Value Stream Mapping

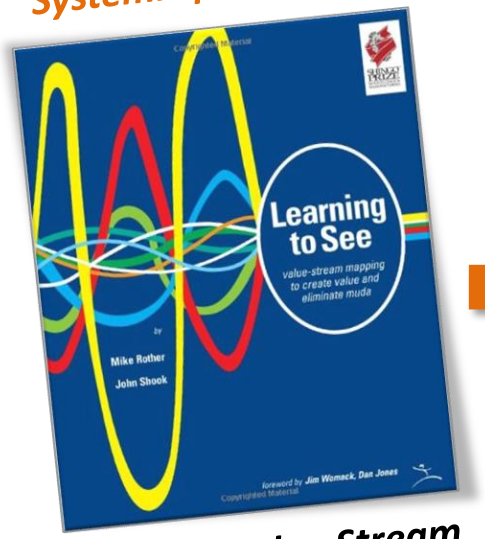
A Holistic Method for Deploying Challenging Target Conditions that our Teams can strive for using the Improvement and Coaching Kata

Why do we need Value Stream Mapping?

How do we use VSM to deploy challenging Target Conditions?

Kata requires Value Stream Mapping in order to make sure our Target Conditions are aligned from the very beginning

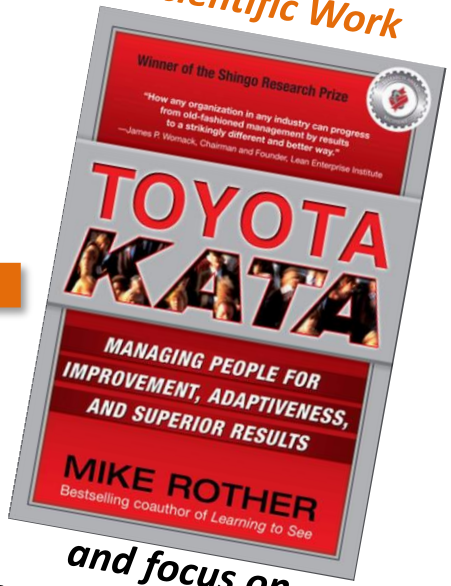
Systemic perspective



through Value Stream Mapping

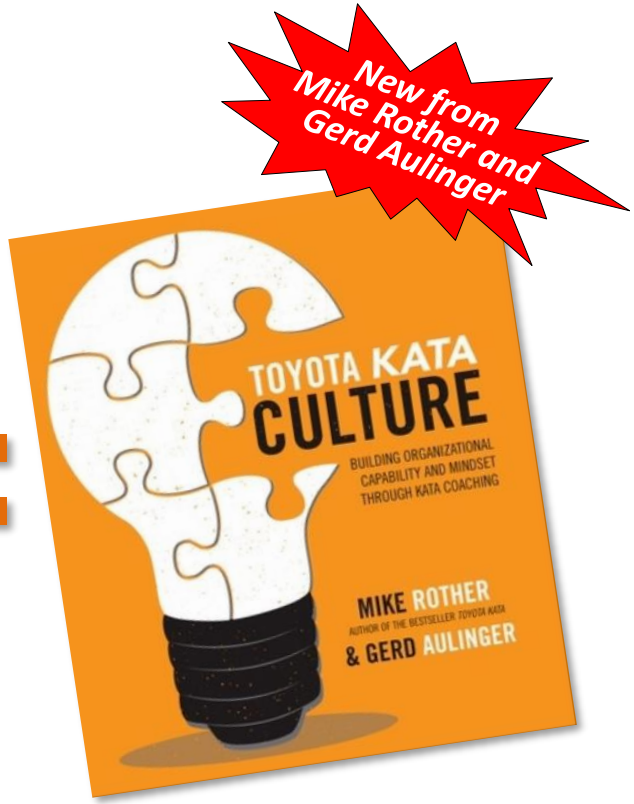
+

Scientific Work



and focus on overcoming Obstacles!

=



Three stages of progress in the development of a scientific improvement organization with Toyota Kata

1. „What *could* be improved?“ results in…

Measure	Who?	By when?	Status
a- Floor markings	Mr. Müller	8.07.2009	⊕
b- Move machine	Mrs. Heine	1.09.2009	⊕
c- Improve tooling	Mr. Wagner	12.09.2009	⊕

Hmmm ... on this measures list there are no *expected numerical outcomes*! So, all I can measure is the *implementation* of each measure

How could I know whether the *expected results* have been achieved if I have not defined the expected outcome first?

Three stages of progress in the development of a scientific improvement organization with Toyota Kata

1. „What *could* be improved?“ results in…

Measure	Who?	By when?	Status
a- Floor markings	Mr. Müller	8.07.2009	⊕
b- Move machine	Mrs. Heine	1.09.2009	⊕
c- Improve tooling	Mr. Wagner	12.09.2009	⊕

Savings: € 7.000

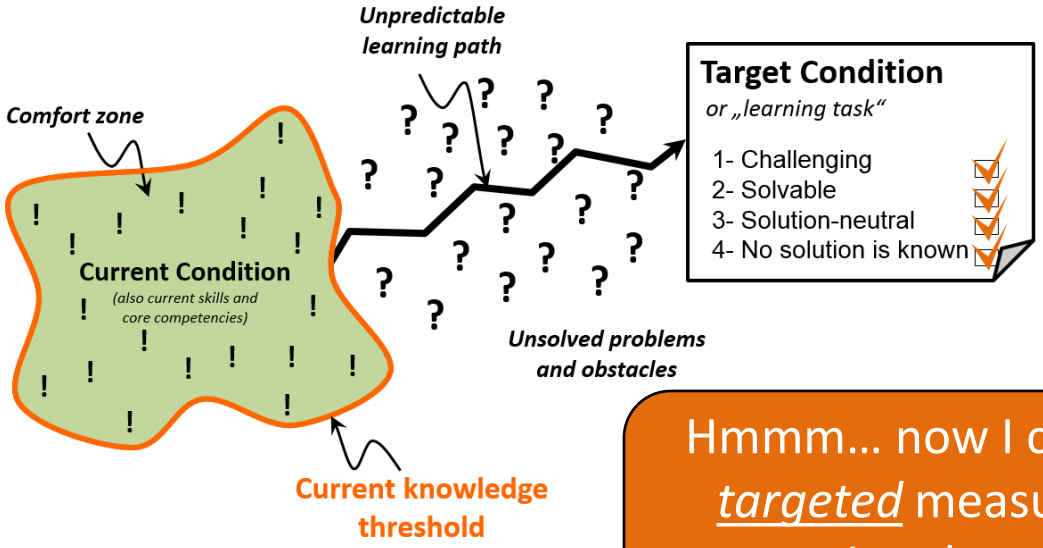
Hehehe! They could have saved € 10.000 if they just would have omitted measure C altogether!

What no one has noticed:
a: € 5.000 saved
b: € 5.000 saved
c: € 3.000 extra costs!

Three stages of progress in the development of a scientific improvement organization with Toyota Kata

2. „What *should* be improved?“ results in…

Definition of measurable **Target Conditions**

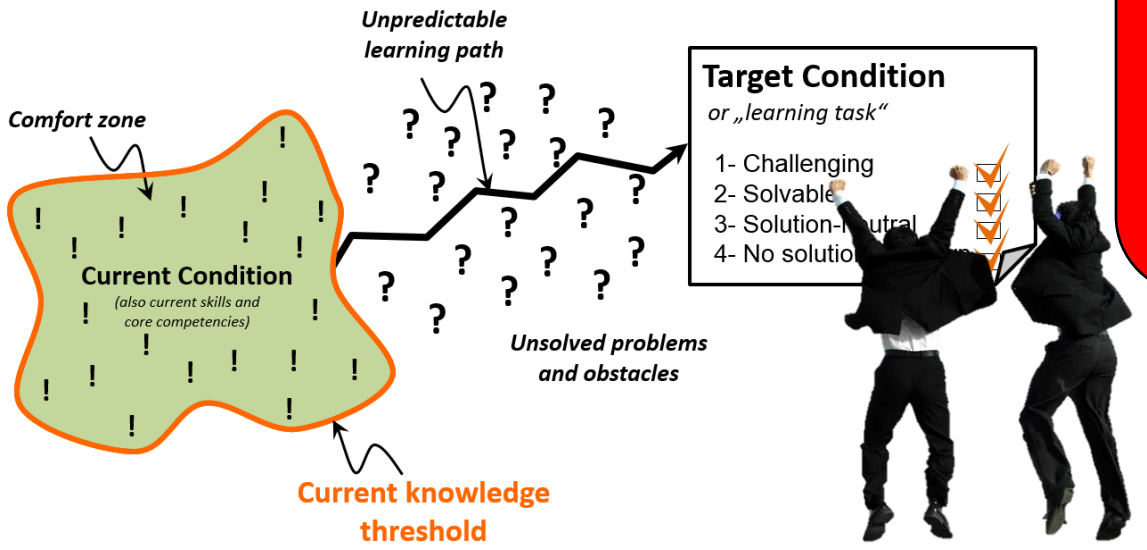


Hmmm… now I can derive *targeted* measures and examine the *expected impact* individually !

Three stages of progress in the development of a scientific improvement organization with Toyota Kata

2. „What *should* be improved?“ results in…

Definition of measurable **Target Conditions**



Hehehe! They might reach their goals, but these are *counterproductive* and ineffective, since they have not been *derived systemically*!

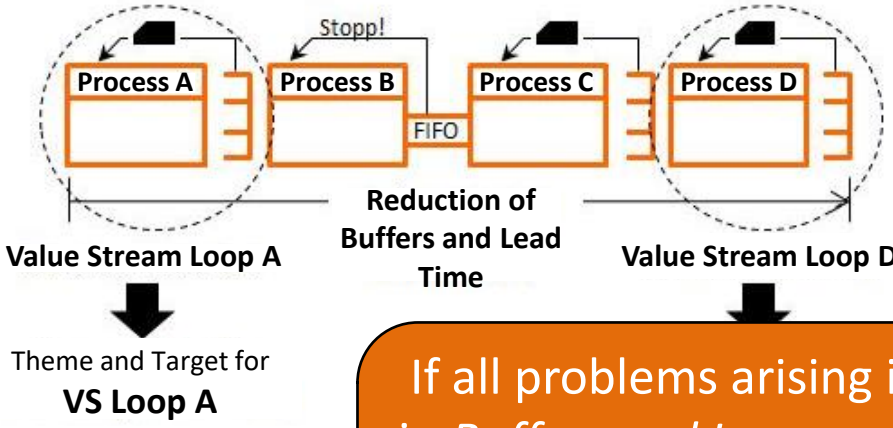
What no one has noticed:

Our ROI-based management system tries to manage complexity by dividing the system in smaller parts and trying to improve them separately. Optimizing each part of a system independently won't lead to the overall optimum. On the contrary, we know from *Systems Theory* that eventually the whole system will get destroyed by doing so!

Three stages of progress in the development of a scientific improvement organization with Toyota Kata

3. „What *should* be improved?“ results in…

Derivation of measurable **Target Conditions**



If all problems arising in a factory result in *Buffers and Increased Lead Time*, then reducing Lead Time should be the overriding activity to improve factories in a *holistic, systemic way*!

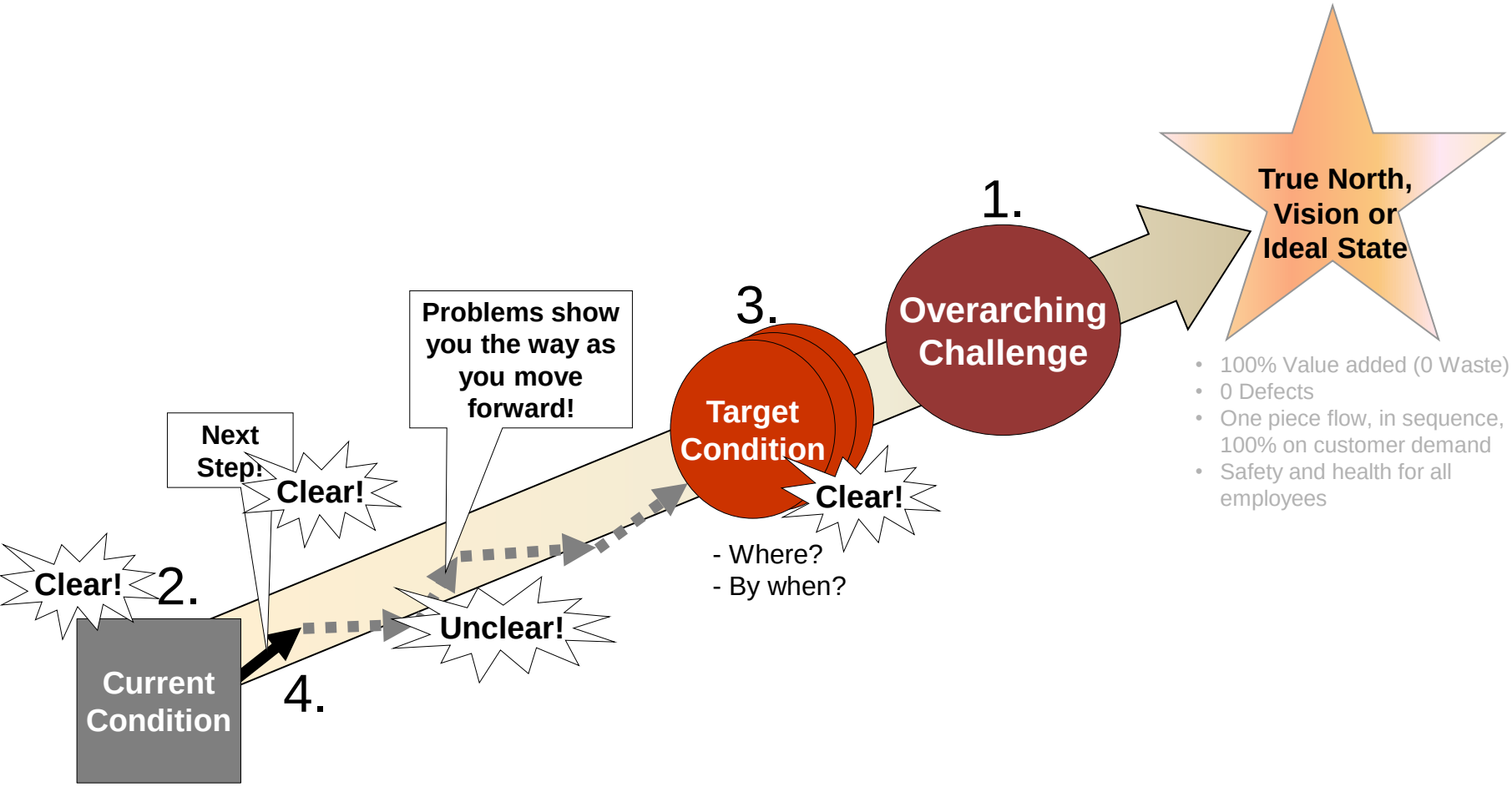
Why do we need Value Stream Mapping?

How do we use VSM to deploy challenging Target Conditions?

Purpose of this course

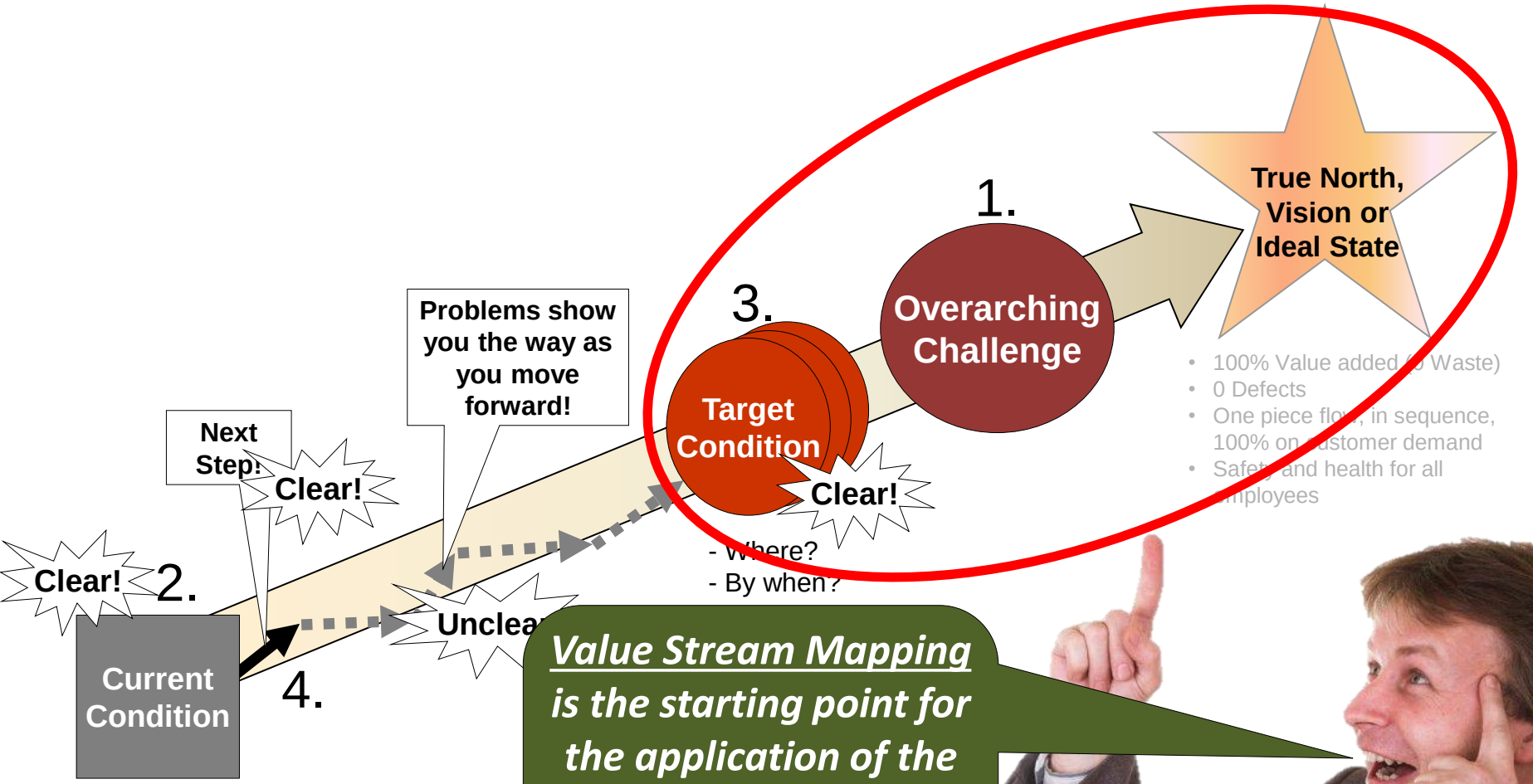
- To develop our ability to see value streams and to design highly efficient, customer-oriented value stream maps.
- To practice the value stream mapping method just using a pencil and a sheet of paper.

