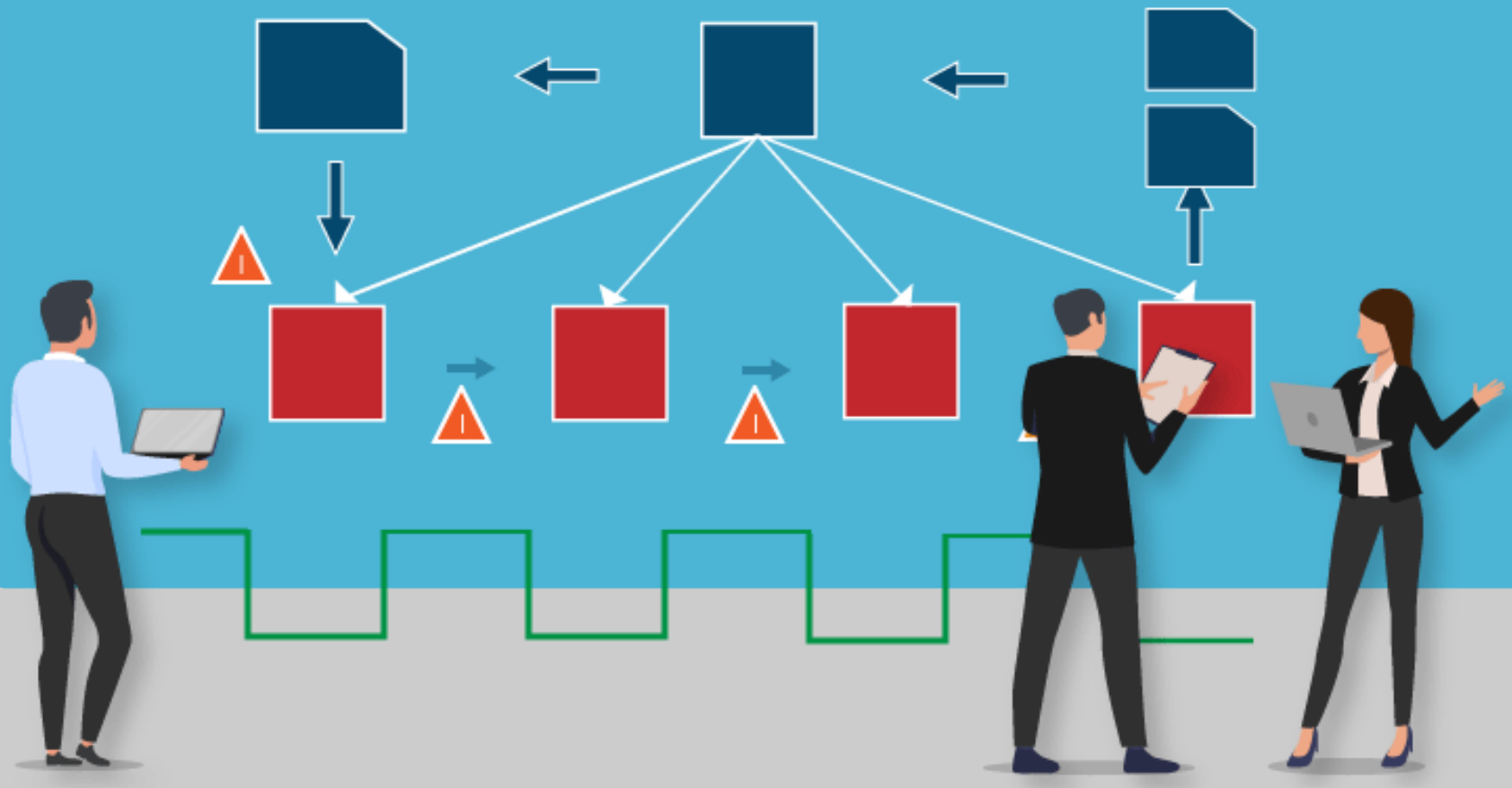




Level 5 – Continuous Improvement with Industry 4.0

Define 3 – example of SIPOC

Suppliers

Steel Mill
Steel supplier
Metal blanking suppliers
