One of LEAN approaches

VSM - Value Stream Mapping (Analyses)

VSM

LEAN in general

Lean Thinking

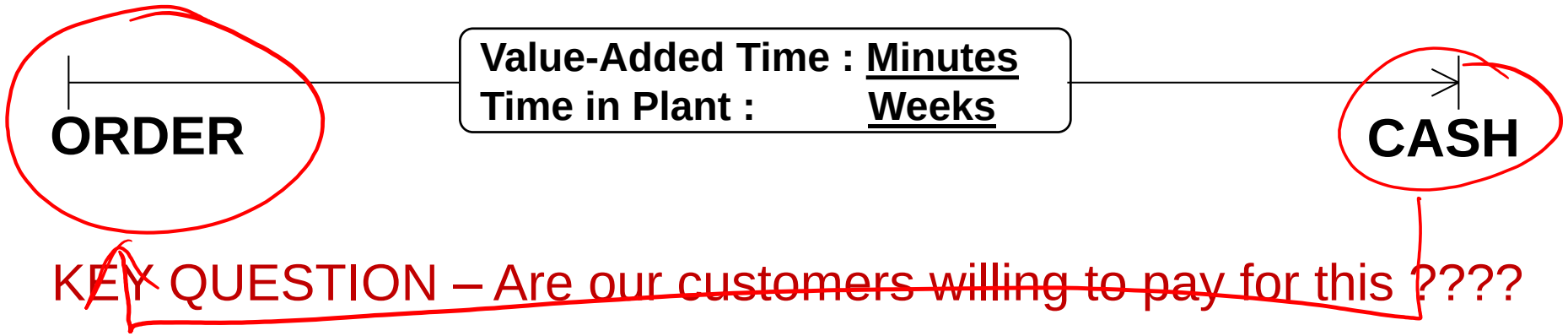
Important

- ***Value*** **in the Eyes of the Customer**
- **The *Value Stream***
- ***Flow*** (material, inform.)
- ***Pull*** **of the Customer (Market PULL)**
- ***Perfection***

Value → added
non added

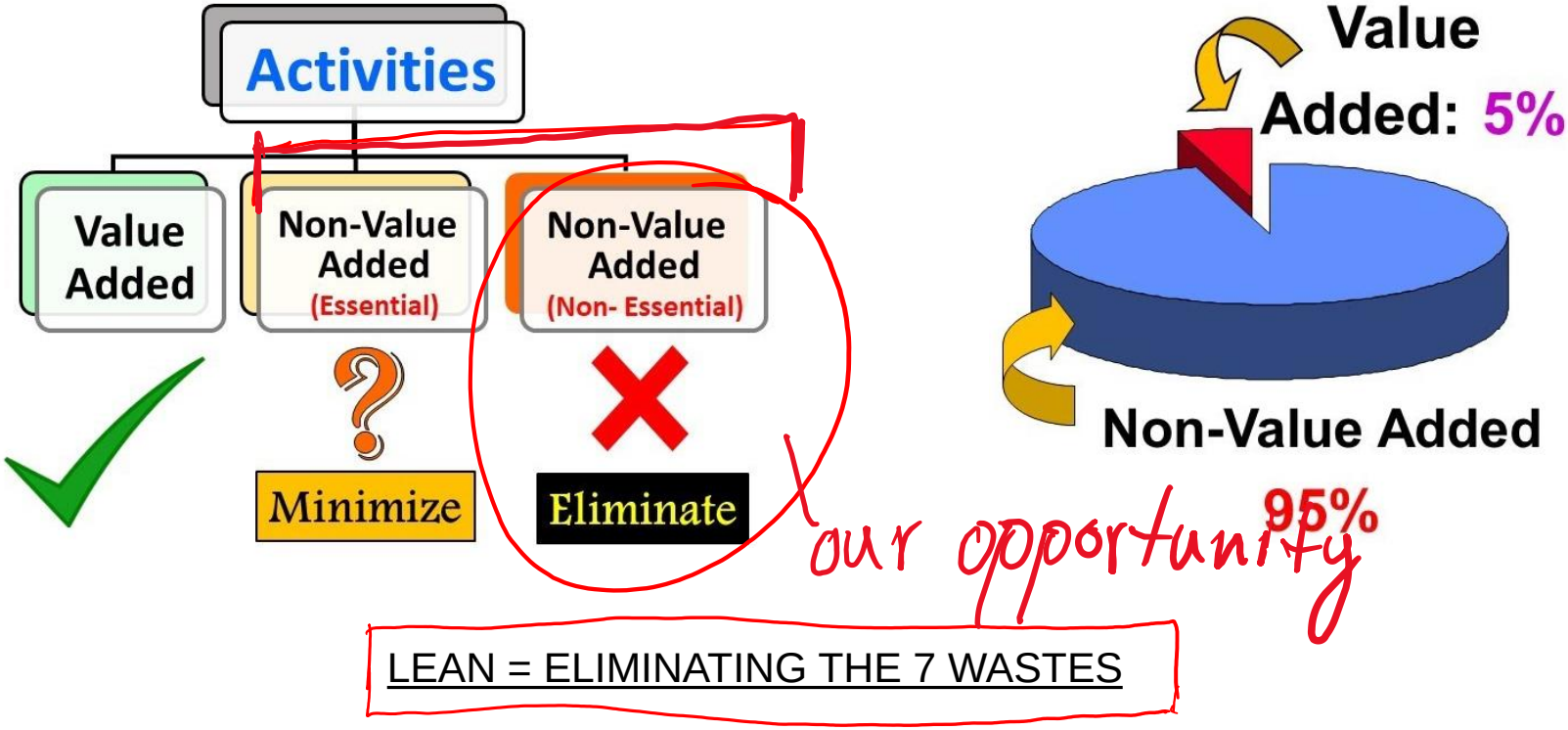
Value Added

- *Value* is added any time we physically change our product towards what the customer is buying
- If we are not adding value, we are adding cost or waste
- Lean Manufacturing drives the systematic elimination of waste



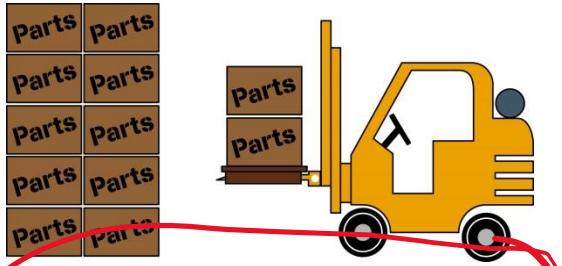
KEY QUESTION – Are our customers willing to pay for this ????

Value Added vs. Non-Value Added



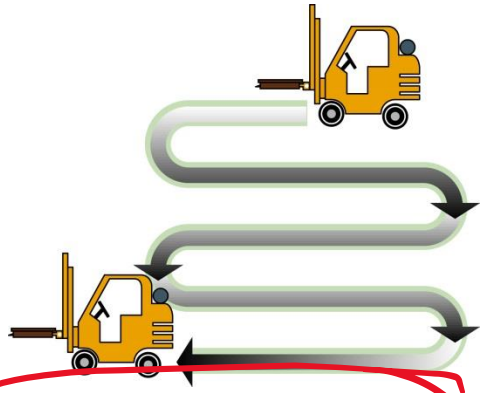
Typically 95% of Total Lead Time is Non-Value Added!!!

WAITING



OVERPRODUCTION

Important

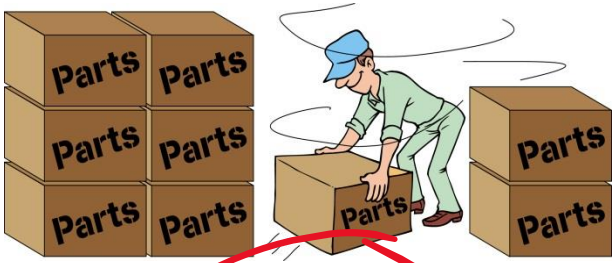


TRANSPORTATION

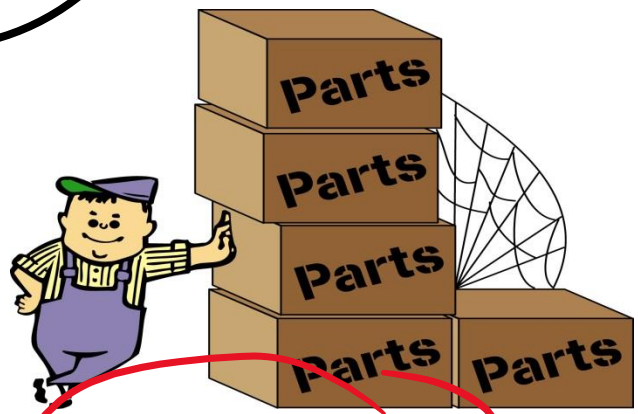
PROCESSING

7 Wastes

DEFECTS



MOTION



INVENTORY

7 Basic Types of Waste (Toyota)

- Waiting – waiting for the next process step
- Overproduction – producing more than what is demanded by the customer
- Transportation – the unnecessary movement of materials
- Defects – scrap and rework
- Inventory – Storing more than the absolute minimum needed
- Wasted motion – unnecessary reaching, walking, looking for parts, tools, prints, etc
- Excess processing – due to poor tool or product design

important

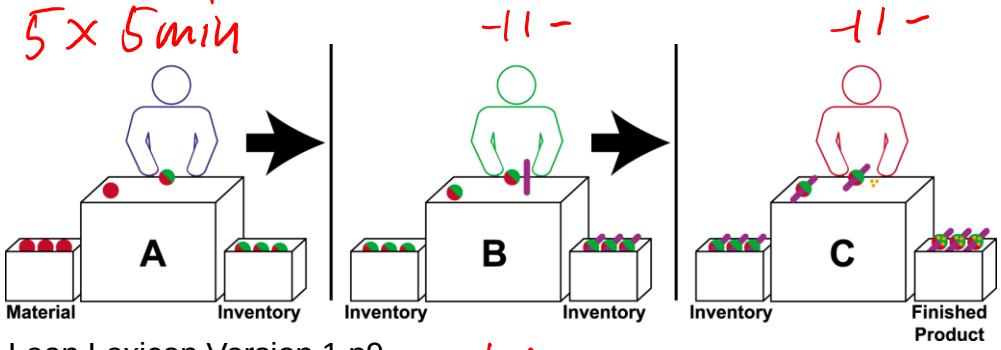
What is *Flow* ?

to understand !!