Target Conditions should be derived from an overarching Challenge which itself should be derived from a Vision or True North



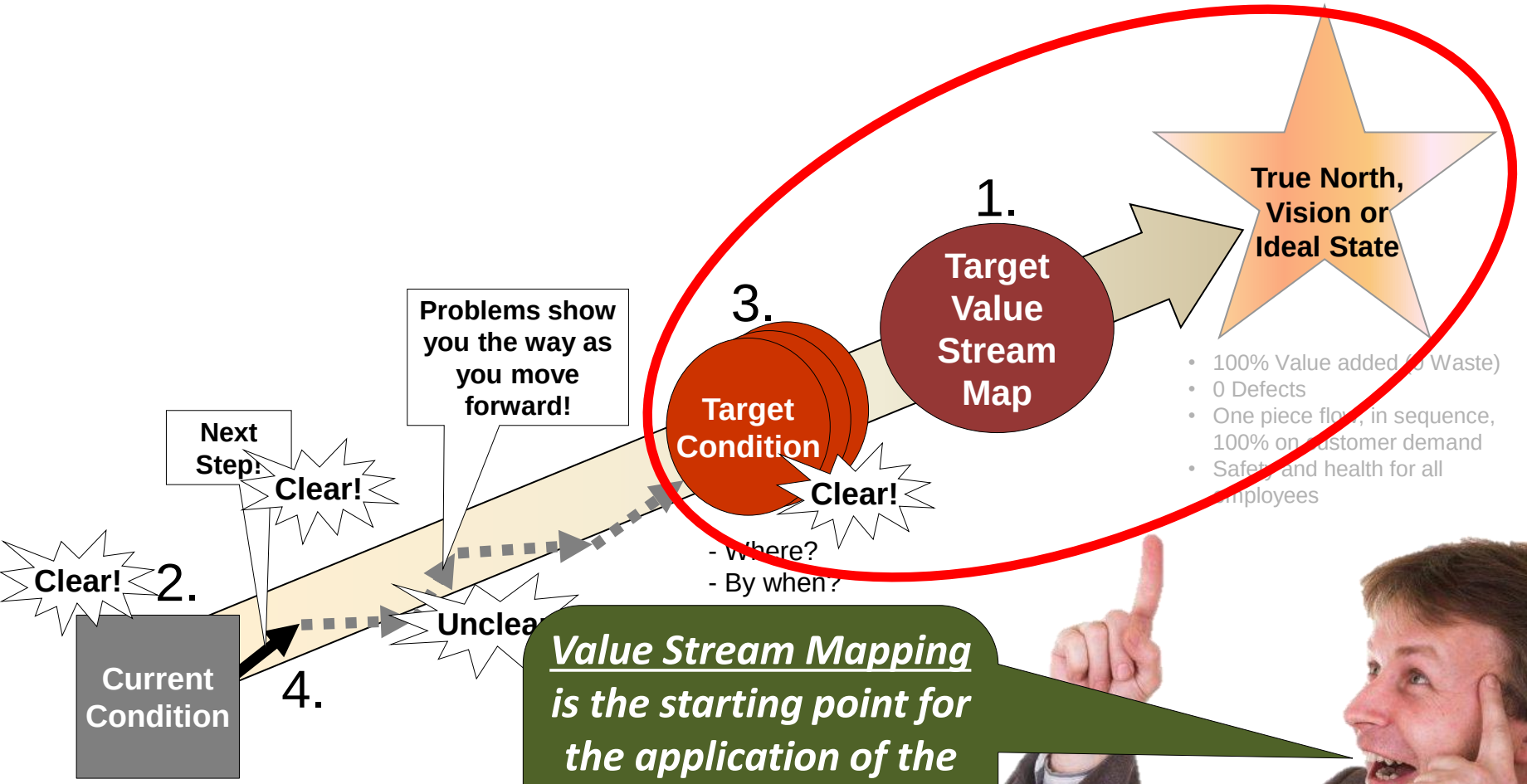
- 100% Value added (0 Waste)
- 0 Defects
- One piece flow, in sequence, 100% on customer demand
- Safety and health for all employees

Value Stream Mapping helps to Align an Organization by giving a shared, overarching challenge derived from the True North



Value Stream Mapping *is the starting point for the application of the Improvement and Coaching* ***Kata as a Team!***

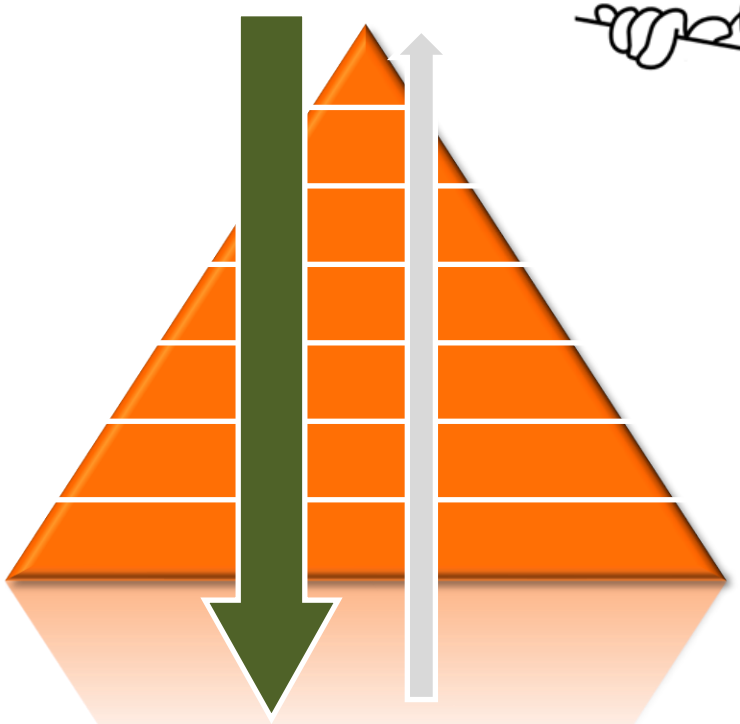
Value Stream Mapping helps to Align an Organization by giving a shared, overarching challenge derived from the True North



Value Stream Mapping *is the starting point for the application of the Improvement and Coaching* ***Kata as a Team!***

All Targets are deployed „Top down“ across hierarchy levels and agreed upon along the Chain of Coaching

1. **Target Deployment**
„Top-Down“
(mathematically linked!)



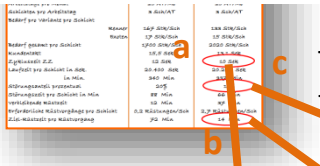
2. **Upward learnings communication**
„Bottom Up“
(mathematically linked!)

Mathematically coherent Target Deployment Process with Target-Forms at all levels

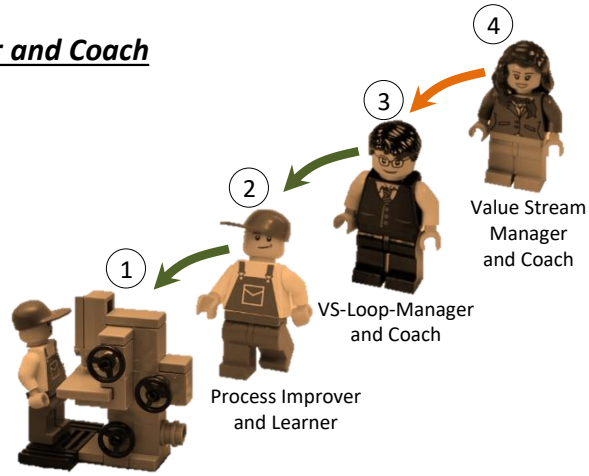
T-Form
④ Value Stream Manager

Target outcome for ***Value Stream Manager and Coach***

9-18 Months into the future

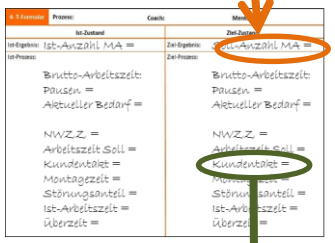


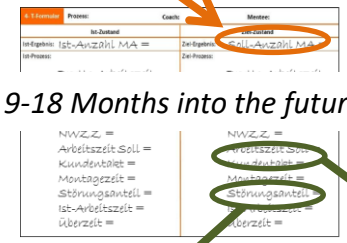
Themes and Process Targets for ***Process Improver***



Mathematical link across all hierarchical levels

T-Forms
③ VS-Loop-Manager

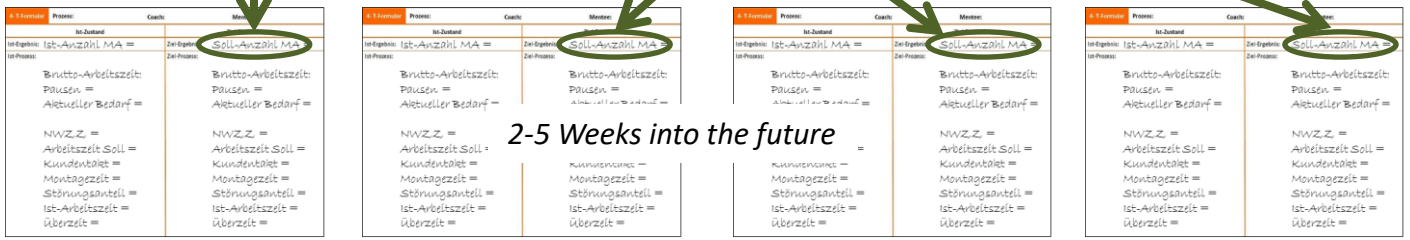




Target outcome of ***VS-Loop-Manager***

9-18 Months into the future

T-Formulare
② Process improver
(and its ① Team)



2-5 Weeks into the future

Example of Target deployment board with four hierarchy levels including Plant-, Value Stream-, VS-Loop- and Process-Targets

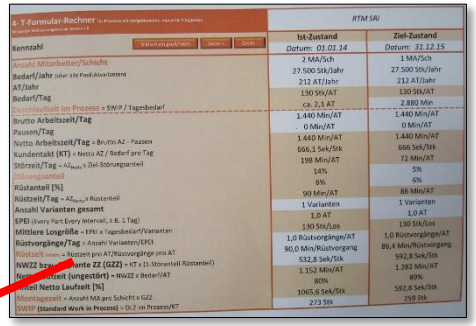
1- Plant Targets
(Costs, Output, Headcount)

2- Value Stream Targets
(Lead times, Buffer stocks)

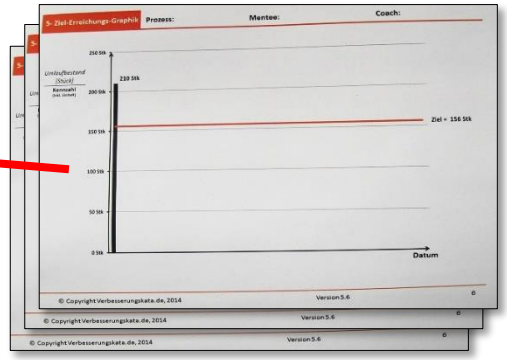
3- VS-Loop Targets
(EPEI, Change over frequency)

4- Process Targets
(C/O times, cycle times, downtimes u.v.m.)

A <u>Target-deployment-board</u> is many meters wide and is used on daily group coachings that take place in a sort of „<u>war room</u>“.
(This board should be adapted over time to your organization‘s needs and improve for better visualisation and usability)



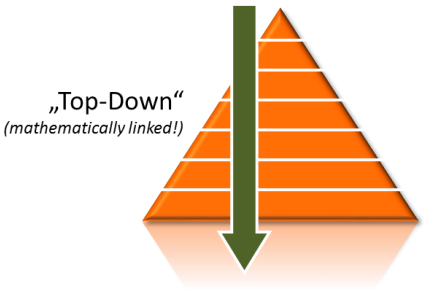
Target sheet,
(1 per VS-Loop) defined using Excel-Target-Condition-Calculator



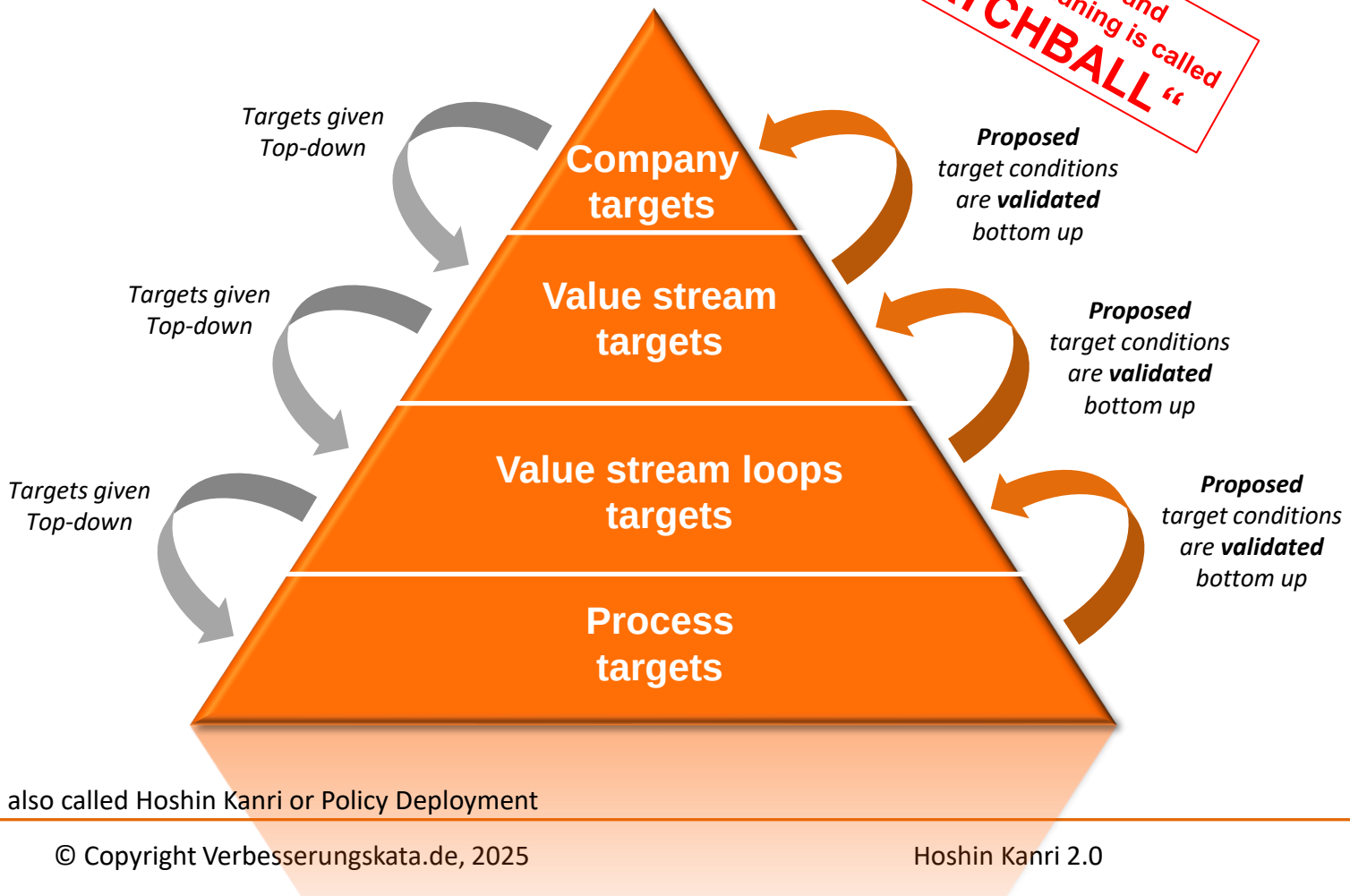
Out of the VS-Loop targets targets at the Process level are defined. A run chart per KPI is hung below and should be filled out on a daily basis.

The Target development process* is iterative: targets are given top-down, but must be validated bottom-up

PLANNING
Target Deployment



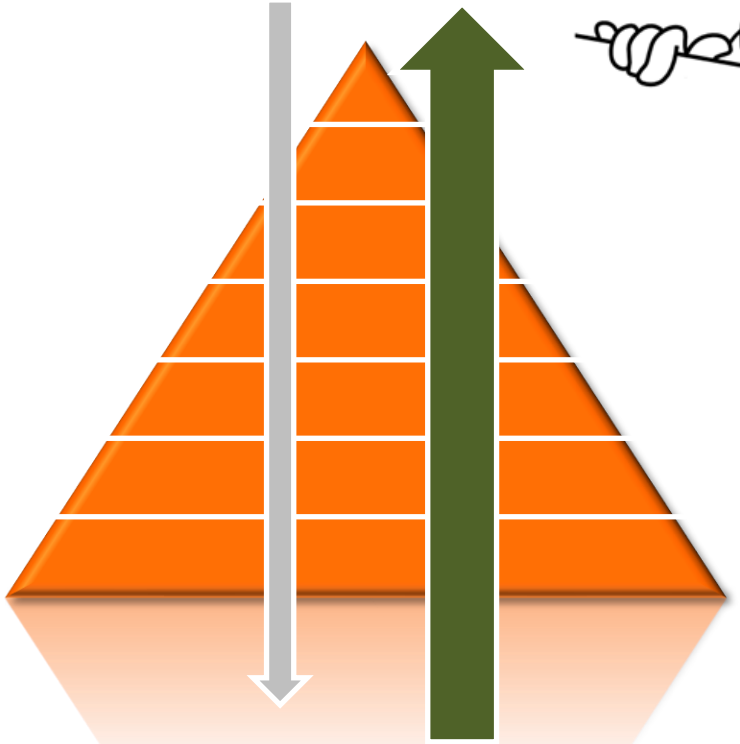
This top-down and bottom-up fine tuning is called „CATCHBALL“



* also called Hoshin Kanri or Policy Deployment

After all targets have been deployed, the „Bottom Up“-Information flow up the Chain of Coaching begins

1. **Target deployment**
„Top-Down“
(mathematically linked!)