Forges

Inputs

Material
Tooling
Material handling
Automation equipment

Process

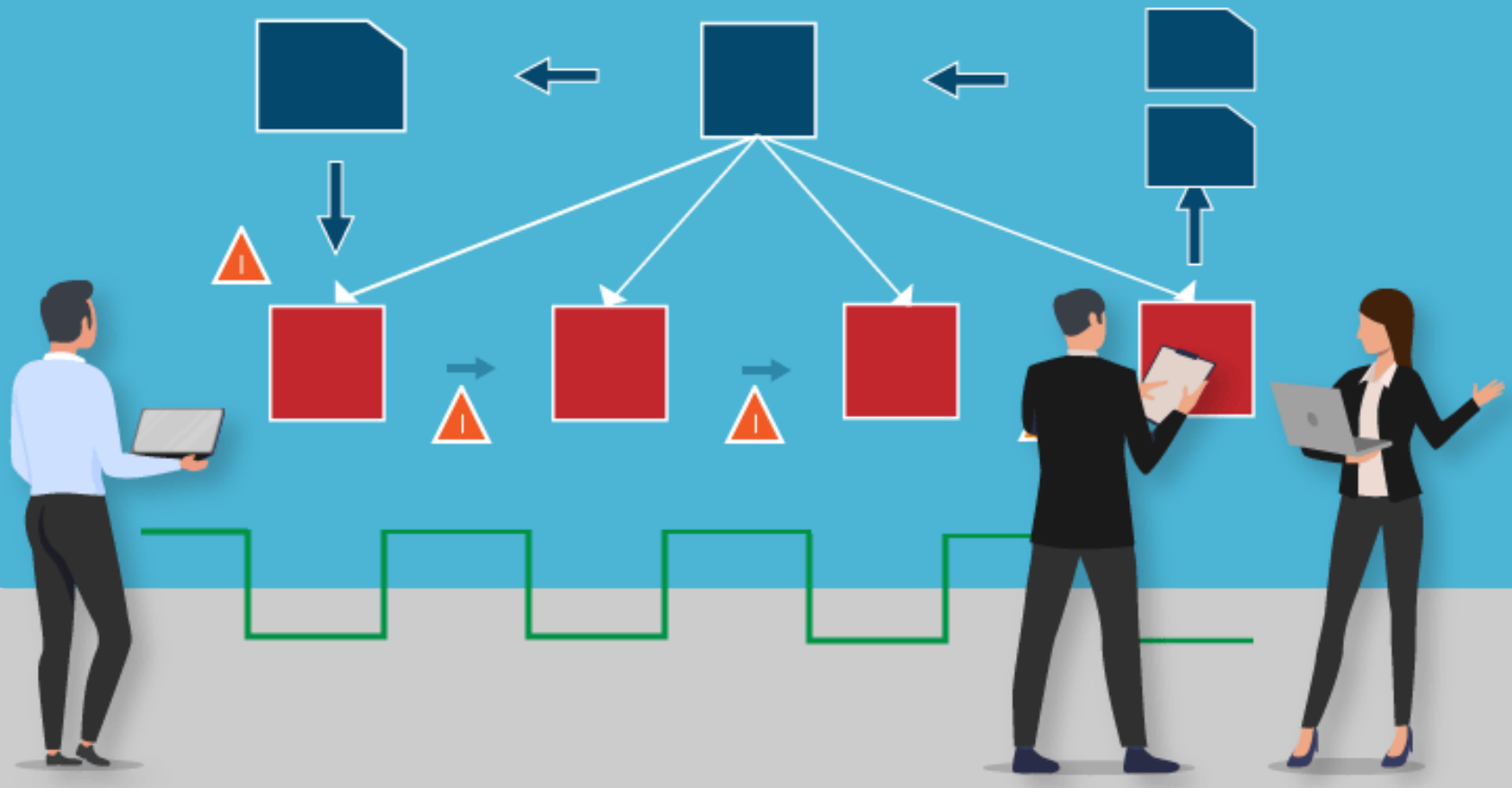
Die loading
Material loading
Robot loading
Quality verification