- Producing and moving one item at a time (or a small and consistent batch of items) through a sequence of process steps as continuously as possible, with each step making just what is requested by the next step.

a) PUSH

TRADITIONAL



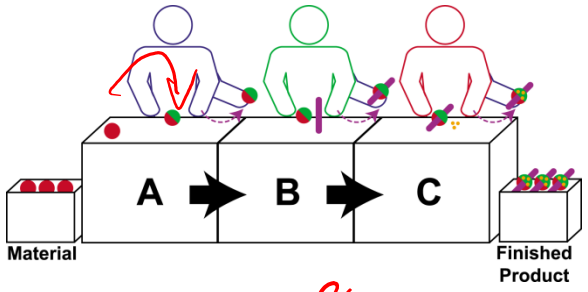
5 x 5 min -11- -11-

batch

Lean Lexicon Version 1 p9

PULL JIT b)

CONTINUOUS FLOW



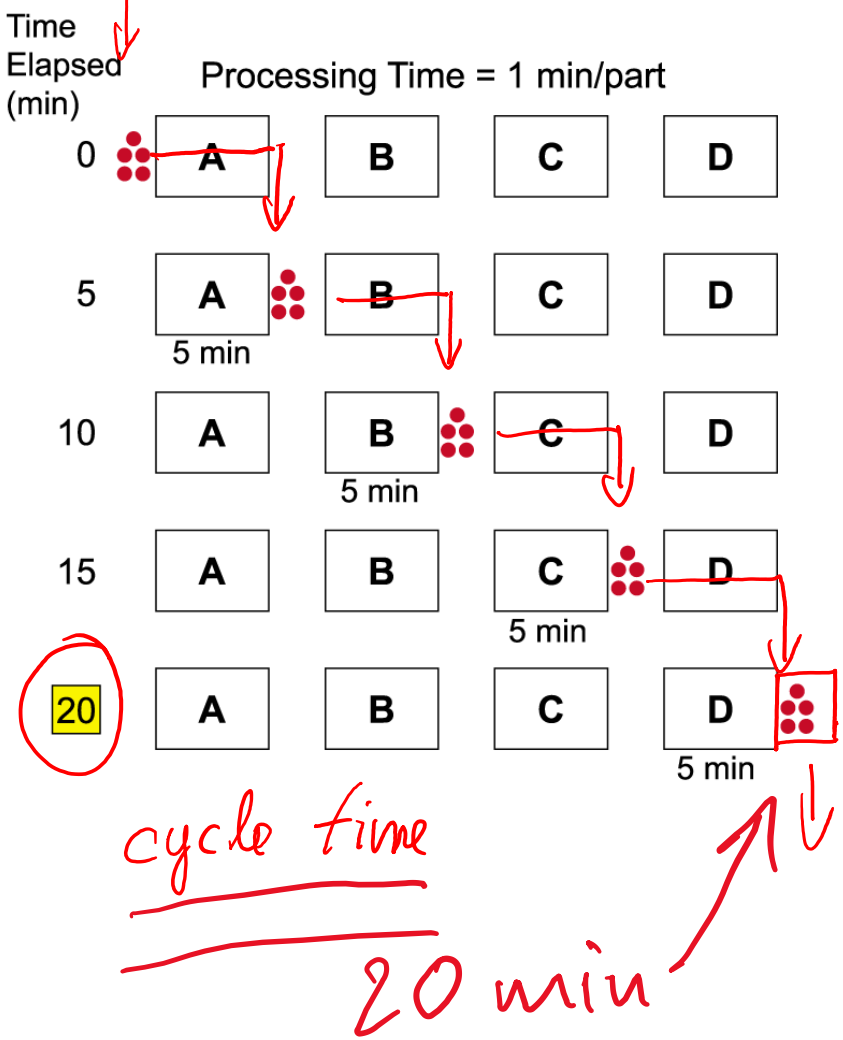
1 min 1 min 1 min

one-piece flow

Continuous Flow – More Efficient & Faster

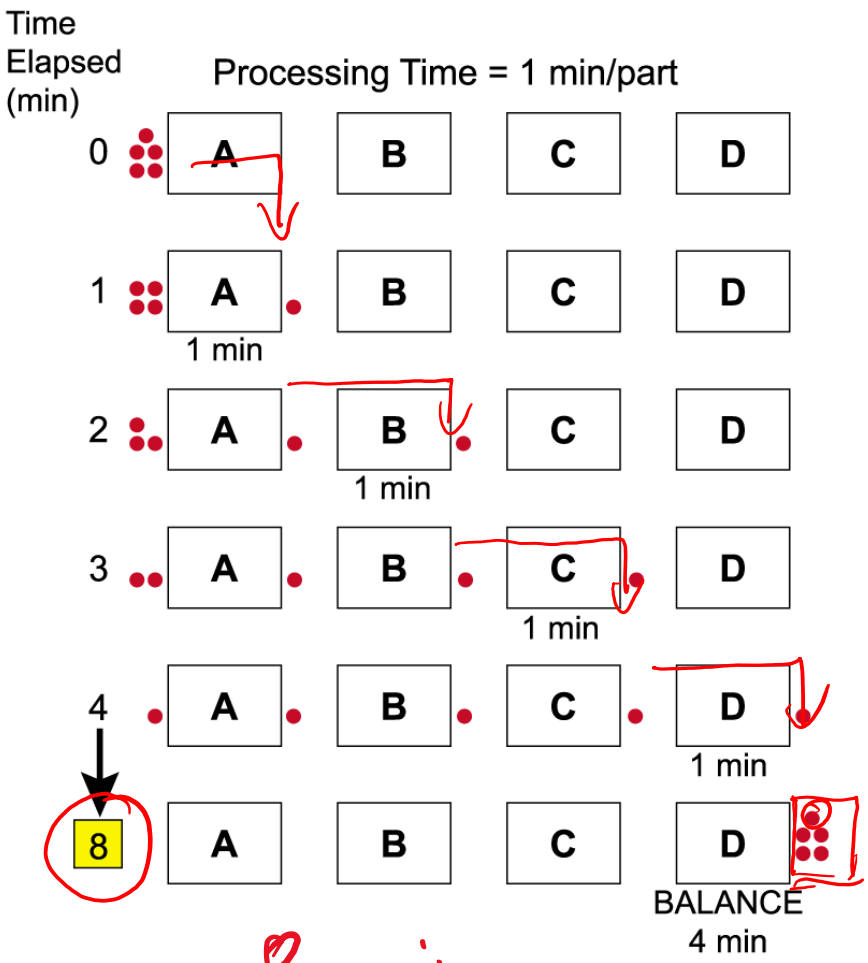
Example

Traditional Batch Layout

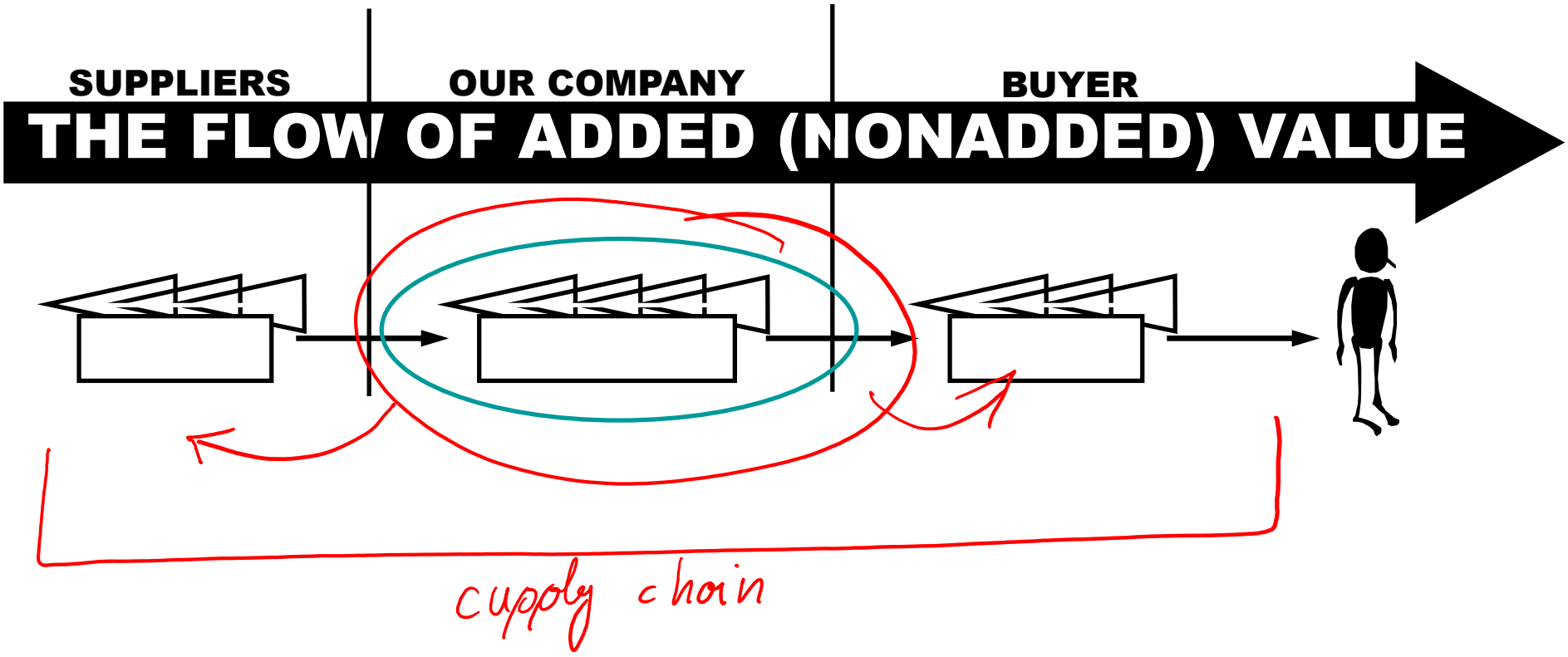


one piece flow

Continuous Flow Layout

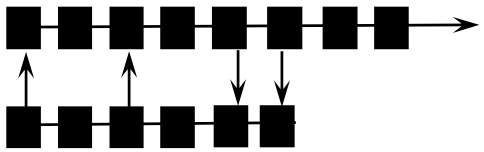


Process:
The Flow of Added (Non Added) Value