2. **Communicating learnings**
„Bottom Up“
(also mathematically linked!)

Kata-Coachings „as an orchestra“ must be synchronised

Coaching dialogues always follow the same Structure…

① Operators in the process

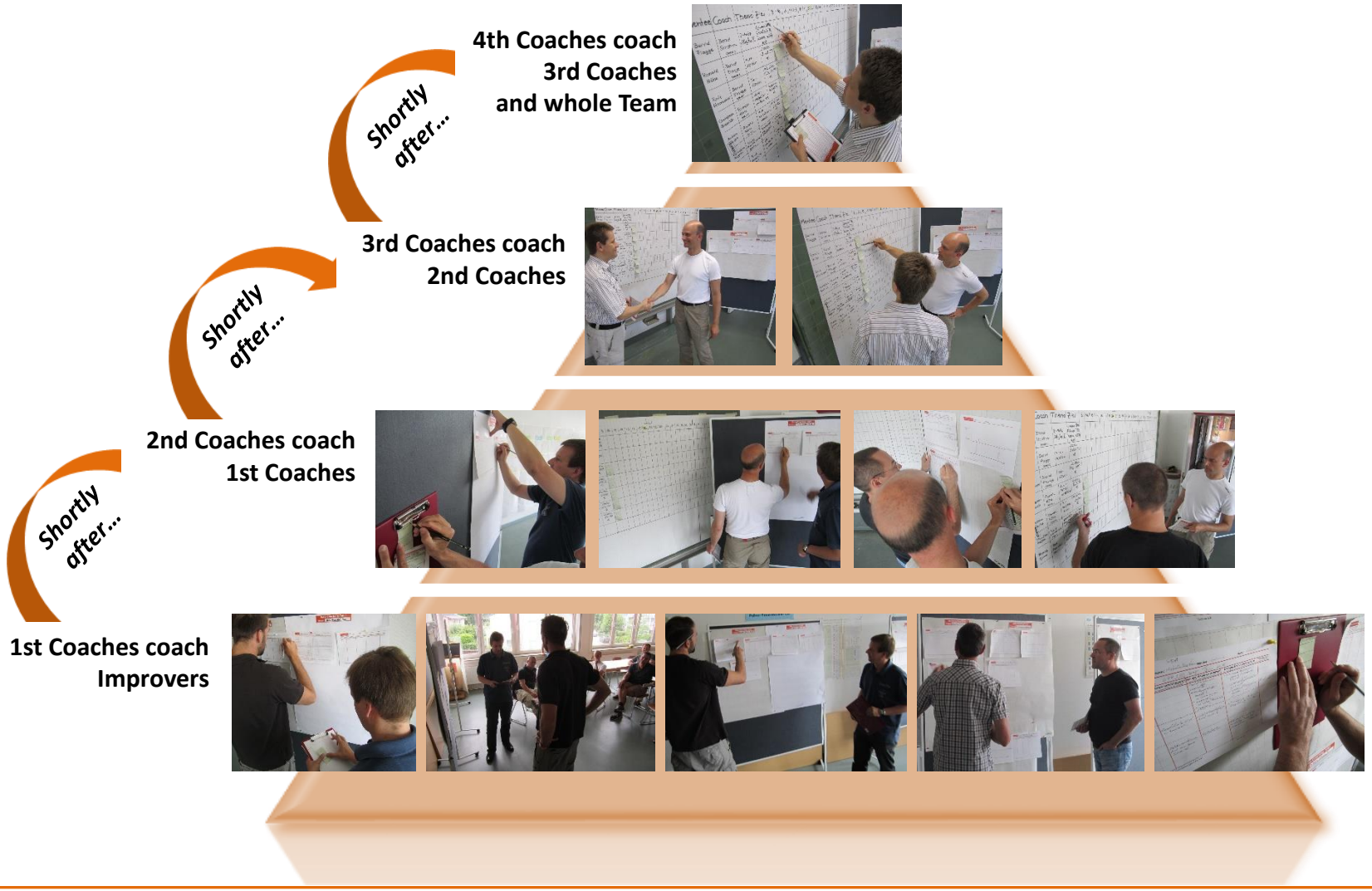
Board with Forms

② Lerner, Hancho or Mentee

③ Coach

④ Second Coach

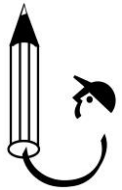
Kata is Fractal and can be expanded to all levels of any hierarchical Organisation

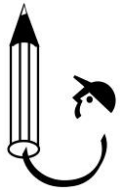


The collective use of Kata sparks a team spirit where all learn and enjoy making their teams even more successful!

Workshop-Agenda

Chapter 1	Introducing Value Stream Mapping
Chapter 2	Drawing a Current State VS Map – *practical exercise* –
Chapter 3	Features of an efficient, customer-oriented Value Stream
Chapter 4	Drawing a Future State VS Map – *practical exercise* –





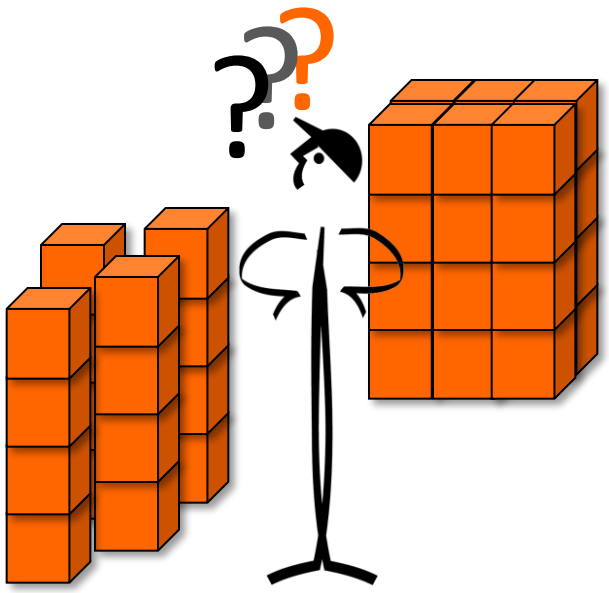
What have we learned after 30 years of continuous improvement ?

Take the value stream perspective !

Management needs to design an efficient, customer-oriented value stream and lead the implementation.

Can you see the Flow?

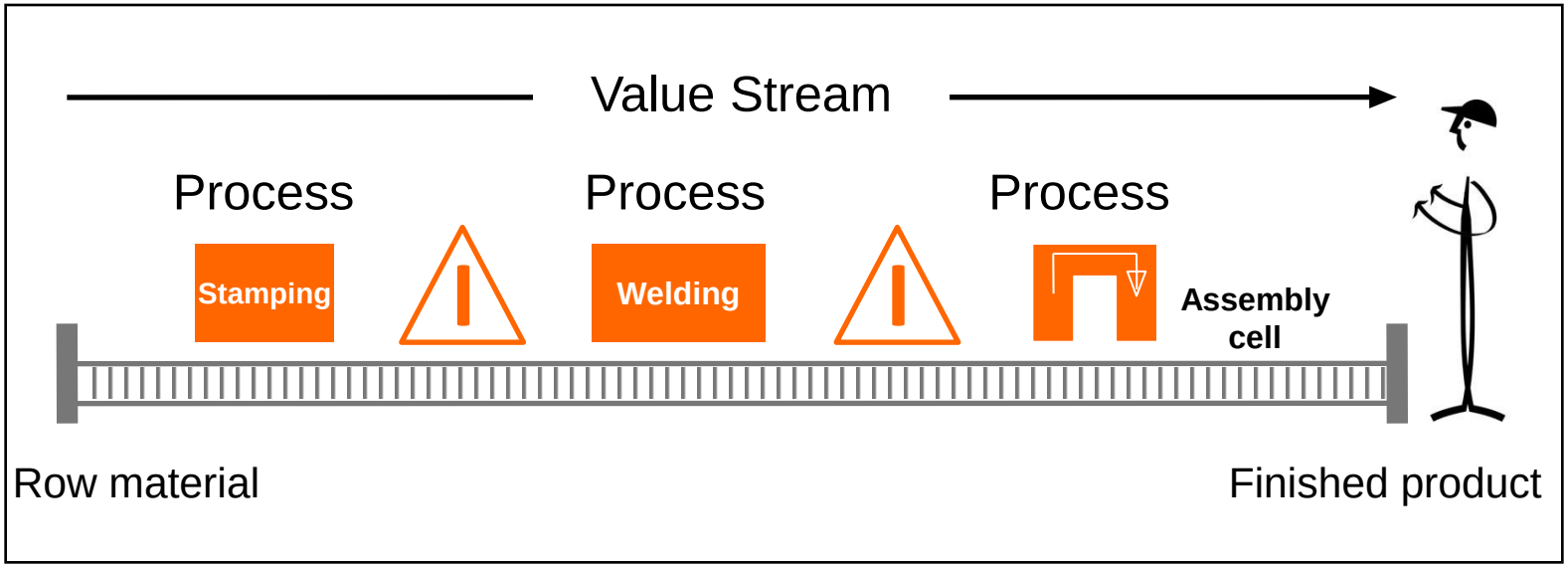
We need an effective way to understand and explain our value stream targets.



Process & Value Stream Improvement

"Process-Kaizen"
"Point-Kaizen"

"Flow-Kaizen"
"Systems-Kaizen"



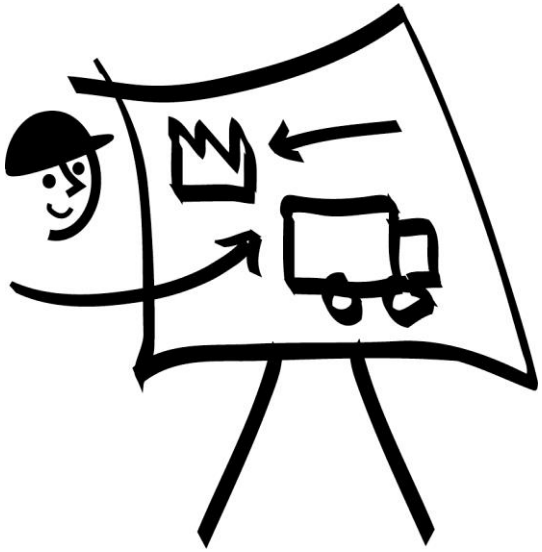
Value Stream =

The flow of all activities (value-added and non-value-added), from raw materials into the hands of the customers which are necessary to produce a product for which the customer is willing to pay.

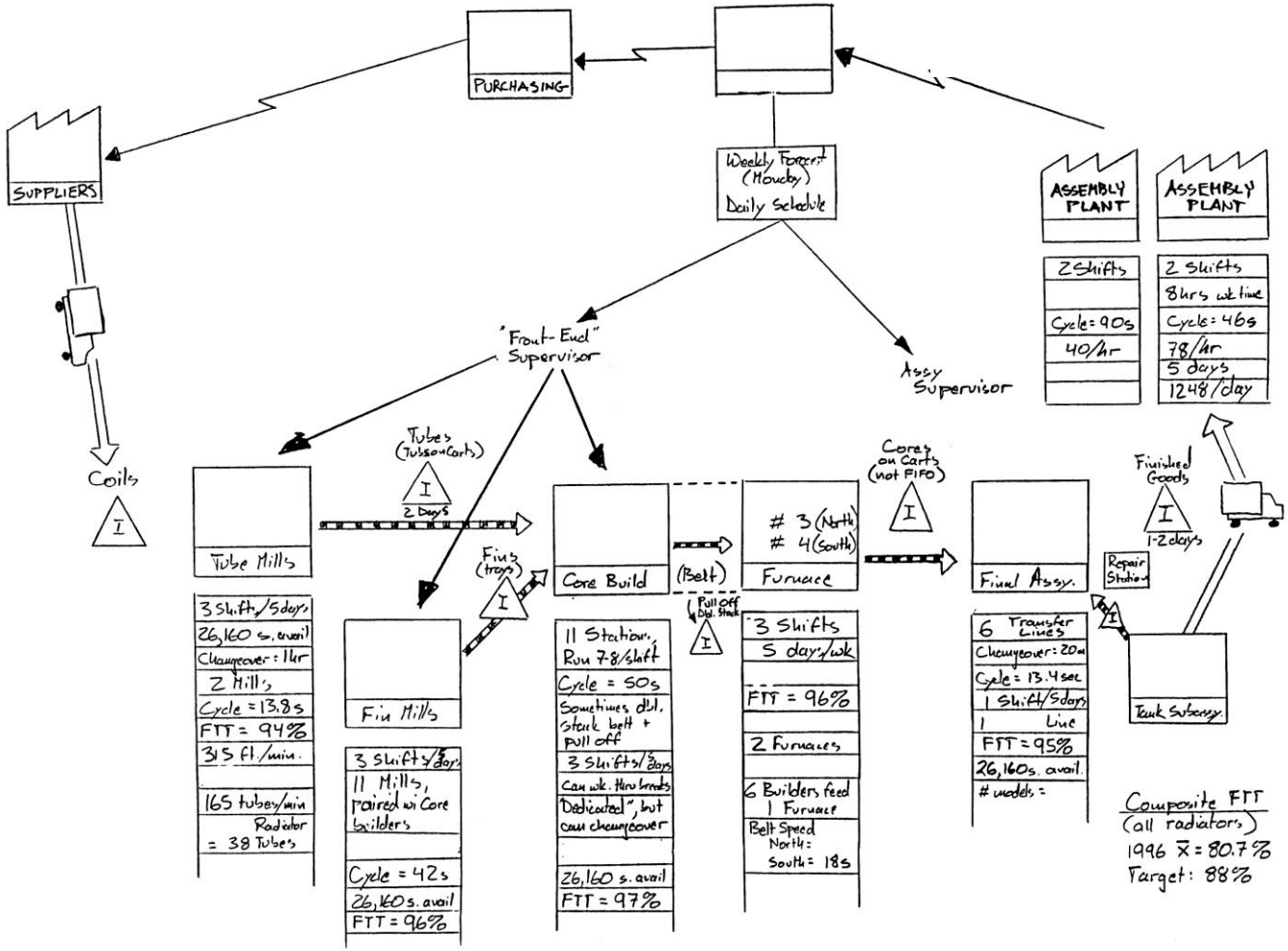
A helpful step: Value Stream Mapping

Trace the path of a product from beginning to end and draw a visual representation of all processes necessary to keep your material and information flowing.

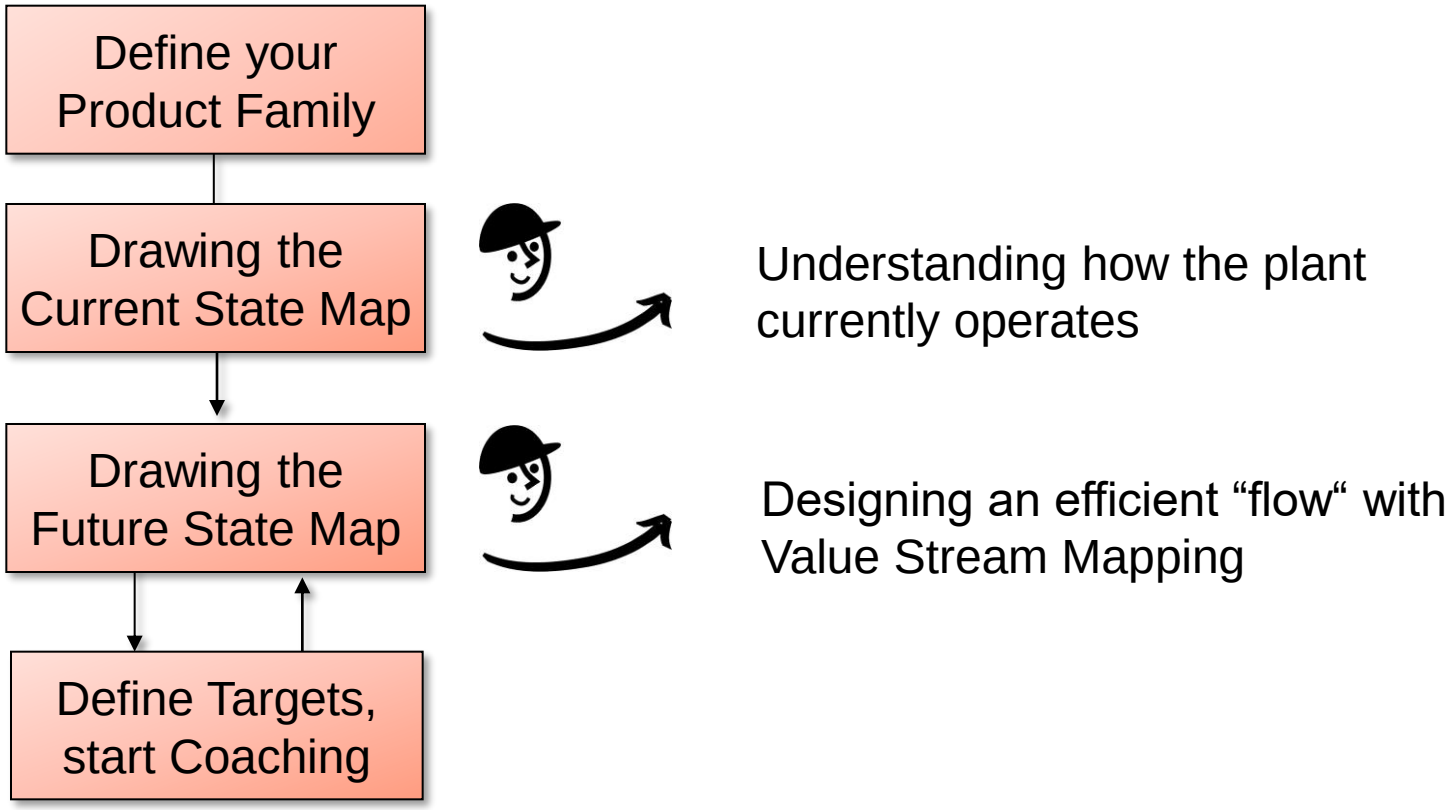
Then draw a „Target Condition“ showing how your Future Value Stream should look like in a time frame of 6-18 months.



