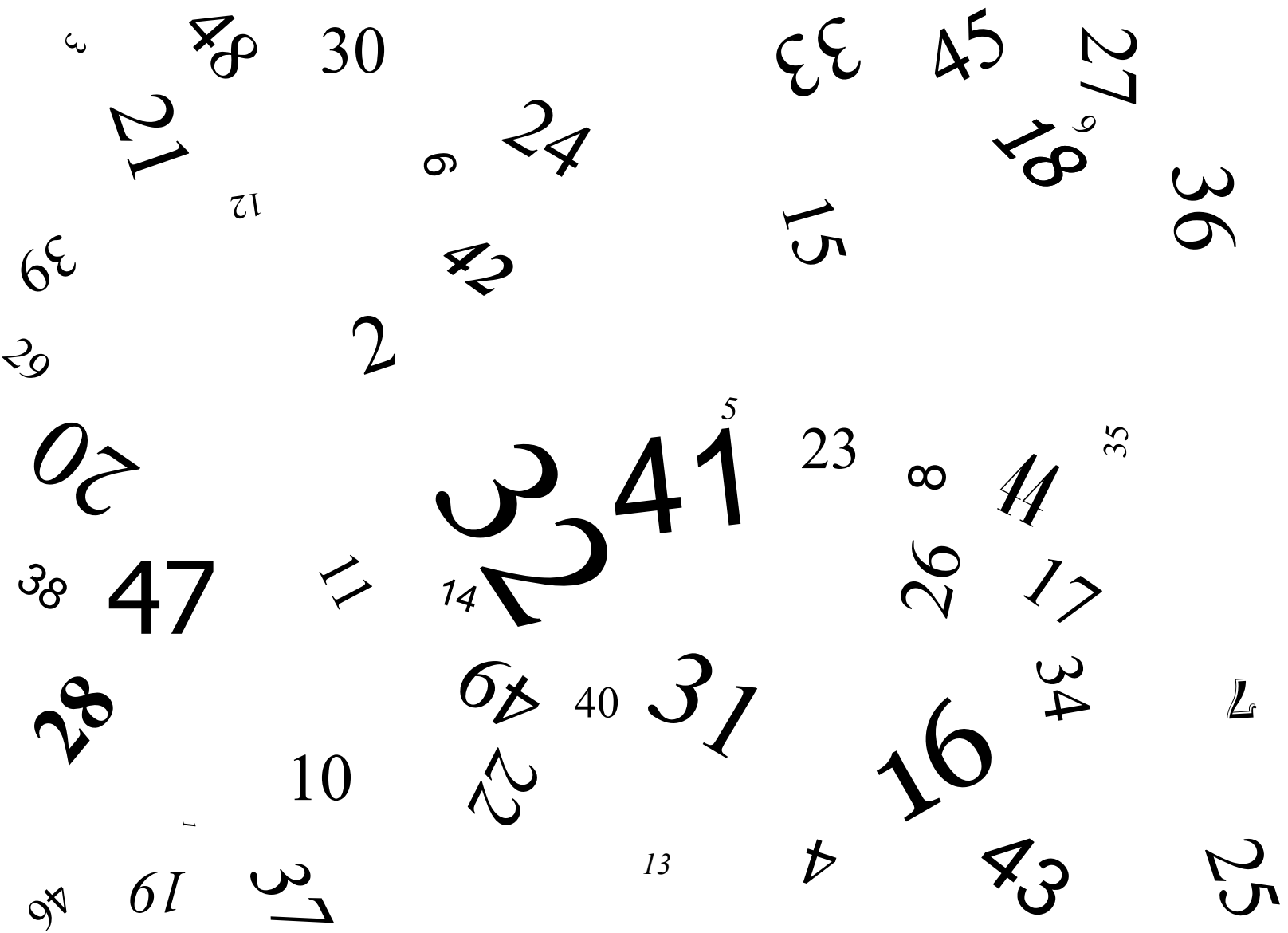ECON

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- For our first action, we are going to implement 5S in this area.
- The first step of this is "Sort" and so we have removed from the area all the numbers from 50 to 90 which are not needed.
- Same rule apply. Strike out numbers 1 to 49 in sequence during a 20 second shift.