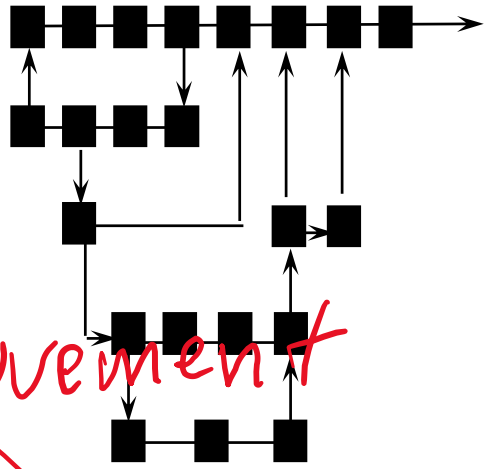
Different views on the process

How we *think* it is ... ①



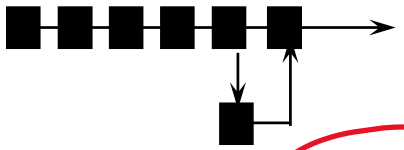
How it *really* is.... ②

base for improvement



... As – is state

How it *will* be... ④



... Future state

what we can

How it *could* be... ③

... Ideal state

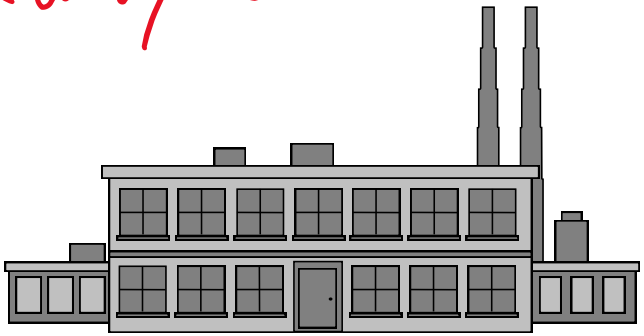
hard to achieve!!

The whole flow of Added Value

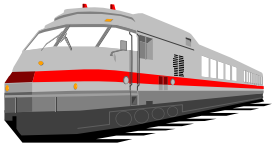
only example

Sawing Trees

Transport



Stationery

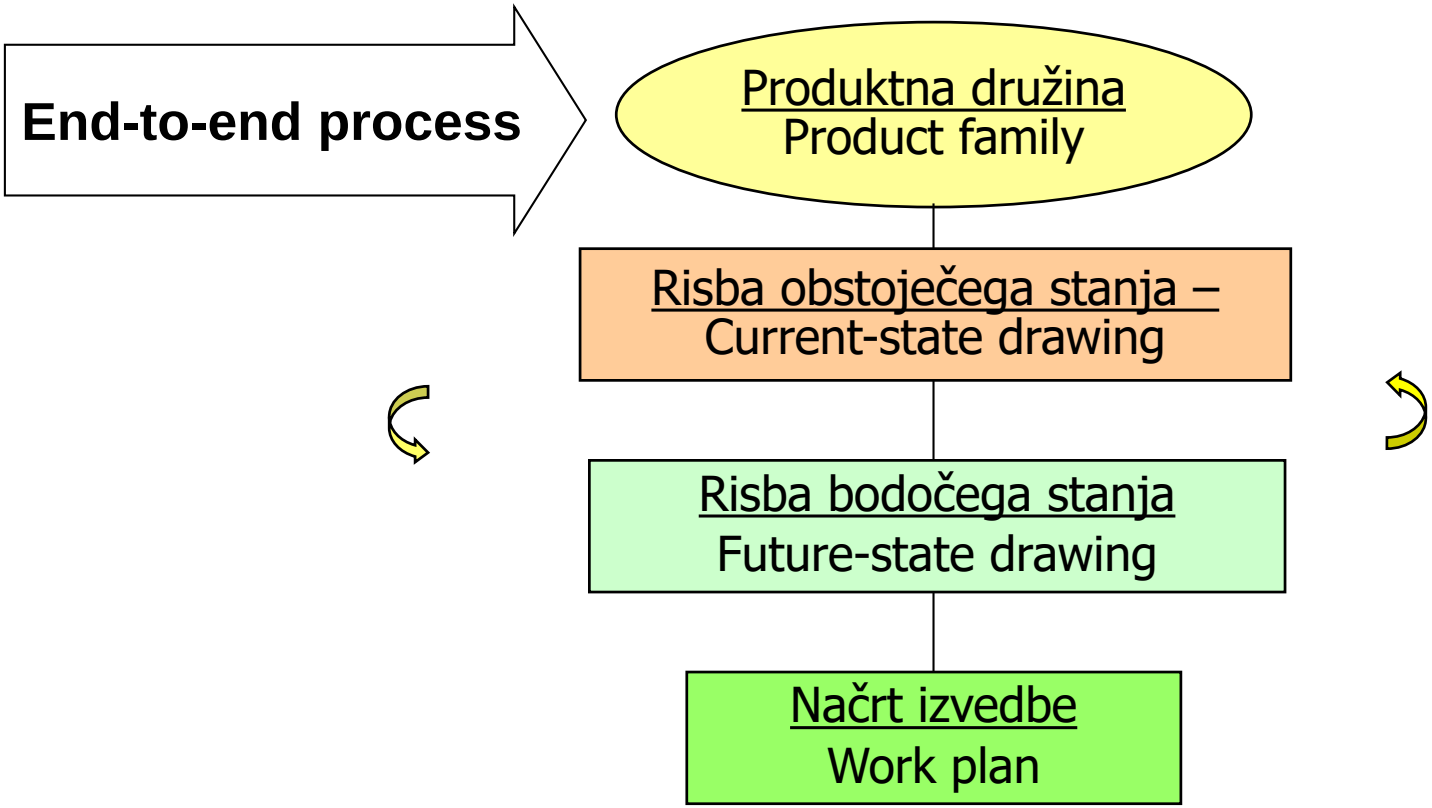


Transport to printing works

Book production

Selling to final buyer

Drawing of the flow of adding value - Value Stream Mapping



+ possibility of immediate savings?

"Quick Wins"

What is a *Value Stream* ?