Acme Radiators – Current State

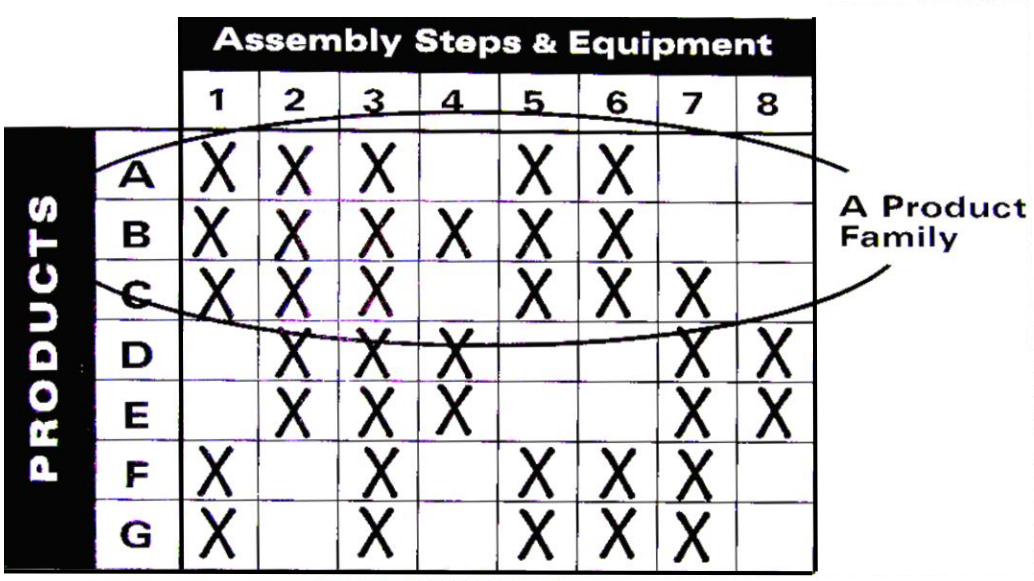


Use of value stream mapping method



Focus on a single Product Family at a time

Define your product family by finding shared production processes and machines

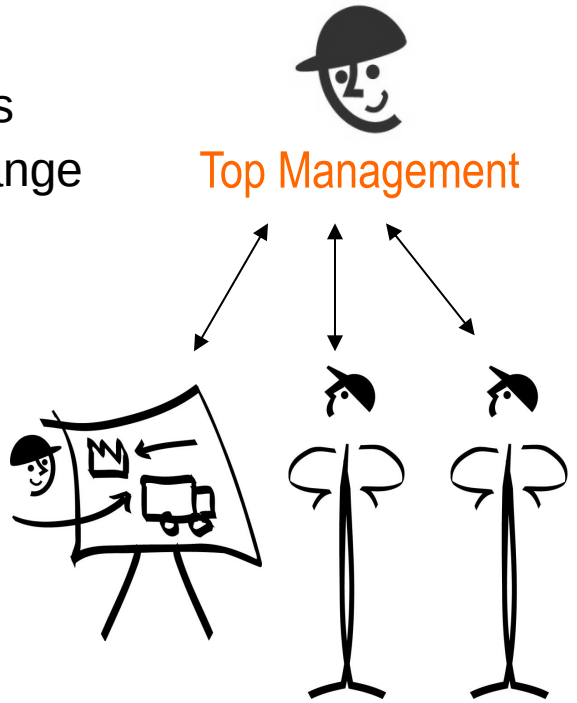


Value Stream Manager

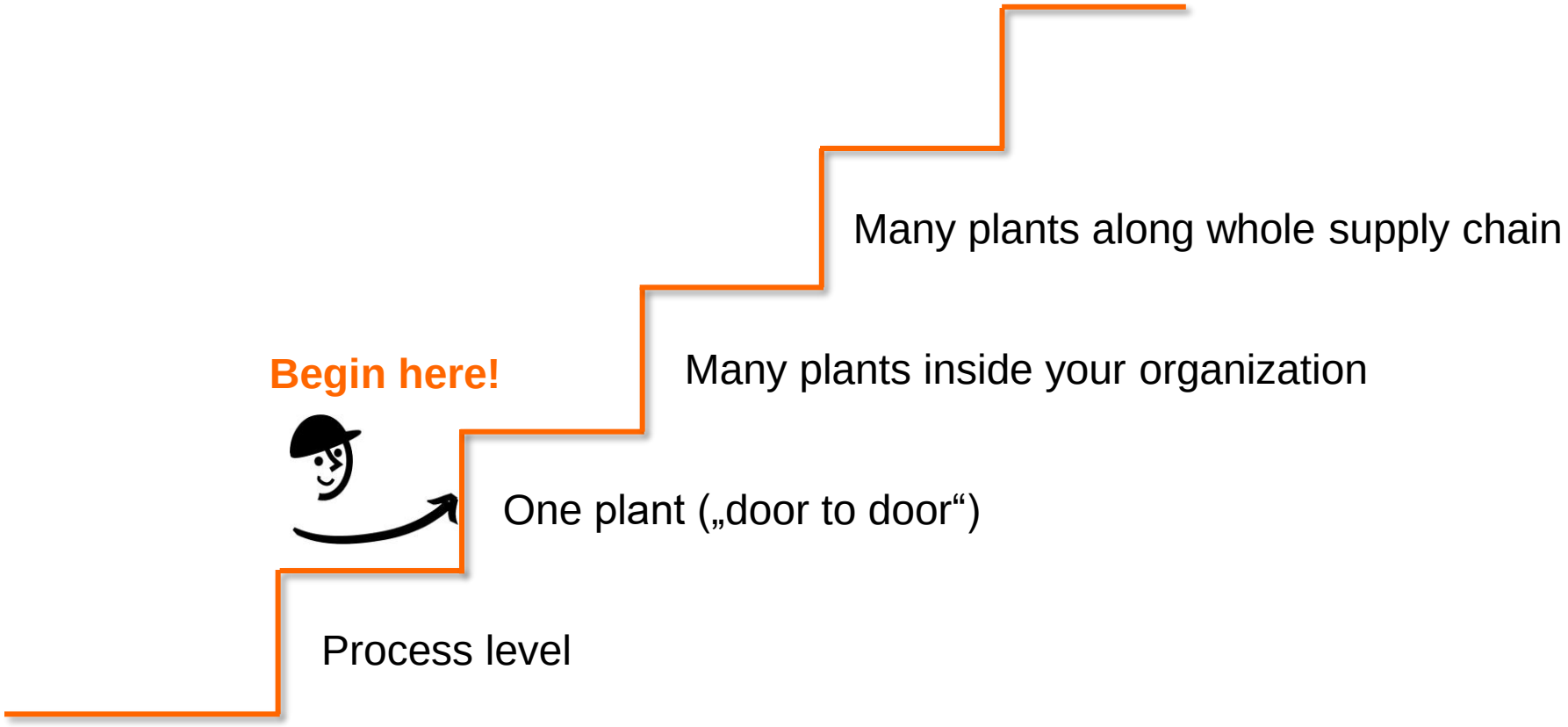
Every value stream needs a Value Stream Manager!
-> someone who manages products across all functions

Give responsibility for Value Stream Mapping and its implementation to managers capable to support change across departmental boundaries.

The Value Stream Manager should report directly The company`s "Top Management".



Levels of Value Stream application

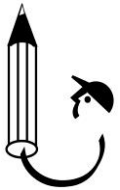


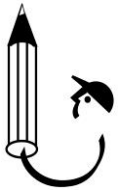
What is different?

- Change of perspective
- Focus on Lead Time reduction
- Focus on the interfaces between processes
- Material- und Information flow
- Simple representation on a single sheet of paper
- Continuous refinement of the vision by iterative learning

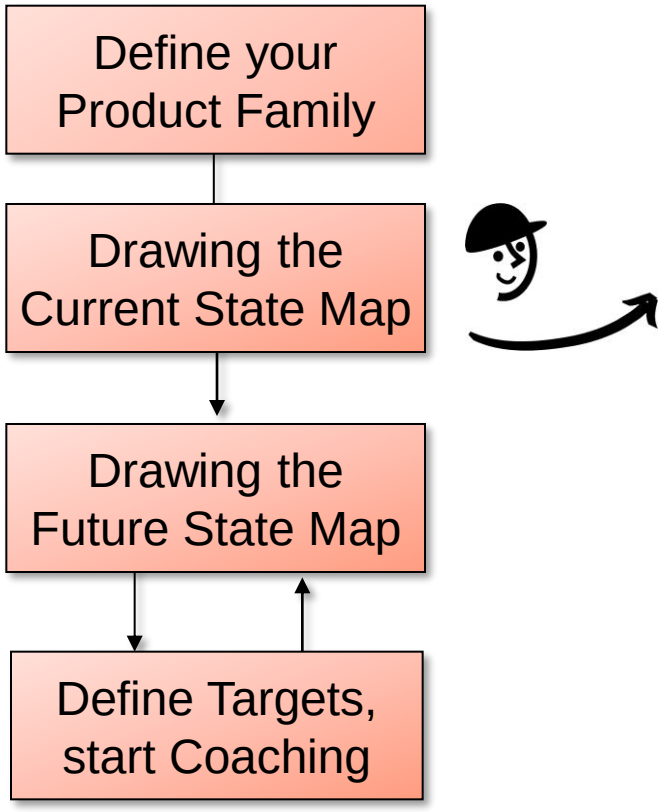
Workshop-Agenda

Chapter 1	Introducing Value Stream Mapping
Chapter 2	Drawing a Current State VS Map *– practical exercise –*
Chapter 3	Features of an efficient, customer-oriented Value Stream
Chapter 4	Drawing a Future State VS Map *– practical exercise –*





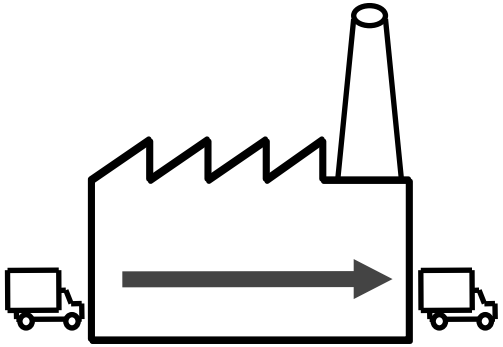
Drawing the Current State Map



Understanding how the plant currently operates:

- Material and Information flows
- Draw using standardized symbols
- Start at the “door to door” level
- Walk yourself along the value stream and draw your map by hand, using just a pencil
- No standard times!
- The current state is the basis for the next steps
- With new products, try to find and analyse similar value streams

Case example: Stamping Inc.



Stamping Inc. produces various components for the car industry.

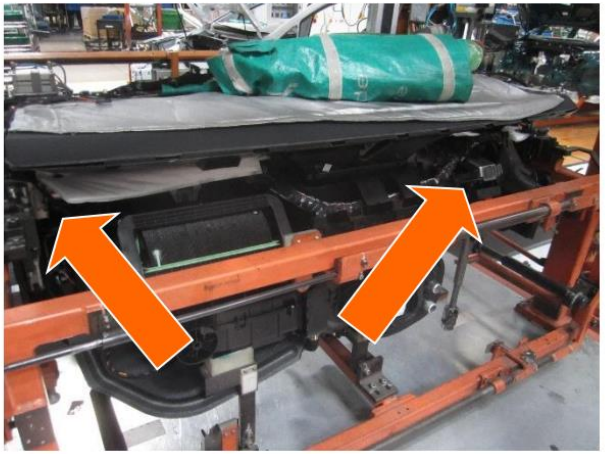
This case relates to a product family of steel dashboard supports made in two versions (a left-hand drive and right-hand version).

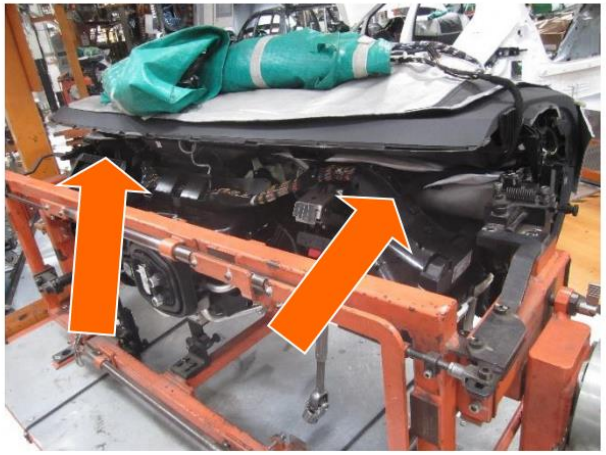
These components are delivered to a car assembly plant in Cologne, Germany.

Case example: Stamping Inc.

The steel dashboard support

Steel dashboard support





Die Armaturenbrettstütze

Case example: Stamping Inc. - continuation -

Customer demand:

- 18.400 pieces per month
  - 12.000 per month „left“
  - 6.400 per month „right“
- Shipping container with 20 supports. The customer orders per container (several containers per order).
- The assembly plant receives a truck delivery every day

Working hours:

- 20 days per month
- Two shifts per day in all manufacturing departments
- 8 hours per shift, overtime is possible if required
- Two 10-minute breaks per shift. During breaks, manual processes stop running.
- Unpaid lunch break.

Case example: Stamping Inc. - continuation -

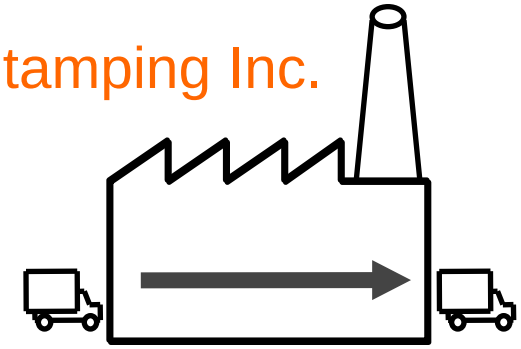
Production processes :

The process steps of this product family at Stamping Inc. include punching metal parts, spot welding them and subsequent assembly. After finishing, the components are brought to the shipping dock where they get sent daily to the car assembly plant.

The changeover time for the stamping press takes 1 hour and another 10 minutes at the spot welding process, necessary to change fixtures.

The Ruhr AG supplies Stamping Inc. every Tuesday and Thursday with steel coils .

Case example: Stamping Inc.



1) STAMPING (Shared process for many value streams)

-Cycle Time C/T: 1 sec. (60 pcs/min.)
-Change over C/O: 1 hour
-Automated 200-Ton Press with coil feed
-Uptime: 85 %
-Current buffer stock:
-4.600 stamped parts „left“
-2.400 stamped parts „right“
-5 days row steel or coils

2) SPOT-WELDING-STATION I

-Manual process with one operator
-Cycle Time C/T: 39 sec.
-Change over C/O : 10 min (Change of fixture)
-Uptime: 100 %
-Current buffer stock:
-1.100 pieces „left“
- 600 pieces „right“

3) SPOT-WELDING-STATION II

-Manual process with one operator
-Cycle Time C/T: 46 sec.
-Change over C/O: 10 min (Change of fixture)
-Uptime: 80%
-Current buffer stock :
-1.600 pieces „left“
- 850 pieces „right“

4) ASSEMBLY-STATION I

-Manual process with one operator
-Cycle Time C/T: 62 Sek.
-Change over C/O : none
-Uptime : 100%
-Current buffer stock :
-1.200 pieces „left“
- 640 pieces „right“

5) ASSEMBLY-STATION II

-Manual process with one operator
-Cycle Time C/T: 40 Sek.
-Change over C/O : none
-Uptime : 100%
-Current buffer stock :
-2.700 pieces „left“
-1.440 pieces „right“

6) SHIPPING DEPARTMENT

- Disposition of the finished goods from warehouse
- Packaging for shipment by truck

Case example: Stamping Inc. - continuation -

Production Planning at Stamping Inc.:

- Receives customers 90/60/30-day forecast and enters it in the PPC system.
- Sends a 6-week-forecast via PPC system to the Ruhr AG.
- Secures steel coil deliveries by a weekly fax order to the Ruhr AG.
- Receives daily a binding order from the Cologne plant.
- The PPC system calculates a weekly production plan for all departments, based on sales orders, WIP, finished goods inventory and expected production losses (scrap, rework, downtimes).
- Sends the weekly production plan to the stamping, welding and assembly departments.
- Sends a daily shipping list to the shipping department.

Typical steps for drawing the Current State Map

- Determine Customer information and demand
- Quick walk along the value stream to identify the sequence of main processes
- Fill out data boxes, draw inventory triangles, note inventories
- Draw supplier processes
- How does each process know what to produce next? (draw Information flow)

Typical steps for drawing the Current State Map

- Determine Customer information and demand
- Quick walk along the value stream to identify the sequence of main processes
- Fill out data boxes, draw inventory triangles, note inventories
- Draw supplier processes
- How does each process know what to produce next? (draw Information flow)
- Where is the material being pulled or pushed to the next process?