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END

MUNI
ECON

48 30 3

33 45 27

21 24 6 15 18 36

12

39 42 2

29 20 5 41 23 35 8 44

38 47 11 14 32 26 17

49 40 31 34 7

28 22 16

10 13 4 43

46 19 37 25

- Having achieved some improvement, we now need to move onto the next step "Set In Order".
- We have installed some racking, and we have organized the items so that with Number 1 in the bottom left hand corner, the numbers are located from left to right and bottom to top - examples 1 in the bottom left, 2 in the middle, and 3 in the top left.
- Same rules apply 20 second shift, lowest individual score equals team score etc…

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ECON

END

3 48 30
21
12
24 33
6
15 45 27 18 6 36
39 42

29 2
20 5 23
32 41 35
38 47 14 8
11 26 44 17

28
49 40 31 34 7
10 22 16
46 19 37 13 4 43 25
71

Cost and effect of Innovation/improvement

– Demanding to implement
– Learning curve

Performance /sales

"old order cancellation"

Intro of innovation

Learning, adopting

Time

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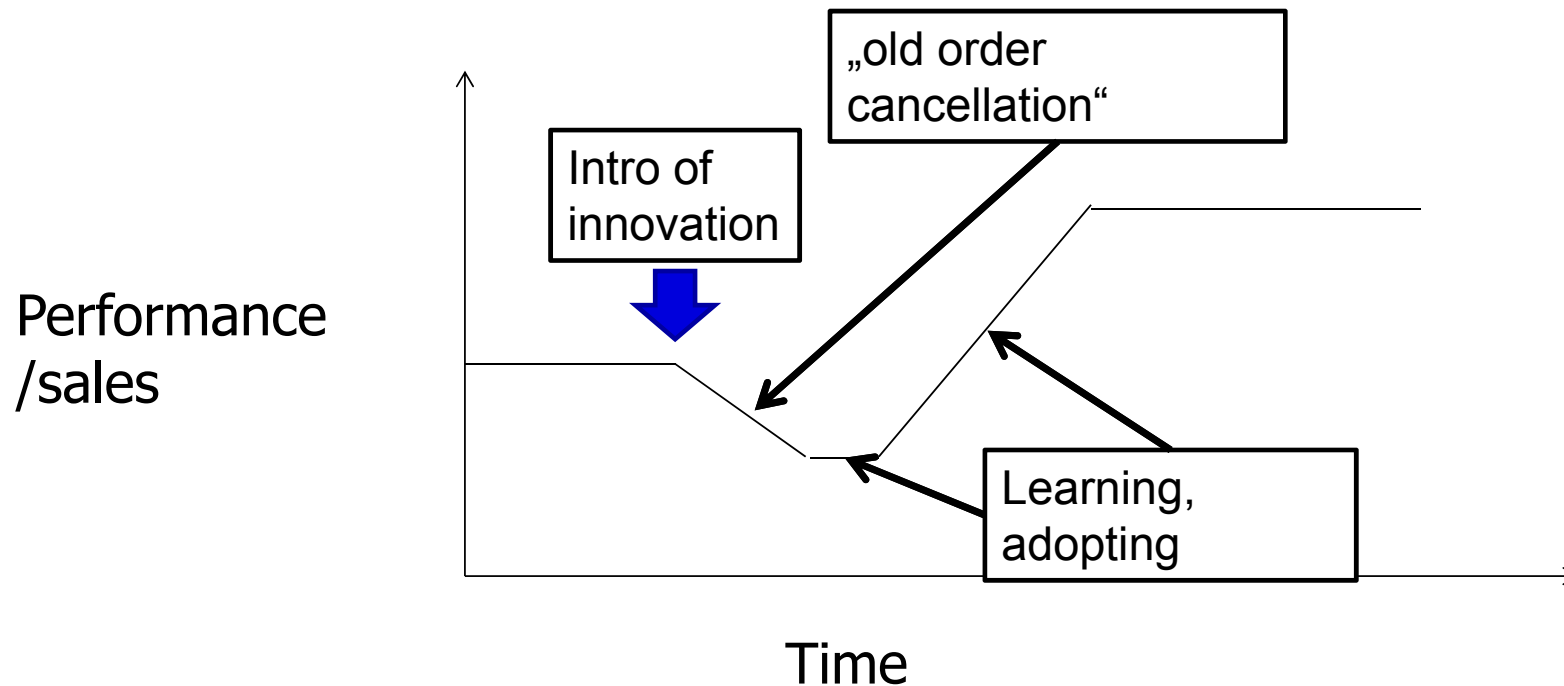
- Having now made a significant step forward, and having ignored "Shine" for this exercise, we must "Standardize".
- Since we are dealing with numbers 1 to 49 in sequence, it seems logical to re-organize them in a standard way that makes the completion of the work task as easy as possible.
- This should ensure that everyone is able to complete the task (and therefore produce a team score of 49.)

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END

Numbers from 1 to 49

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	

- To show respect for Standards it is necessary to make the "management" of the area visual.
- Returning to our original work area, we have for this assignment two numbers missing. We cannot complete the task without these numbers - so first we have to find them.
- Start a clock running and every 20 seconds, tell them how many "shifts" they have been down looking for the appropriate numbers.

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END OF THE YEAR

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- Now, how much easier is it to find the quality problems after 5S principles usage?

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Numbers from 1 to 49

1	2	3	4		6	7	8	9	10
11	12	13	14	15	16		18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	
41	42	43	44	45	46	47	48	49	

END OF THE YEAR