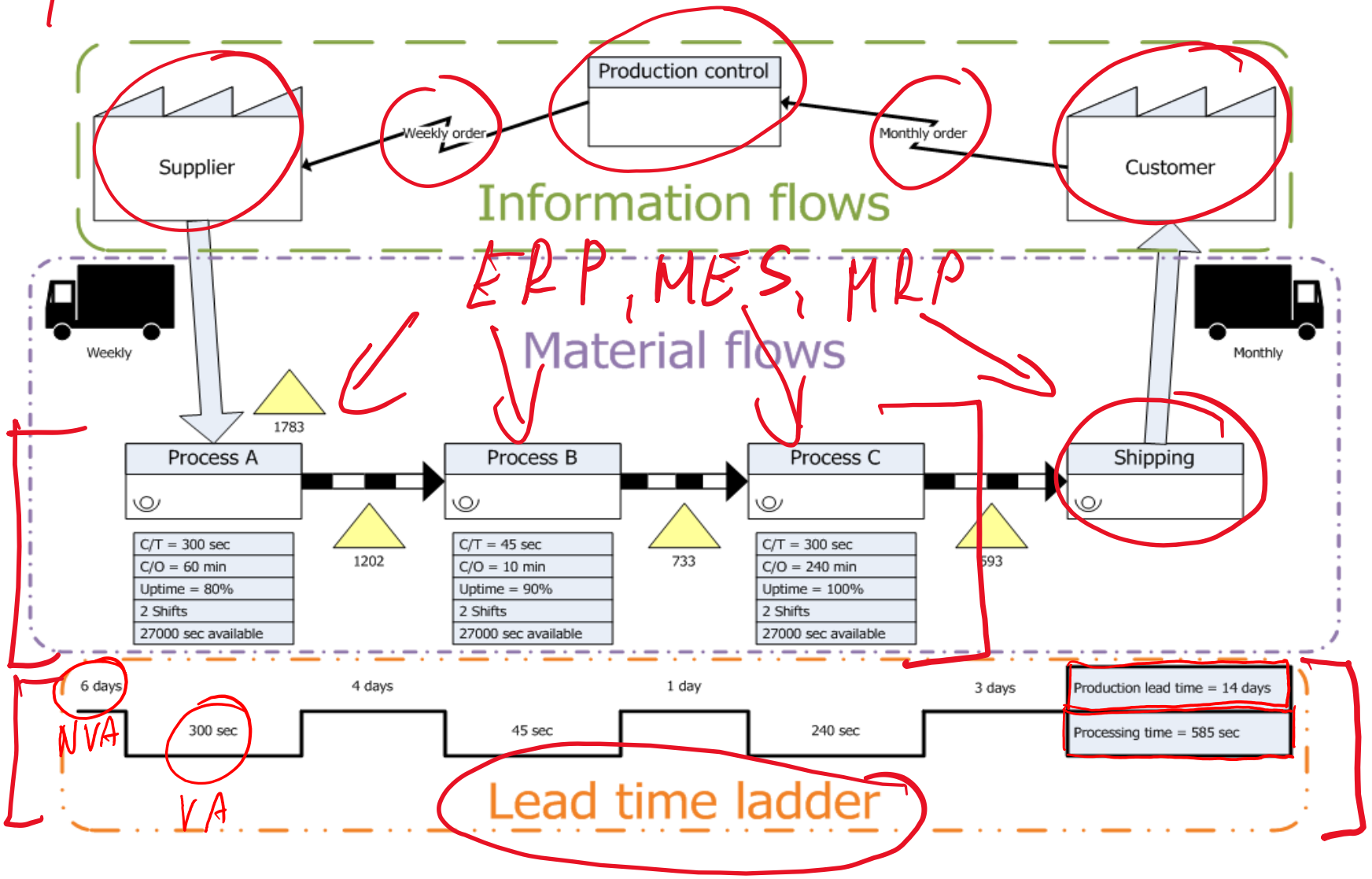
- A *Value Stream* is all the actions, value creating and non-value creating, required to bring a product from order to delivery
  - Starts with raw materials
  - Finalizes at the end-customer
  - Involves several businesses

Important !!

Draw a VSM diagram and explain main components!

How the VSM look like - visualization

Important



Value Stream Mapping

Important

- Helps you to see the sources of waste in the value stream
  - Shows the flow of information and material
  - Forms the blueprint for lean implementation (Imagine trying to build a house without a blueprint).
  - Helps you to see more than just the single process level
  - Provides a common language for talking about manufacturing processes
  - Makes decisions about the flow apparent, so they can be discussed
  - Ties together lean concepts and techniques, which helps to avoid “cherry picking” Improvement projects

Mike Rother
Learning to See

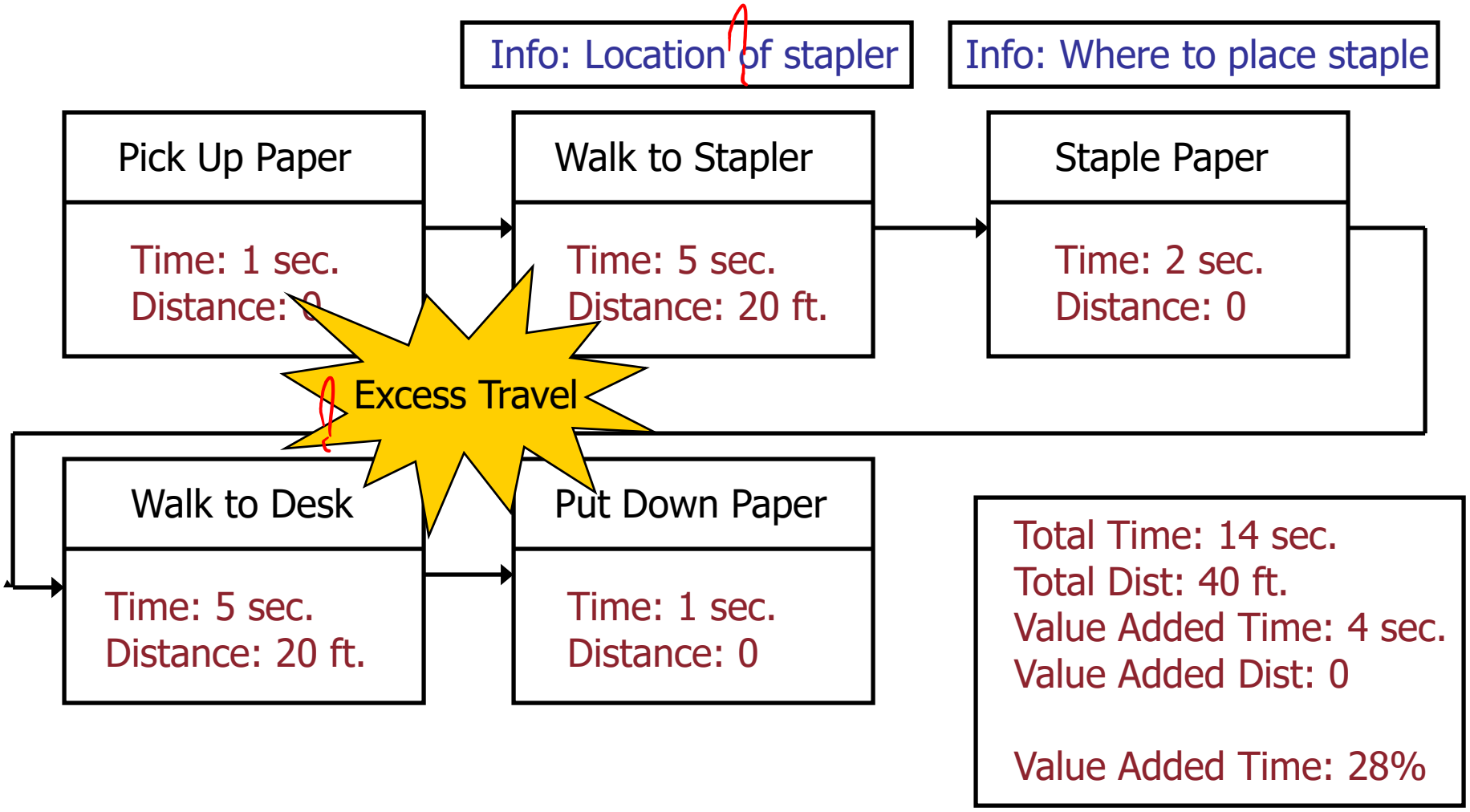
What is *Value Stream* Analysis?

important

- Value stream maps describe a value stream
- Value stream analysis is a planning process
  - Uses value stream maps to communicate
    - Information Flow
    - Material Flow
- Three value stream maps are created
  - Current state
  - Ideal state
  - Future state (3 months from now)
- Action plans are developed for the future state map