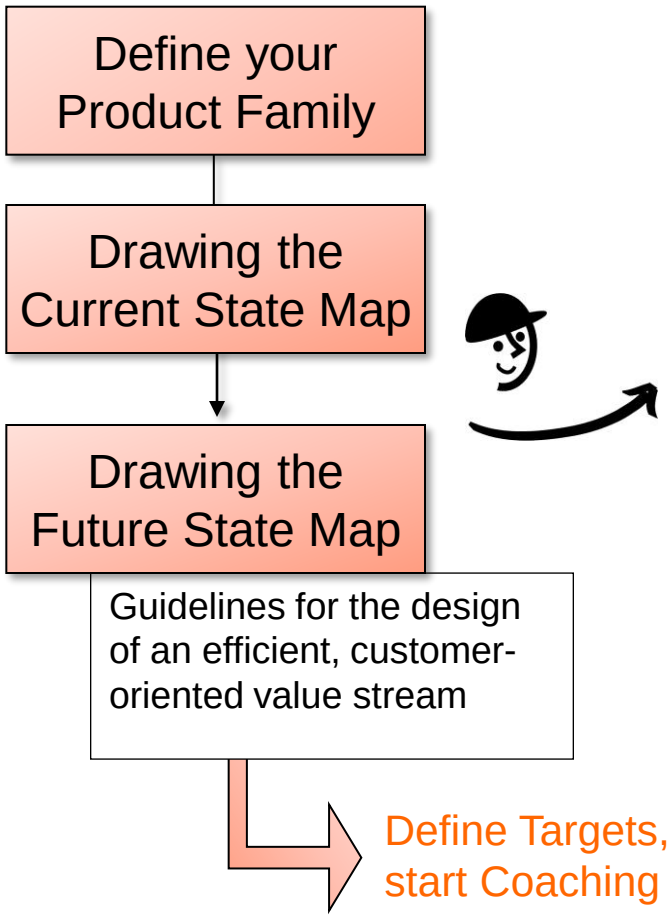
Typical steps for drawing the Current State Map

- Determine Customer information and demand
- Quick walk along the value stream to identify the sequence of main processes
- Fill out data boxes, draw inventory triangles, note inventories
- Draw supplier processes
- How does each process know what to produce next? (draw Information flow)
- Where is the material being pulled or pushed to the next process?
- Calculate the total Lead Time of our Value Stream

Some questions to understand the Current State of your Processes

- What is the Cycle Time c/t of your process?
- What is the Change Over c/o time for this machine or process?
- How reliable is this process/ What is the current downtime of this machine?
- What is the Lot Size/ Container Size for finished parts at this process?
- How large are the Buffers between and inside every single process?
- How many operators are running this process?
- How many different types/variants do you have at this process?
- Working time/shifts per day?
- Rework/Scrap rate?
- Lead Time and Total Process Time?

Drawing the Future State Map

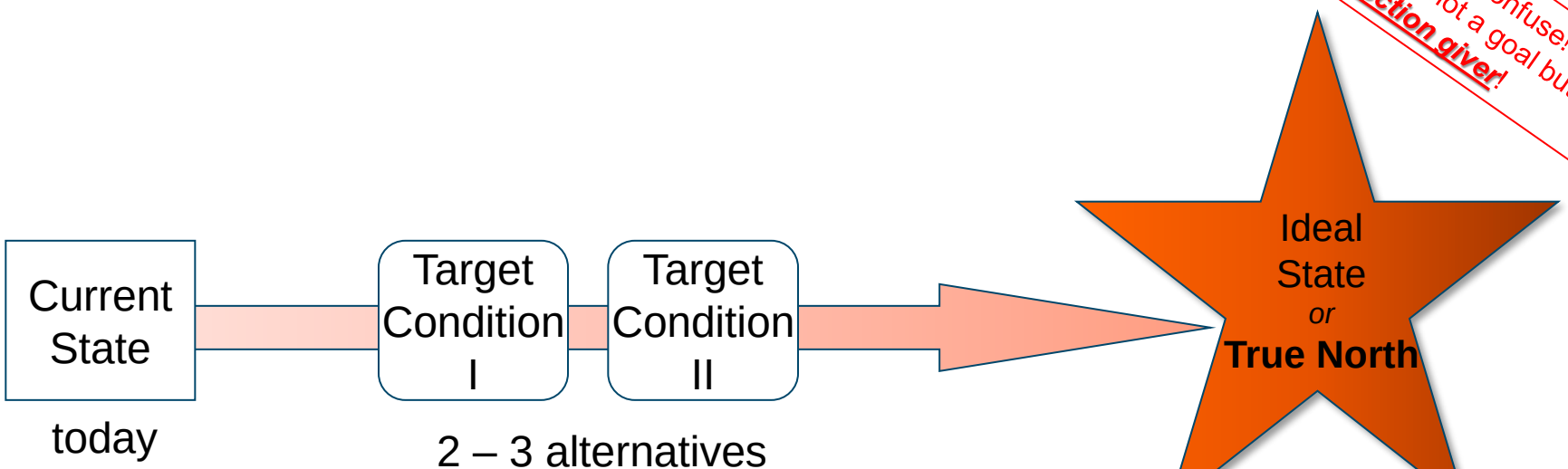


The Design of an Efficient Flow:
... this is the strength of Value Stream Design

- A Target State Map is your working basis
- 70 % accuracy for the Current State is enough, since you will continuously refine your map as you keep learning (use a pencil!)
- Material- and Information Flow
- Start at the Current State Map
- The first iterations should start with existing machines and processes: we should relocate, combine or remove equipment, making only smaller purchases.

Use an Ideal State or True North as Direction giver!

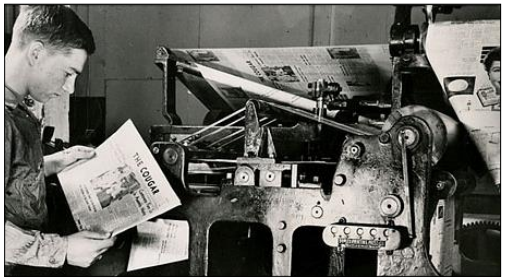
Attention! Do not confuse! The **True North** is not a goal but a **Direction giver**!

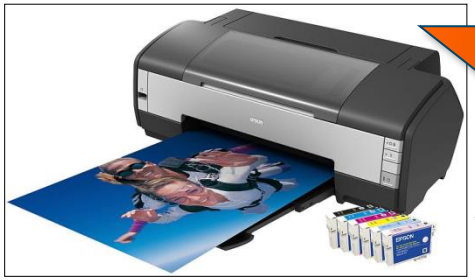


"If there is no agreement on the basics, it is pointless to forge plans together“
Confucius, chinese philosopher

Developments towards True North can be seen over the Centuries!

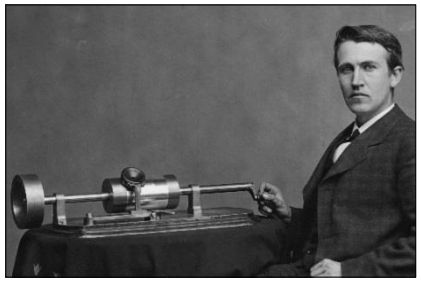
Printing

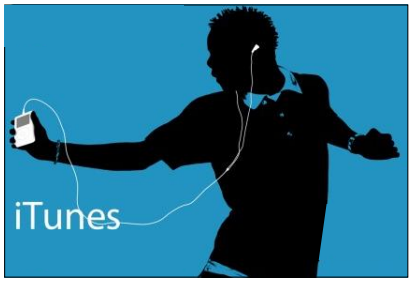




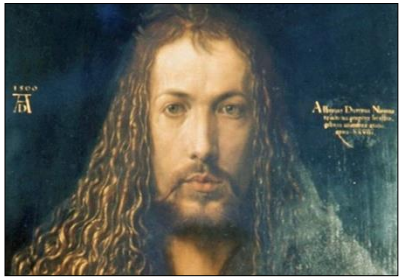
True North

Music



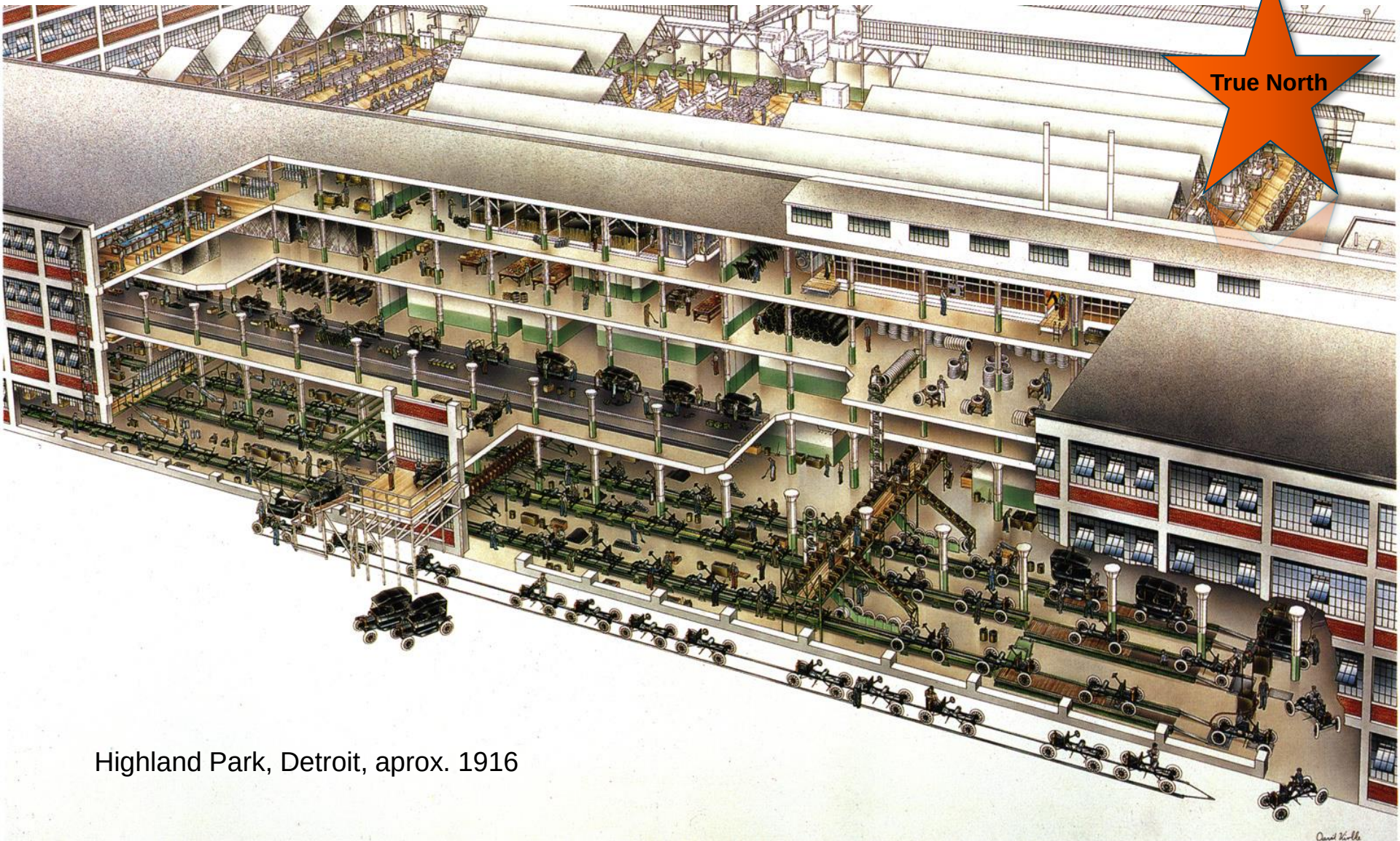


Photography



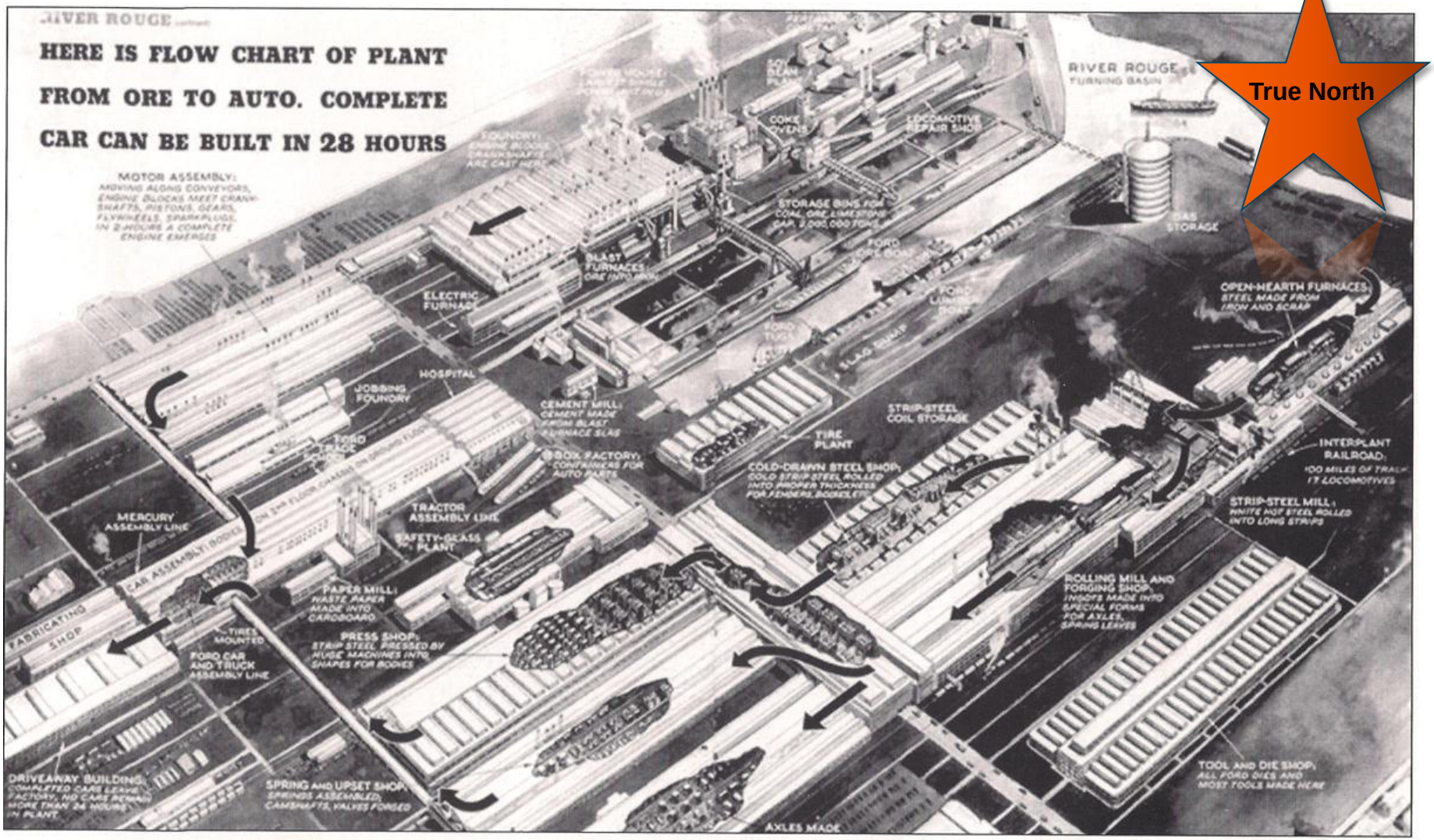
Large Lots, long Change Overs, expensive, long Lead and Waiting Times → *Lotsize 1, no C7O, cheap, shortest Lead Time, often no waiting at all!*

Henry Ford achieved amaizing Lead Times in Highland Park!



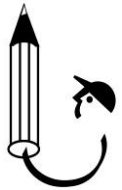
Highland Park, Detroit, aprox. 1916

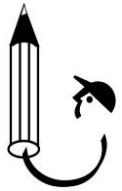
Henry Ford achieved even better Lead Times in River Rouge!