Outputs

OK Parts
Planned scrap

Customer

Vehicle build
Finished product
Sales



Level 5 – Continuous Improvement with Industry 4.0

Define 3 – Value Stream Mapping

Value Stream Mapping (VSM)

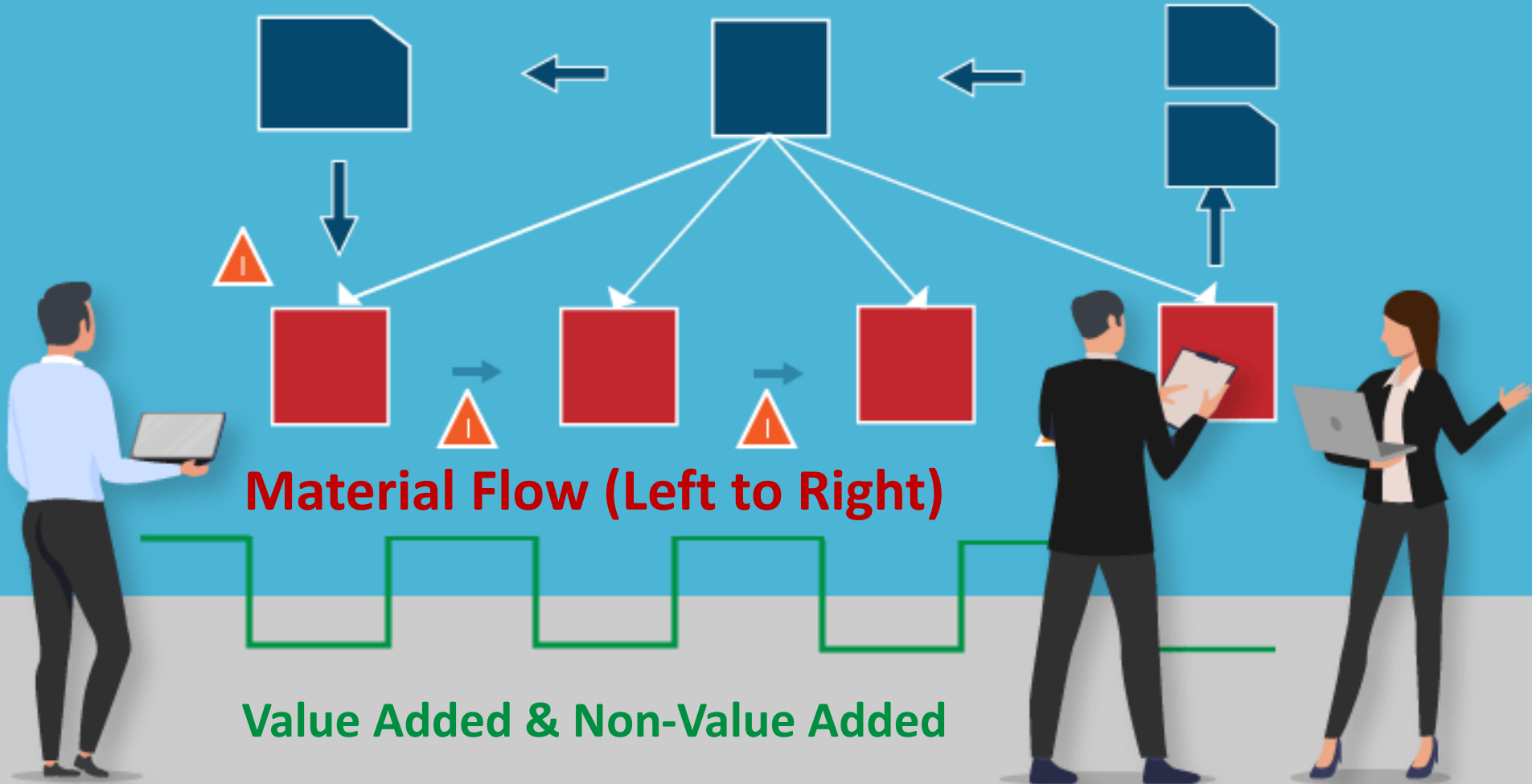
- What is a Value Stream?
- What is Value Stream Mapping (VSM)?
- Why Value Stream Map?
- What can you Value Stream Map?