A Simple Example

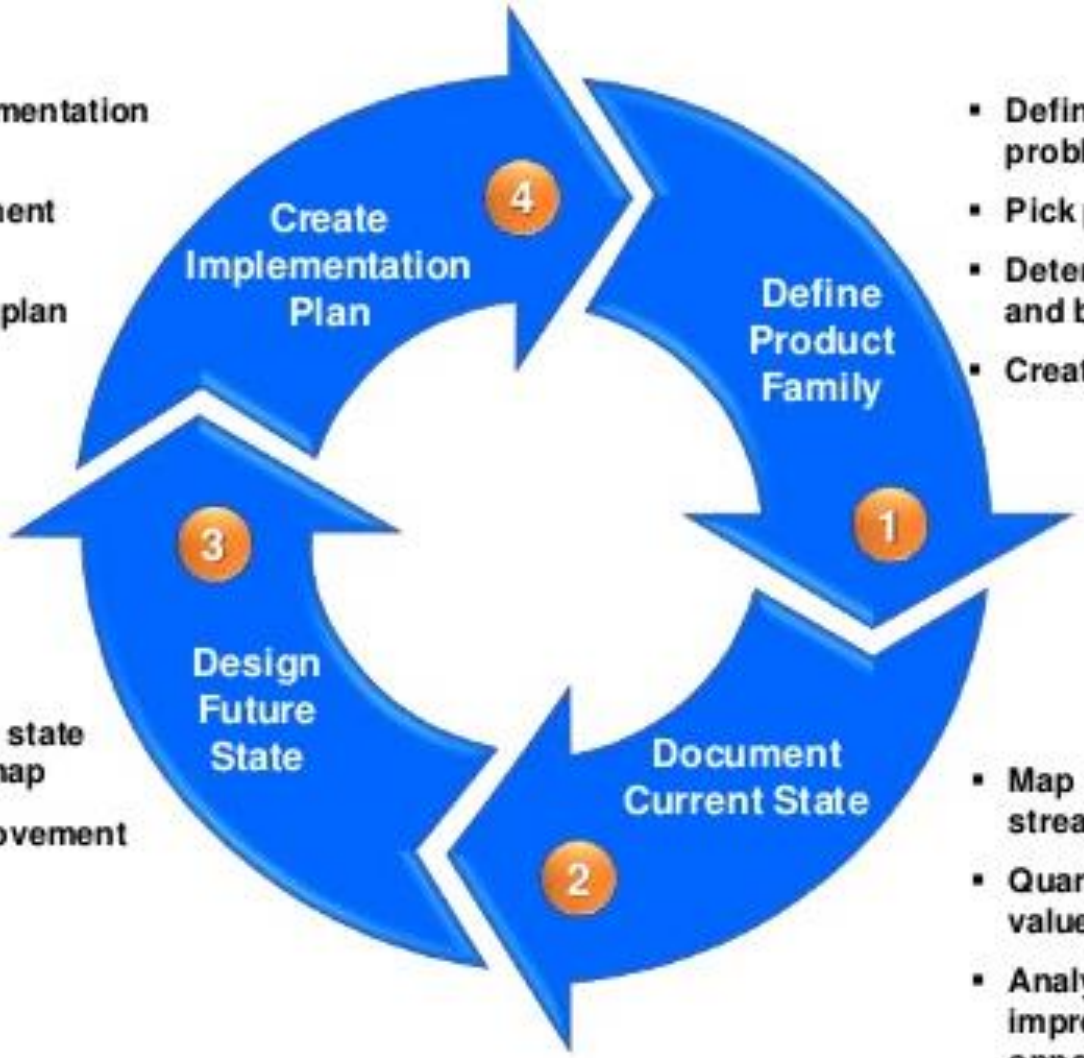
Customer Need:
Stapled pages



Total Time: 14 sec.
Total Dist: 40 ft.
Value Added Time: 4 sec.
Value Added Dist: 0

Value Added Time: 28%

Value stream mapping process



- Define and scope problem
- Pick product family
- Determine VSM objective and benefits
- Create VSM charter

- Map current state value stream
- Quantify current state value stream performance
- Analyze and identify improvement opportunities

- Develop future state value stream map
- Prioritize improvement projects

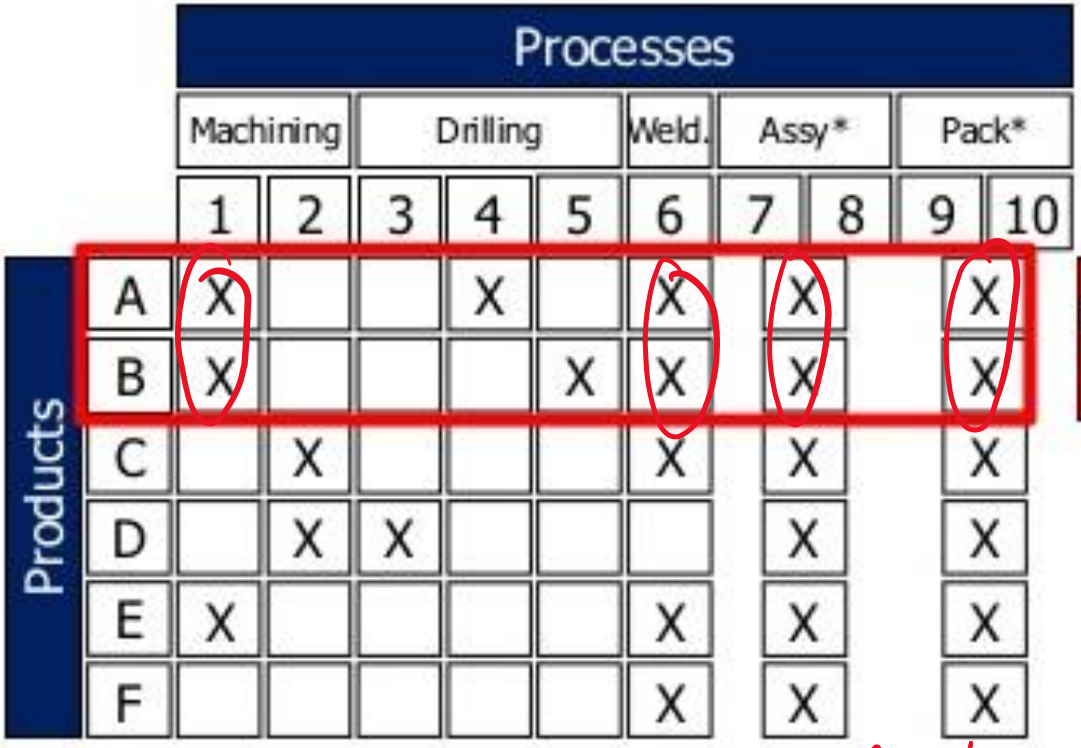
- Develop implementation plan
- Seek management approval
- Implement the plan and monitor progress

Main steps of VSM

1. Training
2. Gemba Walk
3. Value Stream Map-Current State
4. Develop Ideal State Map
5. Develop Future State Map (3 months out)
6. Develop Future State Plan
7. Management Report Out

Scoping: Define a Product Family

Group Product Families by **similar** downstream processes, steps or equipment



Products	Processes									
	Machining		Drilling			Weld.	Assy*		Pack*	
	1	2	3	4	5	6	7	8	9	10
A	X			X		X	X		X	
B	X				X	X	X		X	
C		X				X	X		X	
D		X	X				X		X	
E	X					X	X		X	
F						X	X		X	

Product family

Product family:

- The characteristics of a product family are that the products go through the same – or nearly the same – processes (same flow) and that the products have similar process times.

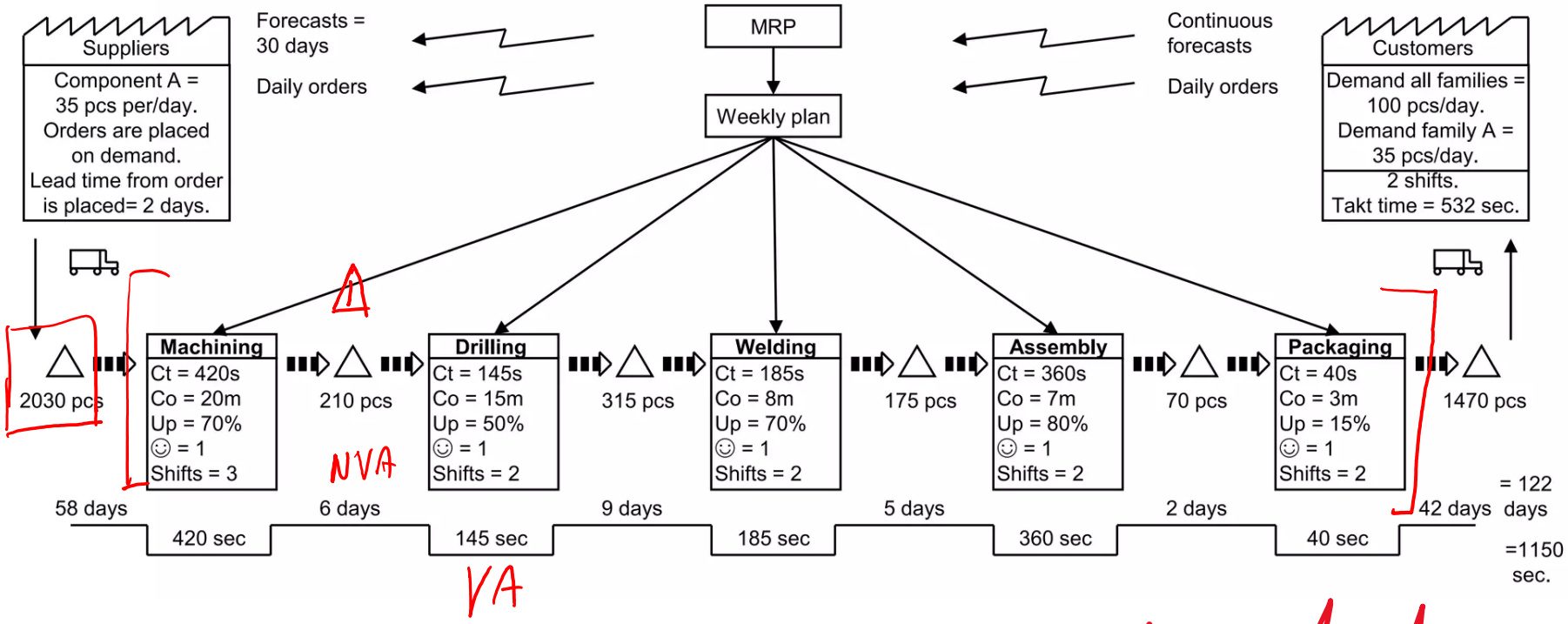
to have major impact

* The two work stations at assembly and packaging respectively are similar. Therefore they are considered as one work station in this analysis.