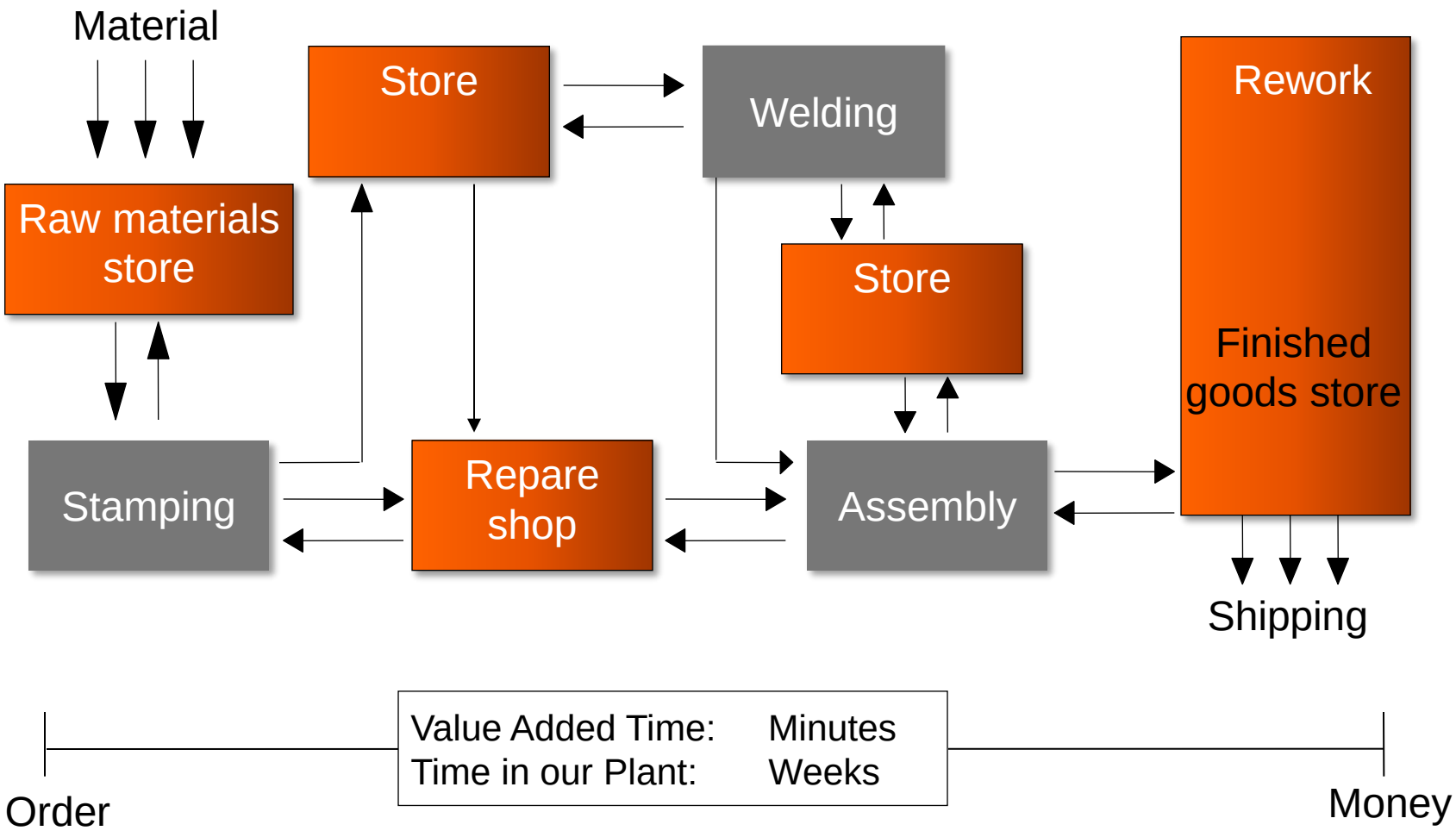
Workshop-Agenda

Chapter 1	Introducing Value Stream Mapping
Chapter 2	Drawing a Current State VS Map – *practical exercise* –
Chapter 3	Features of an efficient, customer-oriented Value Stream
Chapter 4	Drawing a Future State VS Map – *practical exercise* –





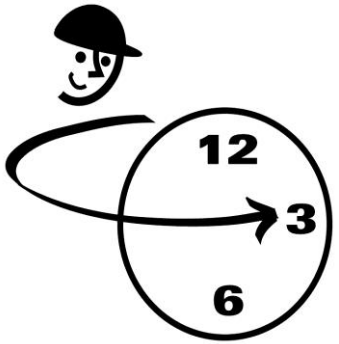
Mass production: huge Lots, material push, „Silo-thinking“



Waste

Waste are activities that do not add value for the customer.

Waste costs you Time and Money.



Important points to make about „Waste“:

- Waste implies there are Problems hidden in your Value Stream.
- Waste is rather a Symptom than the Root Cause of a Problem.

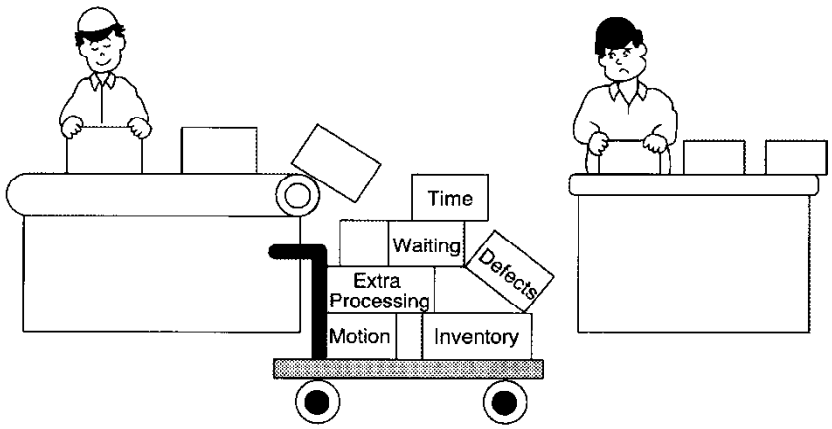
➡ We must find and eliminate the Root Causes of our Problems and Wastes.

„Overproduction“

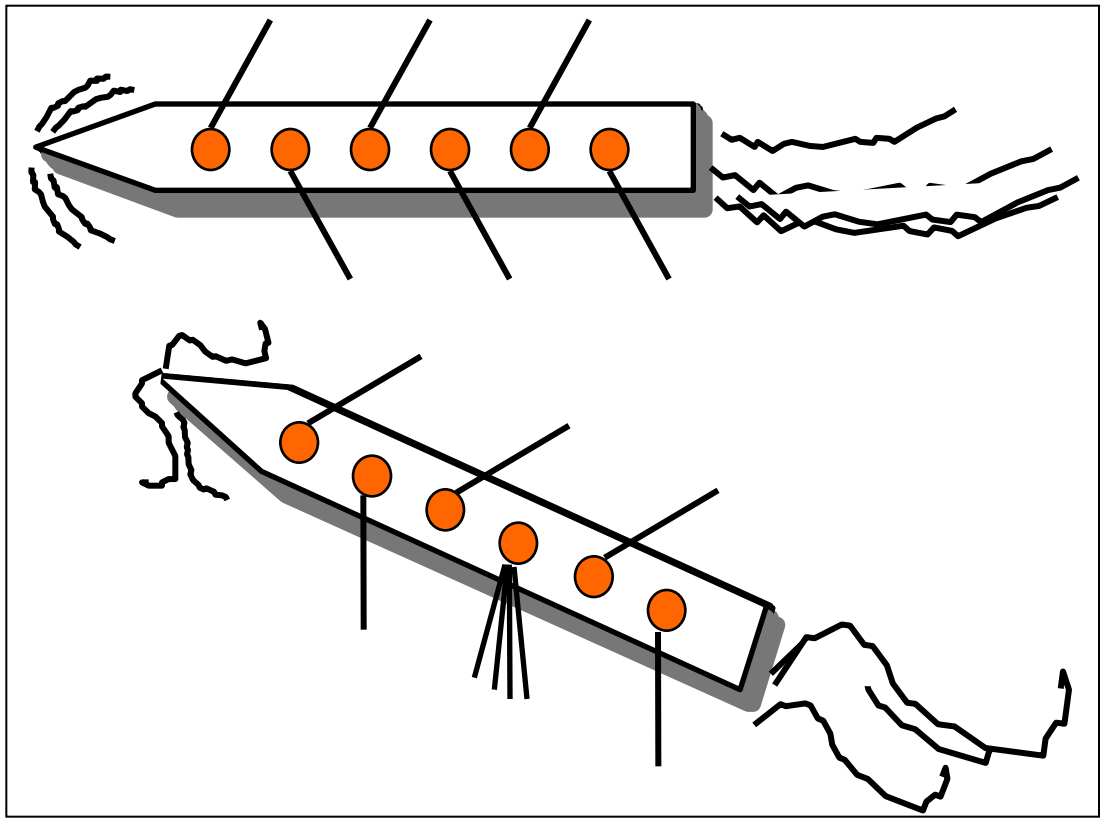
= More
production, as needed for the next process

= Earlier
production, than needed for the next process

= Faster
production, than needed for the next process



Individual Performance versus Systems Performance



Question:
How fast should
we all produce?

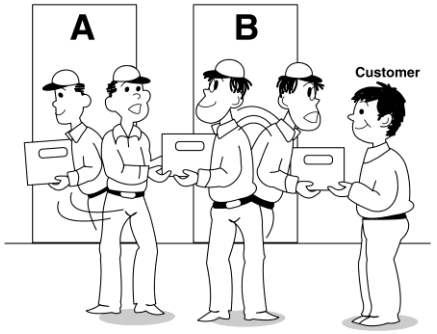
1. Customer Takt

The Customer Takt is a Production Rate which is based on our Sales Rate.

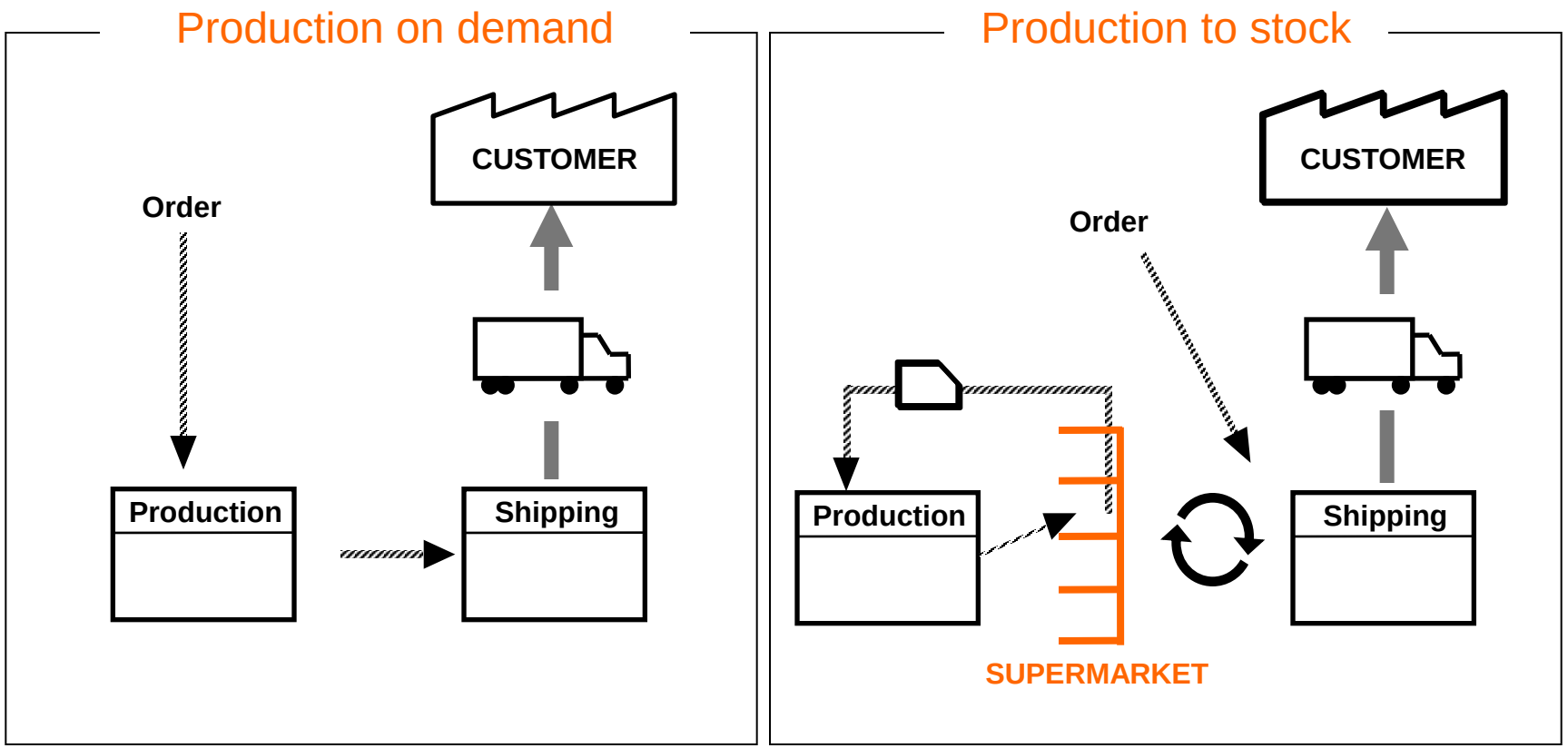
The Customer Takt helps in synchronizing the Assembly Rhythm with the Sales Rhythm .

$$\text{Customer Takt} = \frac{\text{Available uptime per shift}}{\text{Customer demand per shift}}$$

$$\text{Customer Takt} = \frac{27.600 \text{ sec.}}{460 \text{ pcs.}} = 60 \text{ sec.}$$

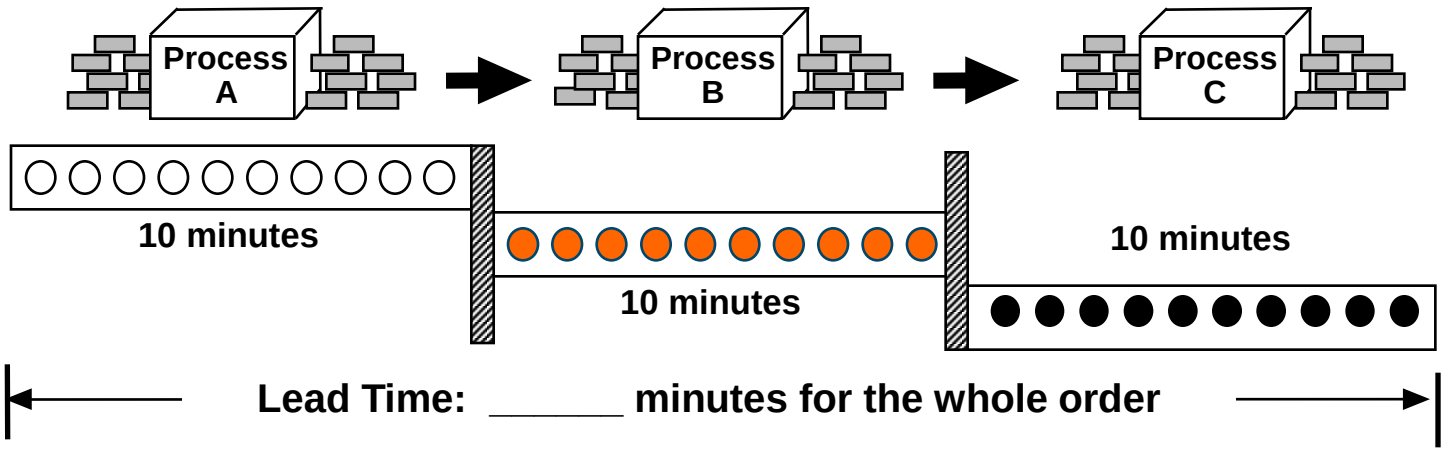


2. Producing according to customer demand or to stock?

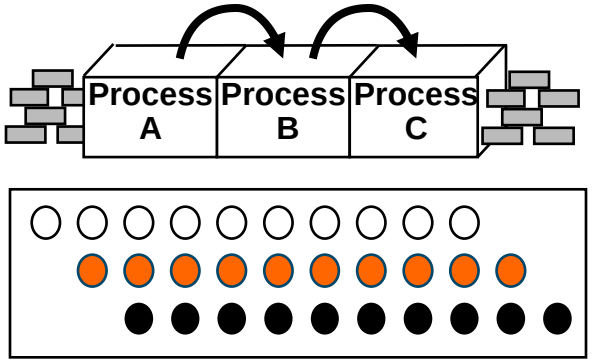


3. Continuous flow or One Piece Flow

a) Batch and Queue Production

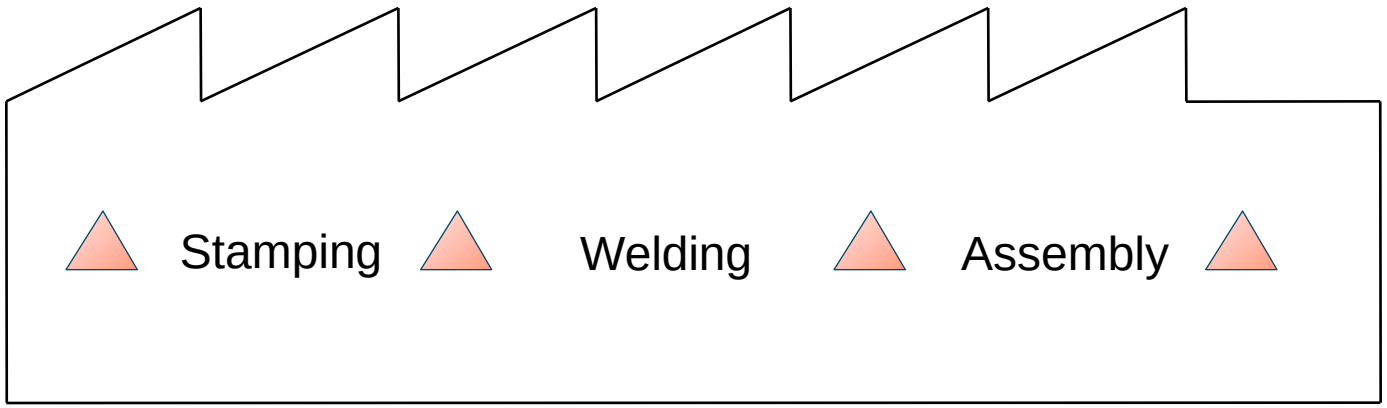


b) Continuous 1x1-Flow



Problematic Places in your Flow

Where does the One-Piece-Flow end?



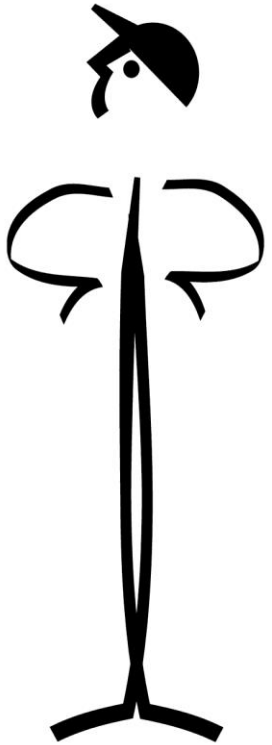
Customer

How can we control production between flow segments?
Should we use a PPC-based production planning system?

Planning your Production?