- A set of actions which adds value to a customer
- A visual means to depict and improve the flow of processes and the flow of information that controls the flow of materials and information through the process.
- Starts with the customer request for a product or service, to the delivery of that to the customer.
- Developed through events, usually 3 to 5 days working with a cross-functional team.
- Any process which adds value to a customer



**All the steps,
required to go
from Concept
to Product or
Request to Cash**

Information Flow (Right to Left)



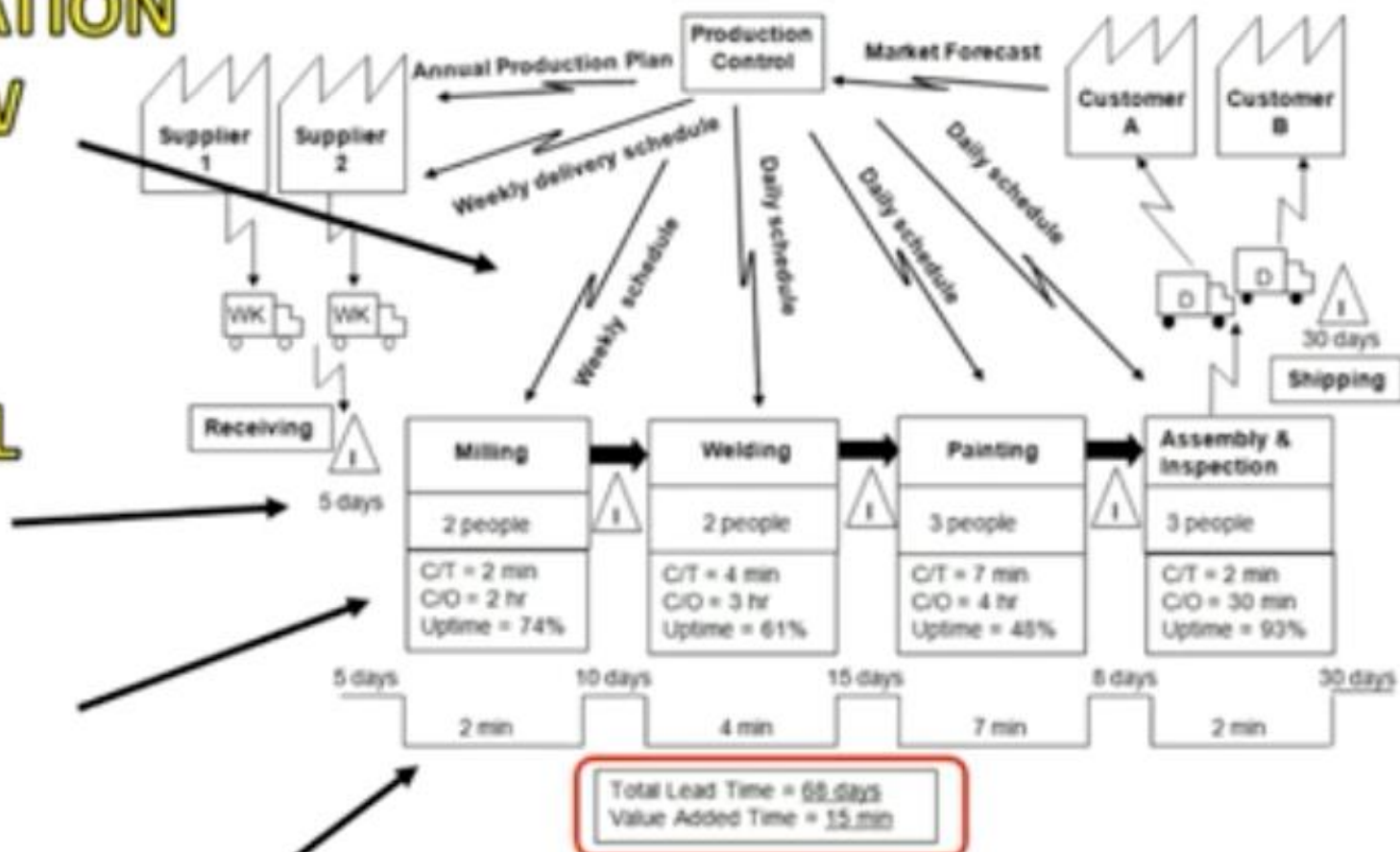
VSM Elements

INFORMATION FLOW

MATERIAL FLOW

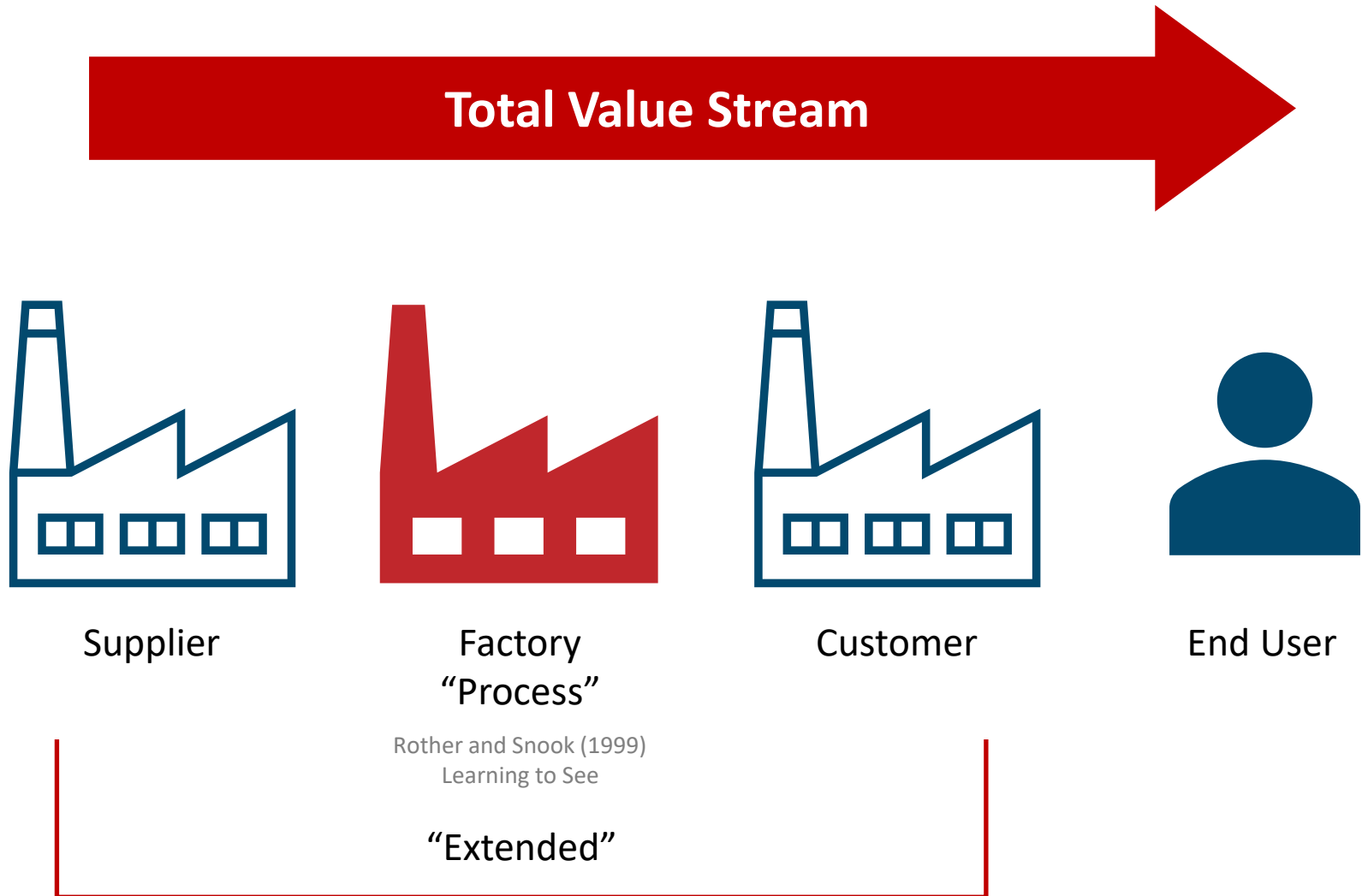
DATA BOXES

TIMELINE



http://www.greensuppliers.gov/tech/tools.html?id=lean_clean

Value Stream Mapping (VSM)



Linking Material and Information flows

MADE



Value Added vs Non-Value Added



**Value Add
Activities**



**Non-Value Add but
necessary.
Incidental Waste**



**Non-Value Add not
necessary.
Pure Waste**