VSM - Step 3 - Value Stream Map-Current State

CT – Cycle time
CO – Changeover time

UP – Uptime (time, when the machine is working)
☺ – Number of operators

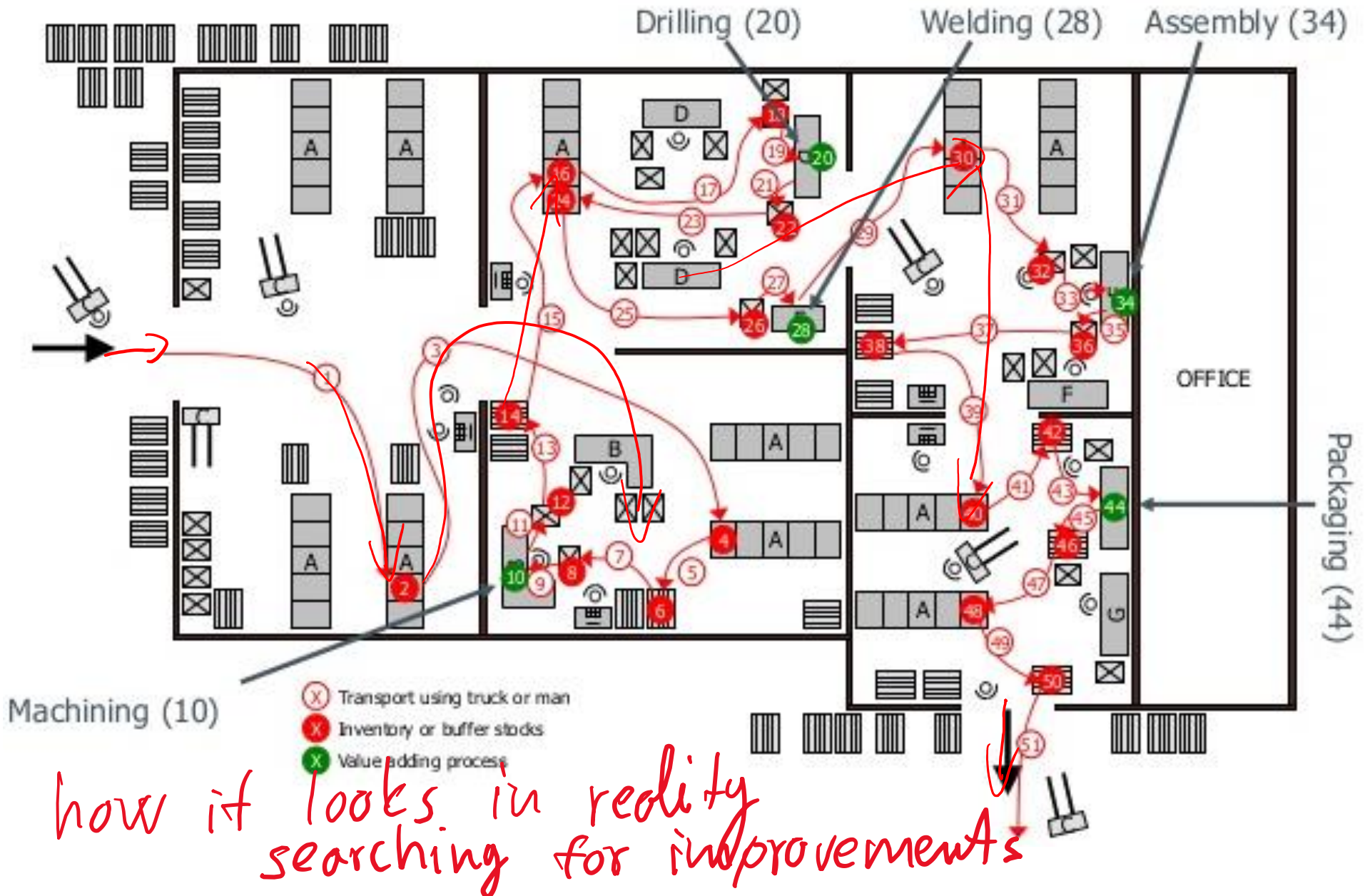


visualisation

Important

VSM - Step 3 - Value Stream Map-Current State

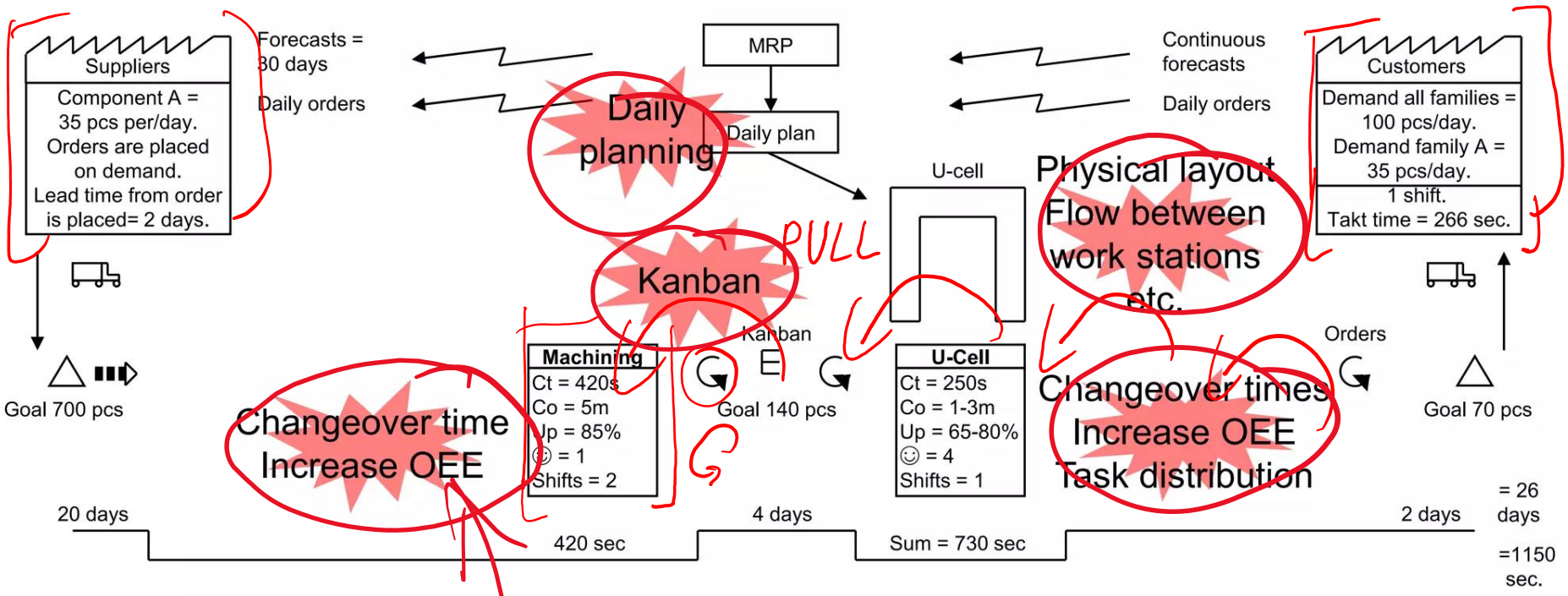
important



how it looks in reality searching for improvements

VSM - Step 3 - Value Stream Map-Current State

Important



highlighted solutions, possible changes

KAIZEN burst (indicators)