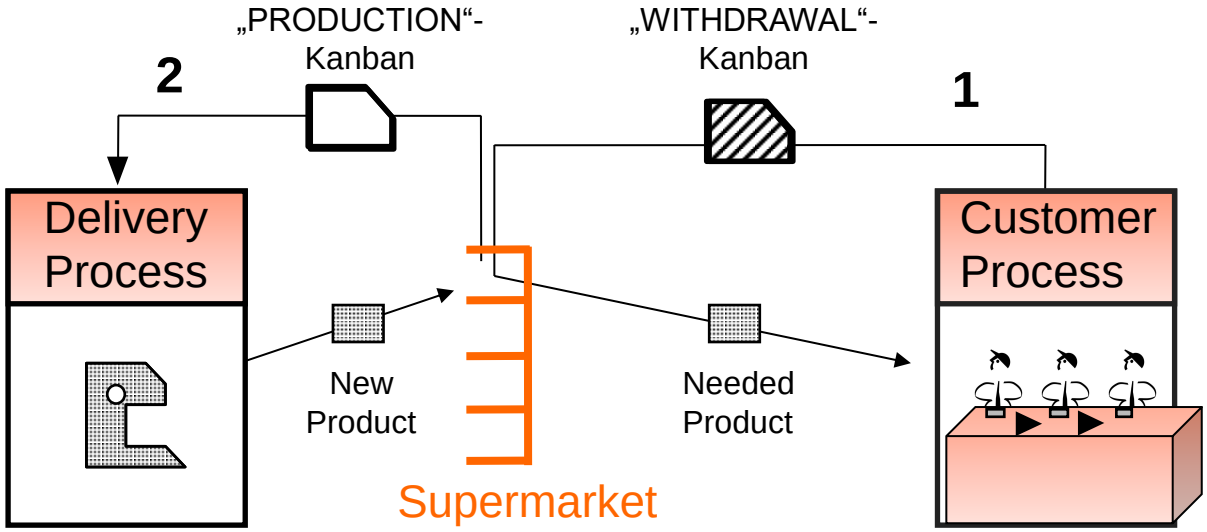
Production schedules change constantly

Production never goes according to plan



4. Supermarkt-Pull-Systems

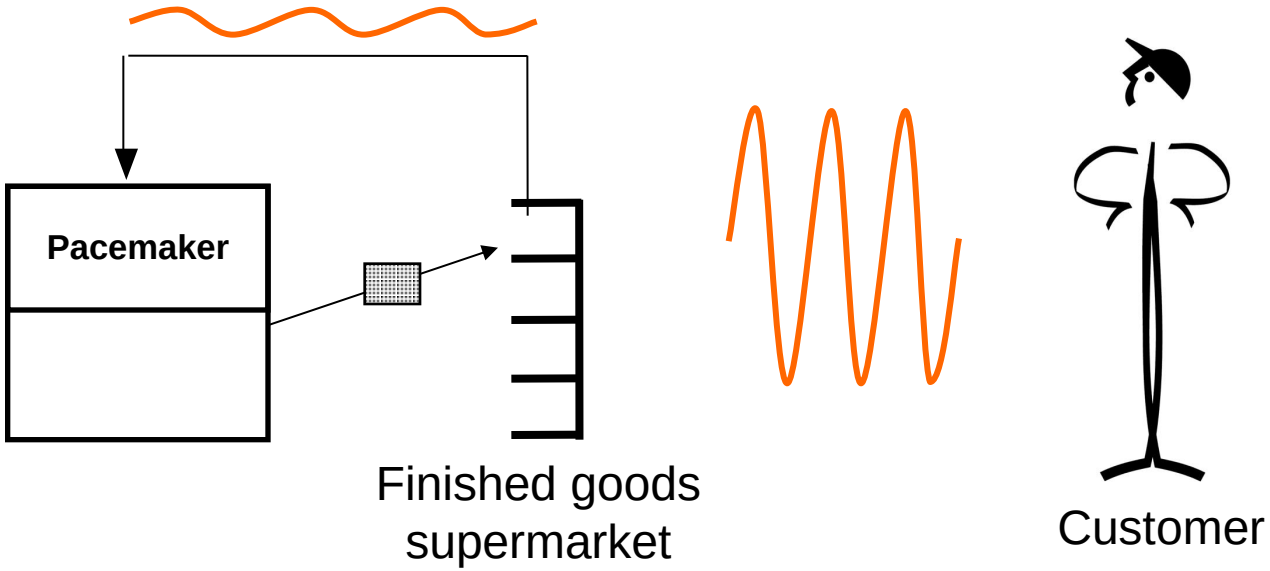
Customer process goes to the supermarket and picks what is currently needed.
The delivery process only produces to refill the collected products.



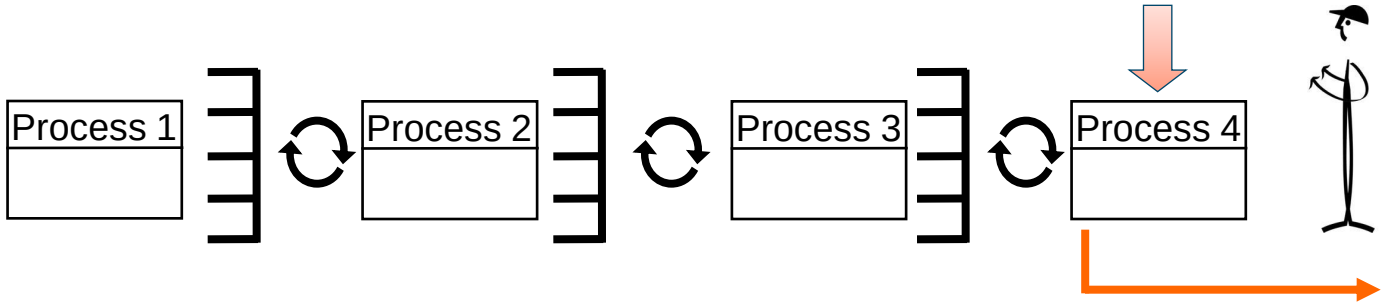
Purpose:

- One way to regulate the flow between production processes
- Builds a chain among processes, connected to through customer-supplier relationships
- Makes Problems visible
- Allows continuous, step by step elimination of the supermarket

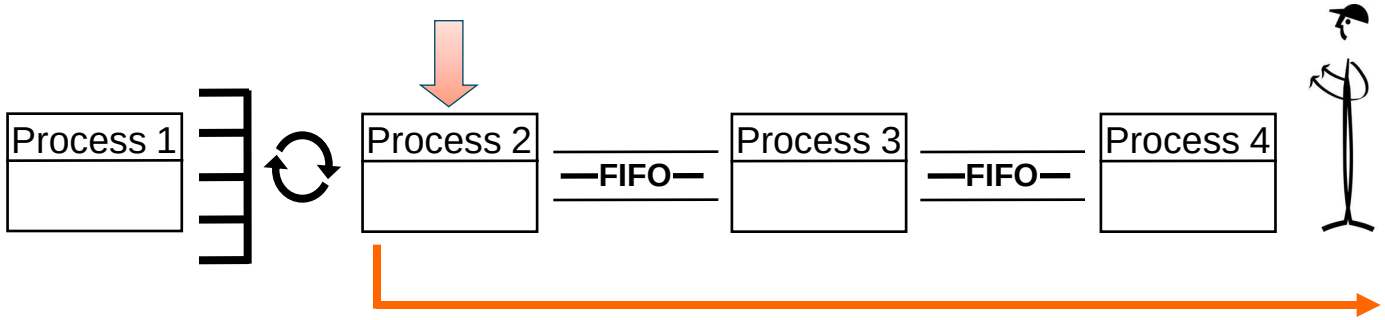
Compensating daily fluctuations



5. Try to schedule only one point (pacemaker) of the value stream!



From here: Flow production or FIFO

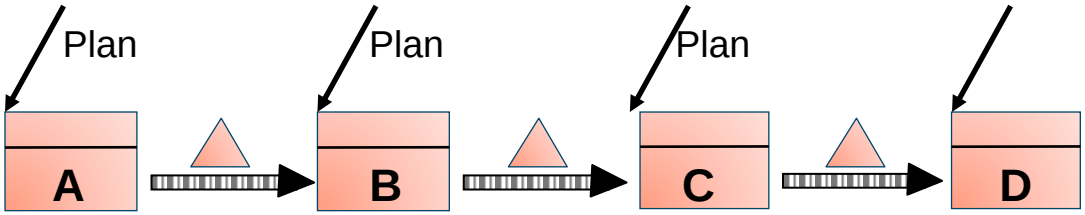


From here: Flow production or FIFO

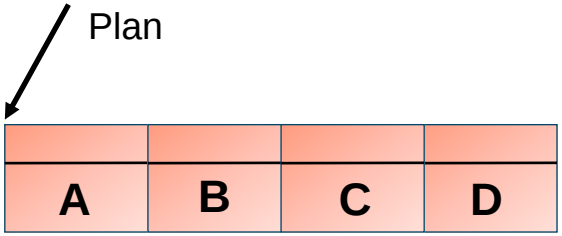
Use Flow production whenever possible, otherwise use Supermarket-Pull or FIFO

Alternatives to Push

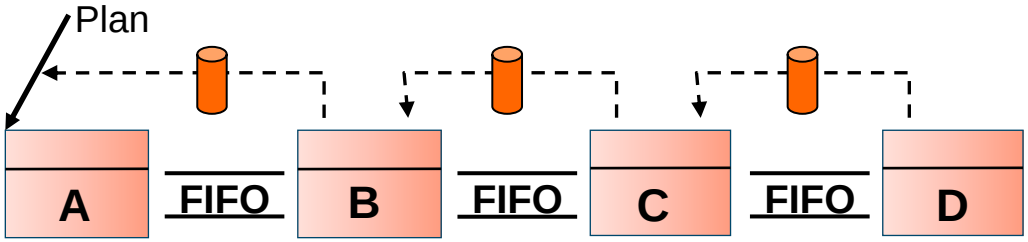
Push



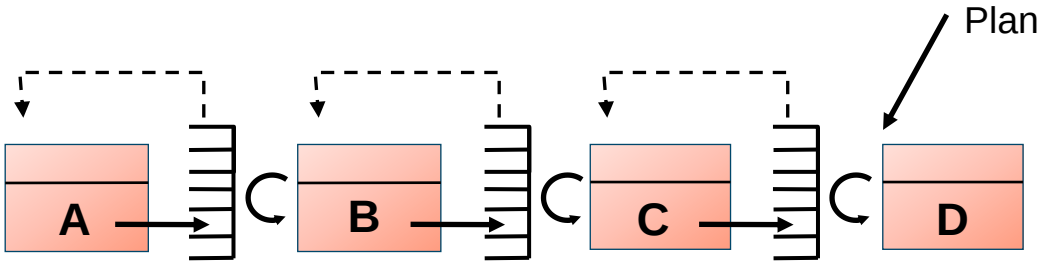
One Piece Flow 1.)



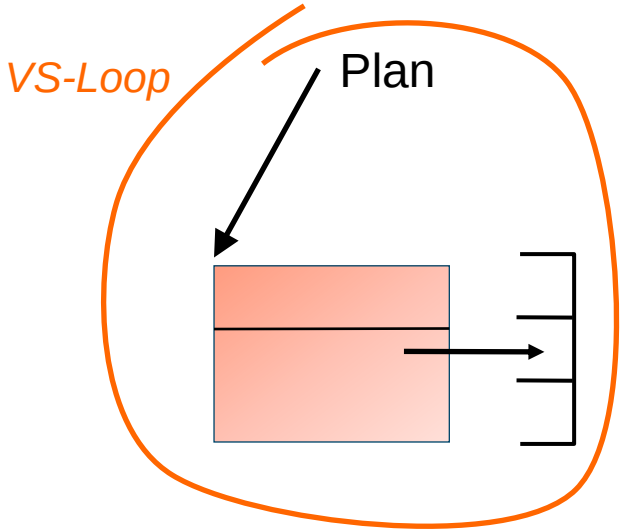
FIFO 2.)
(with a defined max. Buffer)



Supermarket Pull 3.)



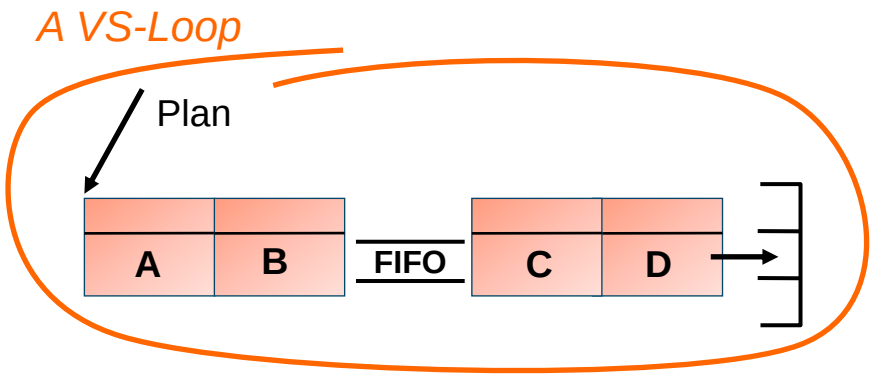
What is a Value Stream LOOP?

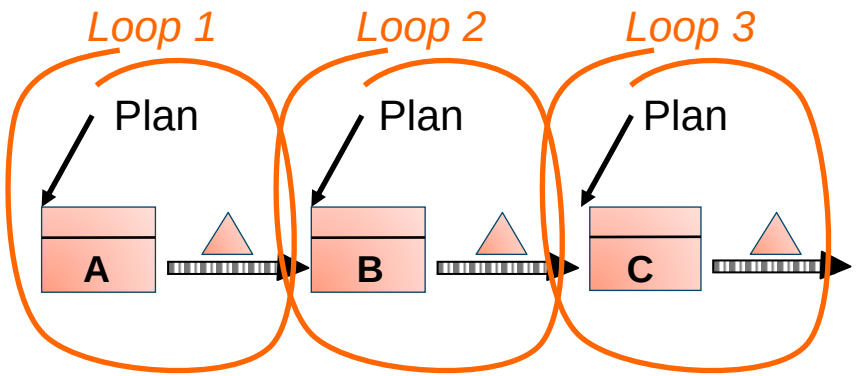


In a Value Stream Loop:

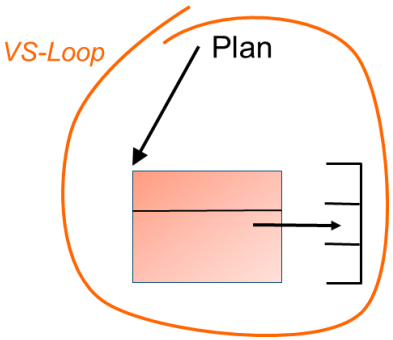
- only one point gets a production plan
- the material flows in a continuous FIFO stream
  (not necessarily in a one-piece-flow!)
- there is always a buffer or supermarket at the end
- there might be many processes
- there might be many FIFO-buffers

Two examples:





How are process- and lead-times related to the WIP and cycle time?



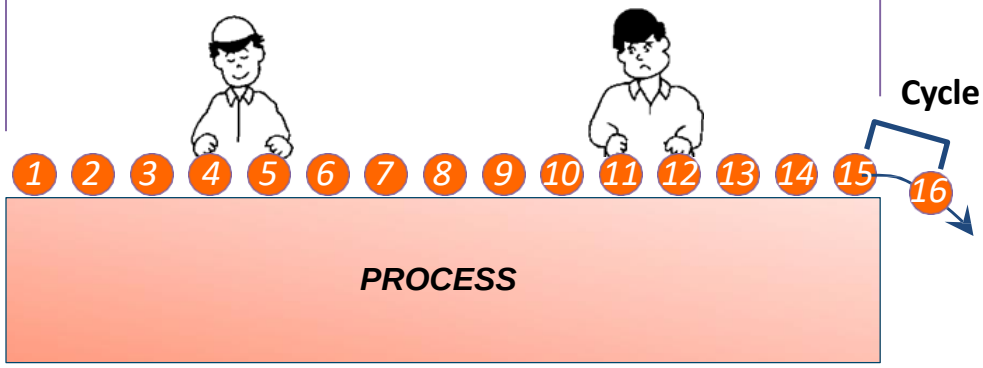
Total lead time of this Value Stream Loop

WIP of this VS-Loop x cycle time or customer takt (in this example: 40 pcs. x 1 min. = 40 min. lead time)

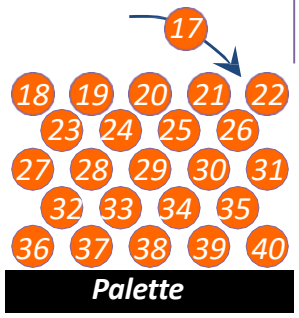
Process- and lead time of this process

WIP in this process x cycle time

Lead time of this buffer



Cycle time *(e.g. 1 min)*



Lead time and process time here:
15 pcs. x 1 min. =
15 min.

Material waiting time or lead time here:
25 pcs. x 1 min. =
25 min.

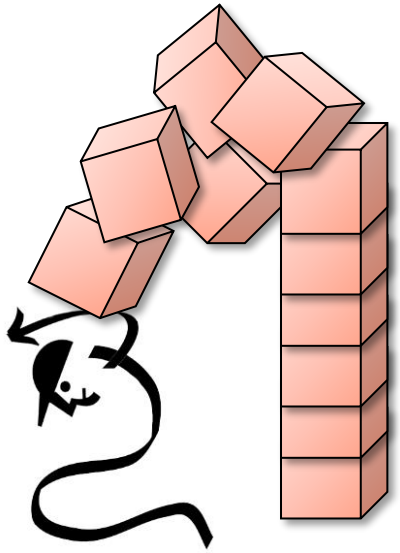
6. Small Lot Production and fixed Change Over Sequences

Bad:

Production Plan

Monday..... 400 A
Tuesday .....100 A, 300 B
Wednesday..200 B, 200 C
Thursday….400 C
Friday.....200 C, 200 A

(Ergebnis)



Better:

Monday:

140 A 100 B 160 C

jedes Teil jeden Tag

Monday

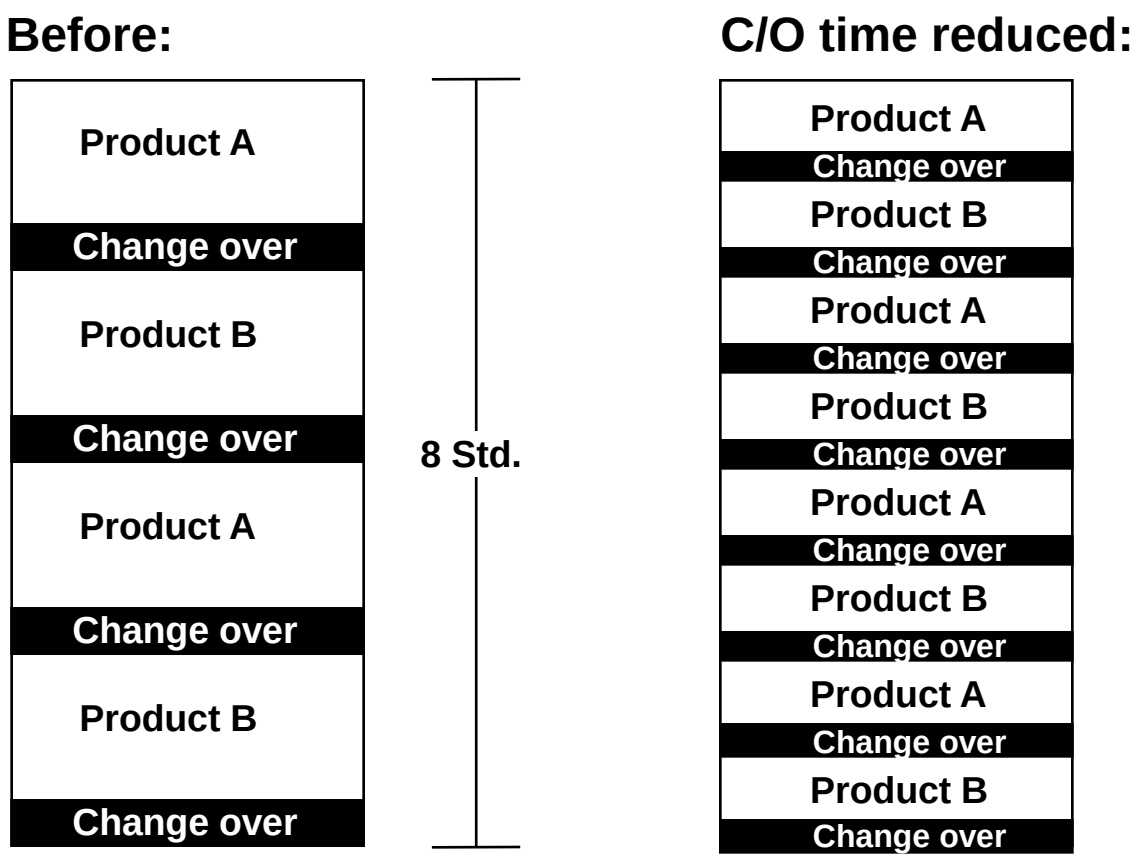
even better:

50 B 70 A 80 C | 50 B 70 A 80 C

Every Part to Every Delivery Slot (“Window”)

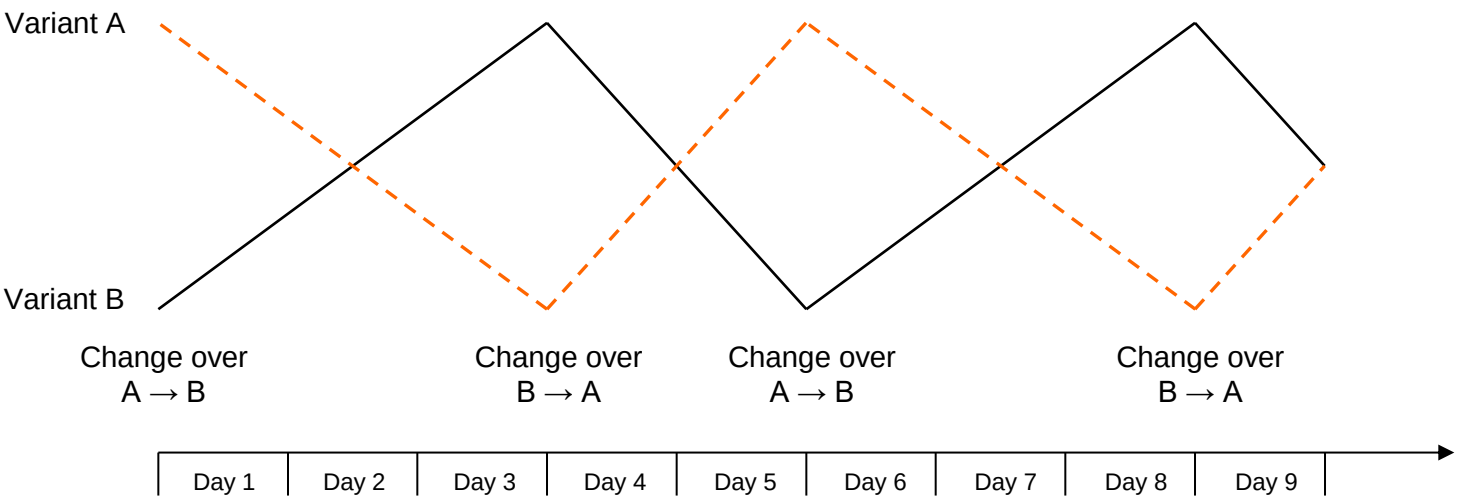
IMPORTANT: Short Change Over and frequent C/O at the delivery process!

Halving the C/O times leads to halving the Lot Sizes, leading to halving the necessary buffers and Lead Time

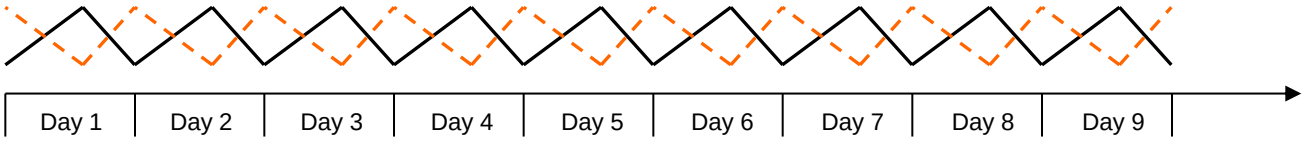


How does EPEI influence your Buffer and Lead Time?

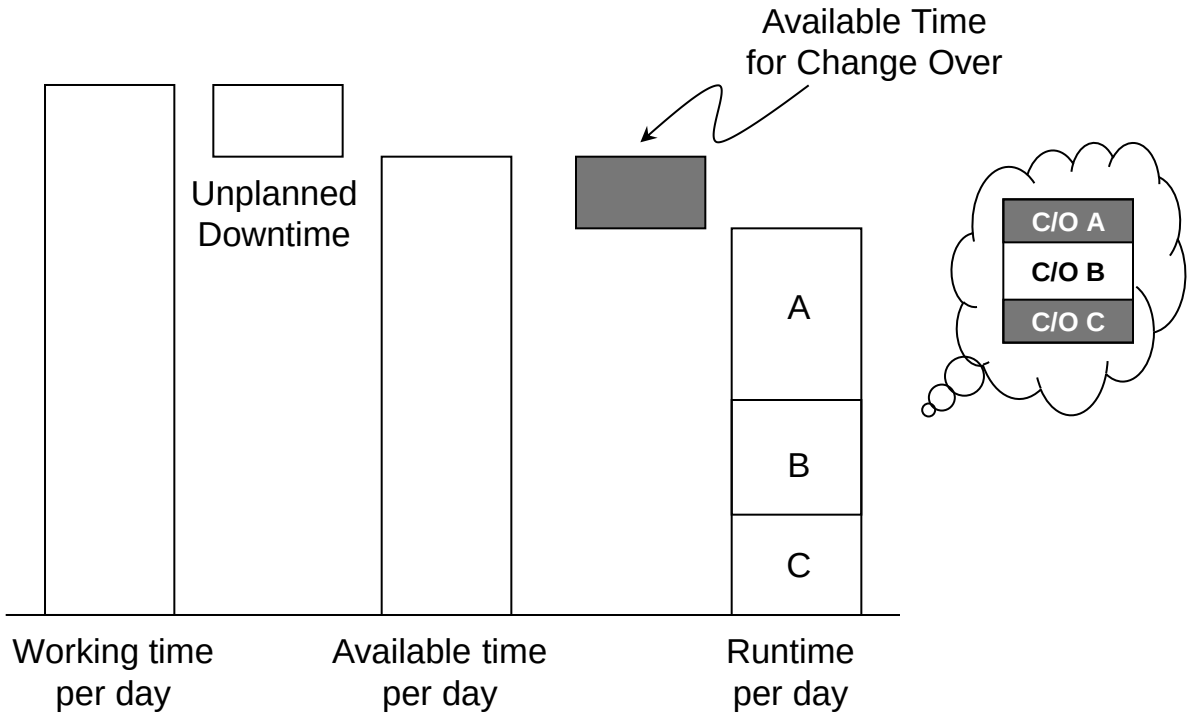
EPEI = 1 week
Safety = 50%
Buffer = 7,5 days



EPEI = 1 day (-80%)
Safety = 50%
Buffer = 1,5 days (-80%)

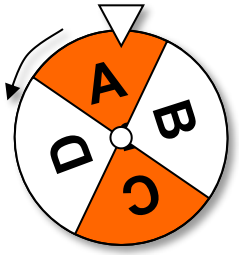


How do you calculate your EPEI?



$$\text{EPEI} = \frac{\Sigma_i \text{ (Change over}_i\text{)}}{\text{Available time per day x Uptime} - \Sigma_i \text{ (Customer demand per day}_i \text{ x Cycle Time}_i\text{)}}$$

How do you calculate your EPEI?



Rüstscheibe

What is the current EPEI of the stamping press at Stamping Inc.?

Available working time = 2 sh. x 8 hs. x 60 min - 2 x 20 min = 920 min

Uptime = 85%

i = 4 Types

Customer demand: Type A = 600 pcs/day, CT = 1 sec, C/O = 60 min

Type B = 320 pcs/day, CT = 1 sec, C/O = 60 min

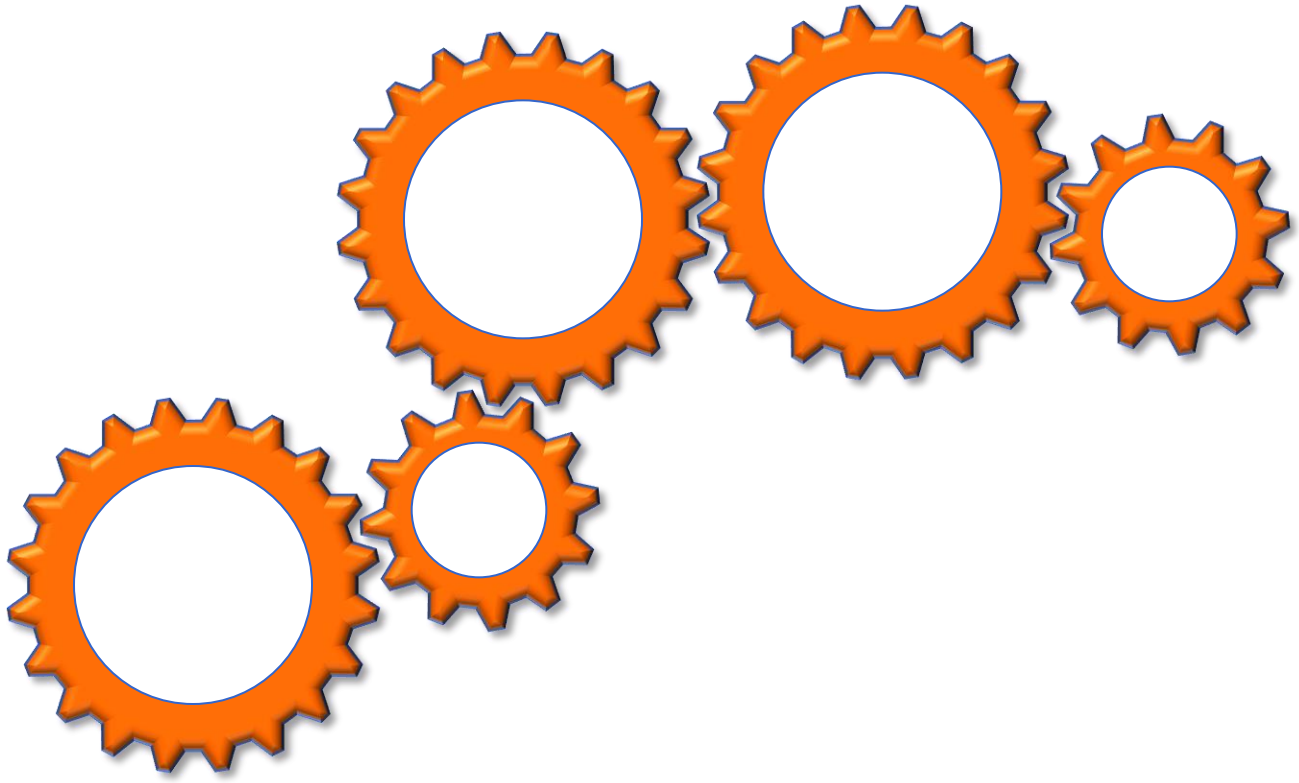
Type C = 2.400 pcs/day, CT = 5 sec, C/O = 60 min

Type D = 6.200 pcs/day, CT = 5 sec, C/O = 60 min

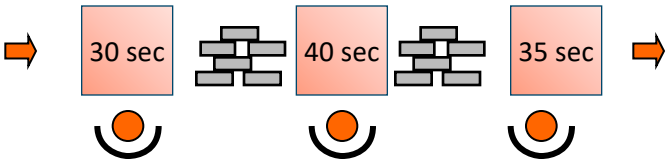
Solution: EPEI = 4,8 days, avg. lot size: A = 2.880, B = 1.536, C = 11.520, D = 29.760

What happens with a lean flow...

... when a machine has a problem?
... if defect parts get mixed into the processes?



U-shaped-cells simplify balancing and continuous improvement

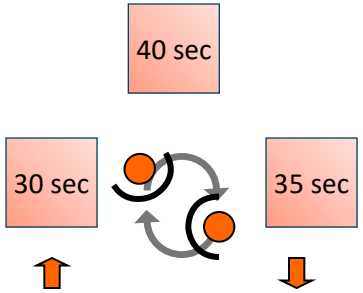


630 pcs / 7hs

40 sec / pc.
90 pcs / hr
30 pcs / operator

Productivity = $\frac{105 \text{ sec}}{120 \text{ sec}} = \frac{30+40+35}{40+40+40}$ = **0,875**

Only the bottle neck station can be used to do effective improvement!



630 pcs / 9h

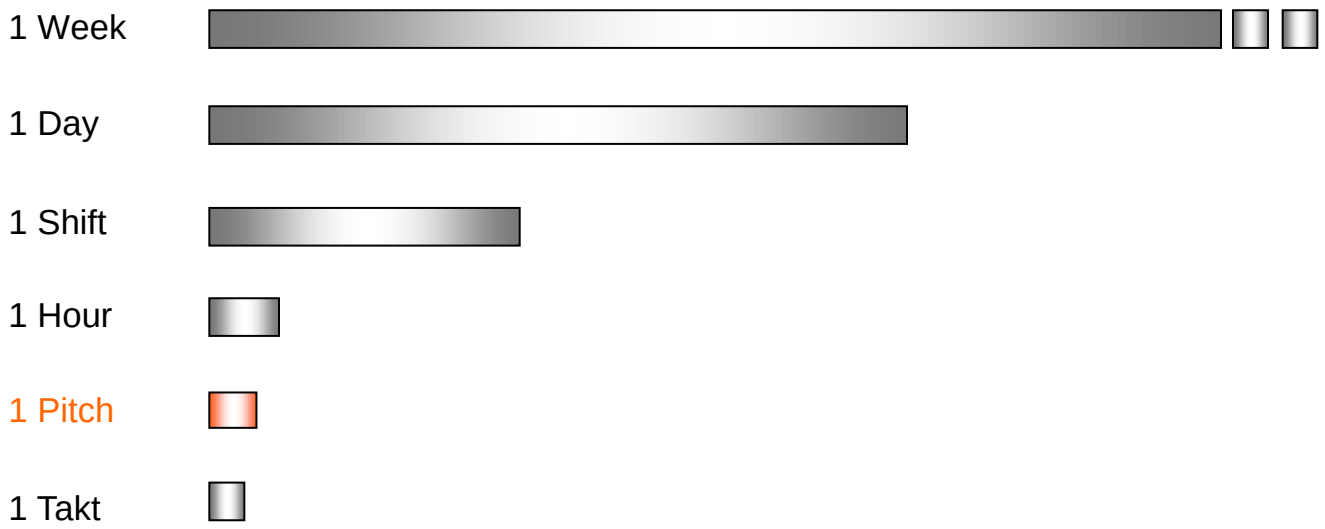
52,5 sec / pc.
69 pcs / hr
34 pcs / operator

Productivity = $\frac{105 \text{ sec}}{105 \text{ sec}} = \frac{30+40+35}{52,5+52,5}$ = **1,0**

Any improvement on any process results in an immediate optimization of the whole process!

7. „Paced withdrawal“ at the pacemaker process

- How much work do you release at the pacemaker process?
- What is your Management Pitch?
  (How often do you recognise deviations between customer demand and actual production rate?)
- Do you offer a “Customer takt image“ to the process operators?



Workshop-Agenda

Chapter 1	Introducing Value Stream Mapping
Chapter 2	Drawing a Current State VS Map – *practical exercise* –
Chapter 3	Features of an efficient, customer-oriented Value Stream
Chapter 4	Drawing a Future State VS Map – *practical exercise* –