a lightning webinar
by **Net Objectives**

mapping a

Value Stream

to a

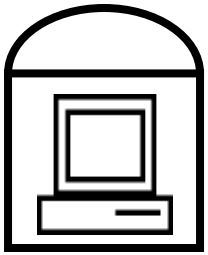
Kanban Board

featuring

Alan Shalloway

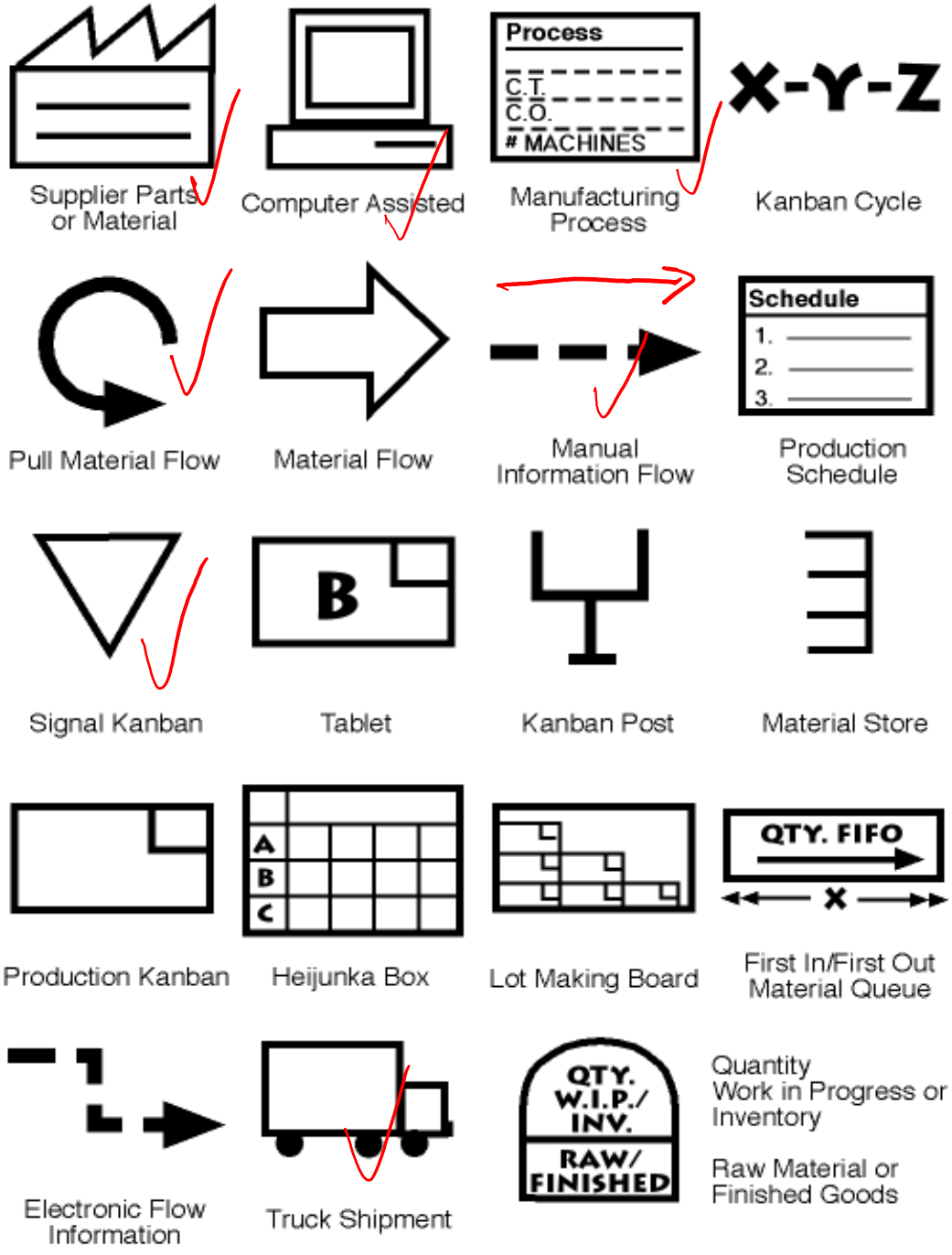
Mapping Icons

We have to know the symbols to



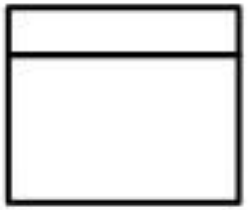
COMPUTER WIP

draw a map



Value Stream Mapping Symbols

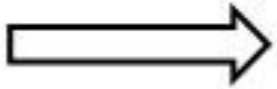
important

Symbol	Name	Description
	Process	Represents a process or operation through which the material flows. Usually, detailed process steps are not shown unless there are significant inventory build up or batch transfers.
	External Sources	Represents the supplier or the customer. The supplier is the start point and it is usually placed on the upper left of the map. The customer is the end point and it is usually placed on the upper right.
	Shipment	Represents the transportation of materials from an external source or finished goods to the customers.

Important to know the main icons – building the VSM diagrams, current state map and future VSM map

Value Stream Mapping Symbols

Important

Symbol	Name	Description
	Operator or Employee	Represents operator(s). The number of available operators is shown below the symbol.
	Push Arrow	Represents the movement of materials from one process to another. It is used when the previous process 'pushes' materials to the next process regardless of whether it is needed by the next process.
	Material Receipts & Shipments	Represents movement of finished goods to the customer. It can also be used to represent movement of raw materials from the supplier to the factory.

Important to know the main icons – building the VSM diagrams, current state map and future VSM map

Primary measurement tool

Takt Time

1

KPI 1

Takt time paces production to the pace of customer requirements.

$$\text{Takt Time} = \frac{\text{Total daily operating time}}{\text{Total daily customer requirement}}$$

Operating time = 1 shift x 8 hours – (2) 20-min breaks

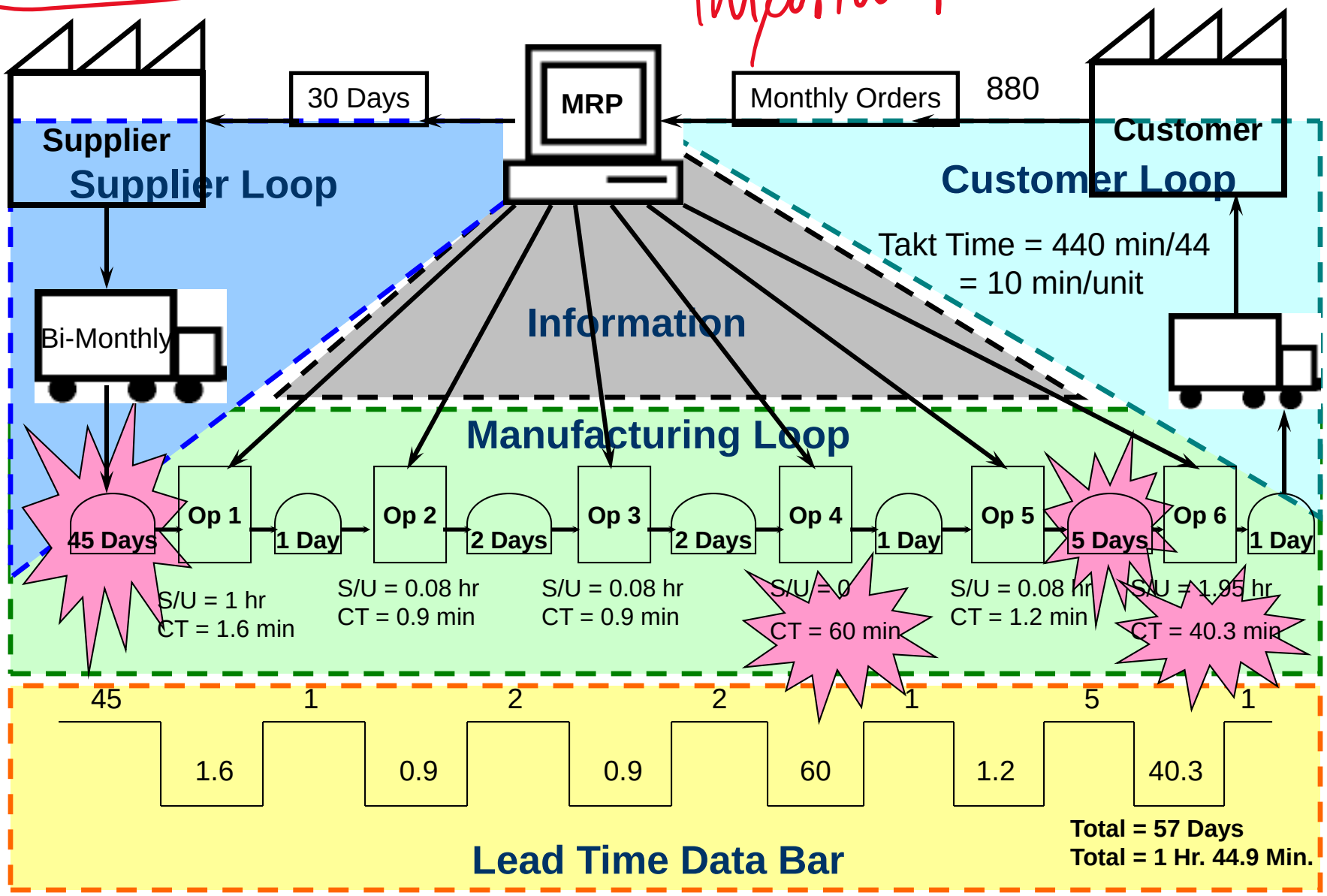
= 440 mins/day

$$\text{Customer Requirement} = \frac{880 \text{ units/month}}{20 \text{ days/month}} = 44 \text{ units/day}$$

$$\text{Takt time} = \frac{440 \text{ mins/day}}{44 \text{ units/day}} = 10 \text{ mins/unit}$$

Elements of Value Stream Maps

Important



https://www.youtube.com/watch?v=ym1YHjxtBb4

(2) (Process Cycle Efficiency – PCE) KPI 2

Key performance indicator

data from VSM

$$PCE = \frac{\text{Value Added Time}}{\text{Lead time}}$$

KPI

Key Performance Indicator

$$PCE = \frac{1 \text{ Hr } 44.9 \text{ min}}{57 \text{ Days}}$$

The max is 100%

$$PCE = 0.00127 * 100\% = 0.127\%$$

Very low value

Important

Usually:
0.2 – 0.5 (most of the companies)
1 - 10 (best companies)

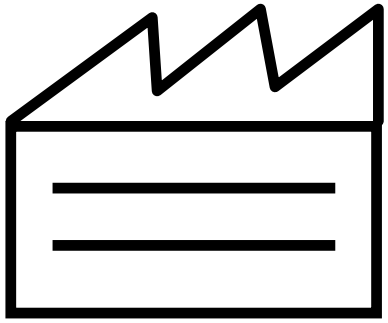
When defining the possible improvements

Manufacturing Loop Questions

- What are the changeover times?
- What are the quantity of machines per process?
- Count all work in process (WIP)
- Look for evidence of quality problems
- Look for processing waste
- Is there great distances between processes?
- Is the product flexible or made to order?
- Is there obvious batch processing?

When defining the possible improvements

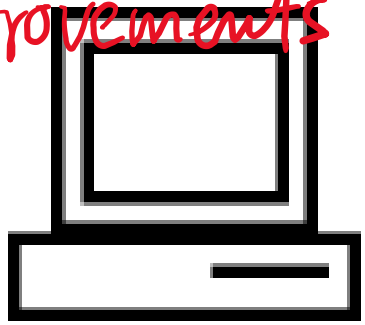
Customer Loop Questions



- Who and where are your customers?
- What are the product lines or families?
- Future marketing plans? Review growth potential.
- What is the total yearly order requirement? Quantity by product family or product type?
- What is the high, low and mean ordering pattern? Monthly or quarterly high & low for several periods?
- How often do we deliver to our customer?
- What takt time do we supply to?

When defining the possible improvements

Production Control Questions



- Where in the production chain do we trigger production?
- How much work do we release at one time?
- How long does it take to go from customer order to production order?
- How do we physically schedule production?
- How do we react to customer emergencies?

When defining the possible improvements

Supplier Loop Questions

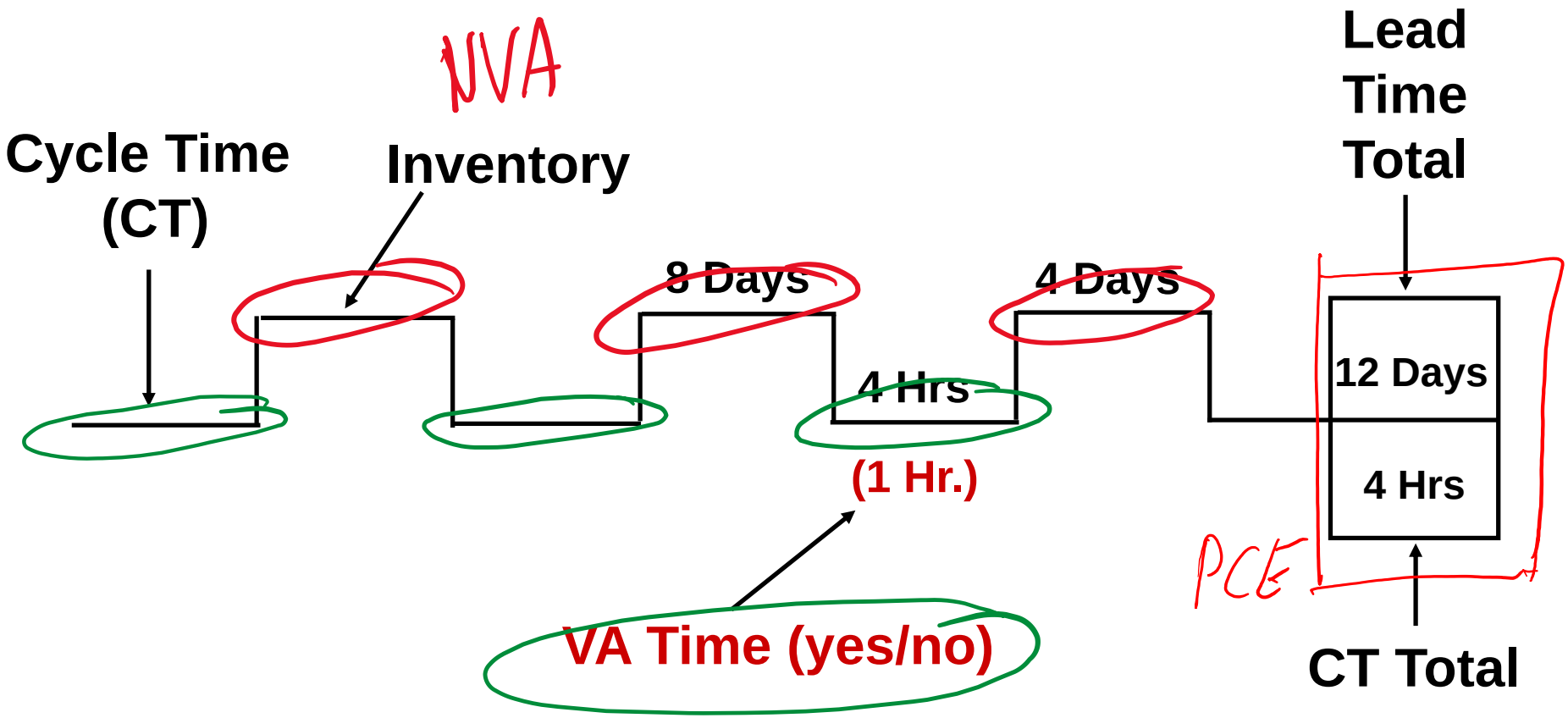
- **#1 question, how do you tell suppliers what to ship, make, etc.?**
- When and how often do they get purchase orders from Customers?
- When and how do we change the purchase order?
- When and how often do suppliers ship product and how? is it level? (Truck, train, etc.)
- Do we have standard pack quantities?
- Are suppliers aware of our inventory quantities?
- Are we sure of suppliers inventory? How?
- Do we have a supplier training program?

When defining the possible improvements

Information Flow Questions

- How are the manufacturing and procurement orders distributed?
  - Who gets them
  - How frequently
  - What is the process of generating them
- How are the shop order schedules generated and revised? Are there “shortage meetings”? What parts of the manufacturing loop are scheduled by MRP? Make sure to document the informal (hot lists) as well as formal (MRP) information channels.

Current State Lead Time Data Bar



When defining the possible improvements

Visually Identify Waste

- As a team, review each process step for elements that are value added and non value added
- * Each step can have any combination of value added, type 1 waste and/or type 2 waste
  - Identify value added with a green dot VA ✓
  - Identify type 1 waste (waste but unavoidable in the current state) with a yellow dot NVA ✓
  - Identify type 2 waste (pure waste, eliminate immediately) with a red dot NVA ✗
- As type 2 waste is identified, generate the actions to remove it (this will be the beginning of the future state implementation plan)
- Prioritize the waste opportunities and identify the biggest opportunities on the CS map with kaizen bursts

VSM - Step 4: Ideal State Map

Important

- Avoid shared resources
- Assume that anything is possible
  - Our customers are happy
  - Our profits are up
  - High job satisfaction
  - Capital is available if needed
- Create an ideal state map
  - Map the physical flow
  - Map the information flow
  - Complete the lead time data bar

VSM - Step 5: Future State Map (3 months out)

Important

- What of the ideal state map can be implemented in 3 months?
- Identify short term goals
  - LEAD TIME ✓ short
  - INVENTORY ✓ reduce
  - PRODUCTIVITY ✓ improve
  - QUALITY ✓ ↑ improve
  - CAPACITY ✓ ↑ improve
- Work from your current state map

VSM - Step 6: Future State Plan

- This plan answers the question, “what actions need to be completed in the next 90 days to achieve the future state?
  - Think back to the “visually identify waste” step
  - Plan addresses all “red dots” and Kaizen bursts

	Activ-ity	GOAL/ OPPORTUNITY	ACTION	PRIORITY	LEADER	DATE			STATUS/REMARKS
						OPEN	EST COMP	ACT COMP	
1	Test	The electrical station is located away from the test area.	Re-locate electrical station closer to test area.	Short Term	TEAM	1/5/2005	1/10/2005	1/7/2005	THE ELECTRICAL TEST STATION HAS BEEN RELOCATED NEAR THE TEST AREA
2	Assy	Only three technicians are certified solderers.	Train and certify more technicians to perform soldering	Short Term	Joe	1/5/2005	4/30/2005	3/18/2005	4 MORE TECHNICIANS HAVE BEEN TRAINED
3	Plan'g	Details are being issued in the middle of the process	Review kitting process	Long Term	John	1/5/2005	3/15/2005		Most of the detail parts are part of POU inventory. The leftovers will be looked at case by case.

VSM - Step 7: Management Report

NOTES!! FINDINGS

- This report is about how the team publicly commits to management
  - What the goal of the event was
  - What was learned
  - What was accomplished during the event
  - What the outcome is. How much better will we be?
  - Description of the future state
  - Commitment of the action plan

saved for the future

Important

Additional educational material

Create Real-Time Value Stream Maps with Industry 4.0:
https://www.youtube.com/watch?v=iPgFZ_mIdwo

VSM 1 – Introduction to Value Stream Mapping (VSM)
https://www.youtube.com/watch?v=HgS0Ig0ii94

VSM 2 – How to build a VSM? Symbols and Steps
https://www.youtube.com/watch?v=lTobwIsGm_g&t=23s