- Transform or shape material or information
- Customer wants it and willing to pay for it.
- Done right the first time.



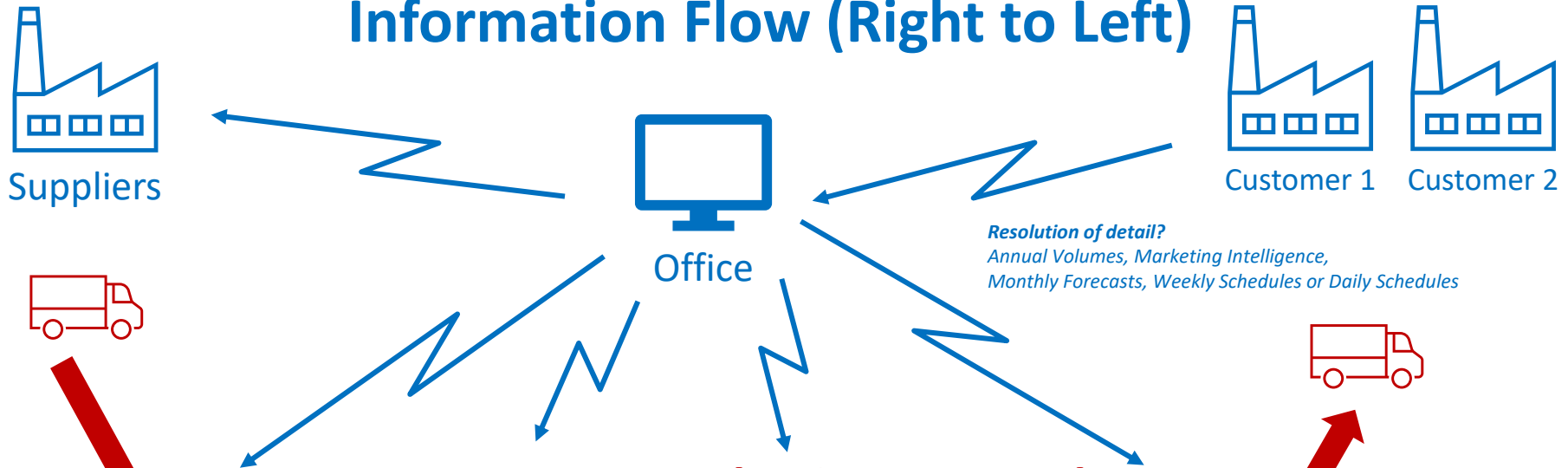
- No value created by required by current thinking.
- No value created by required by the current process limitations.
- No value created but required by current technology.
- No value created but required by Government / Regulations

- Consume resources but creates no value for the customer.
- Could be stopped and it would be invisible to the customer.

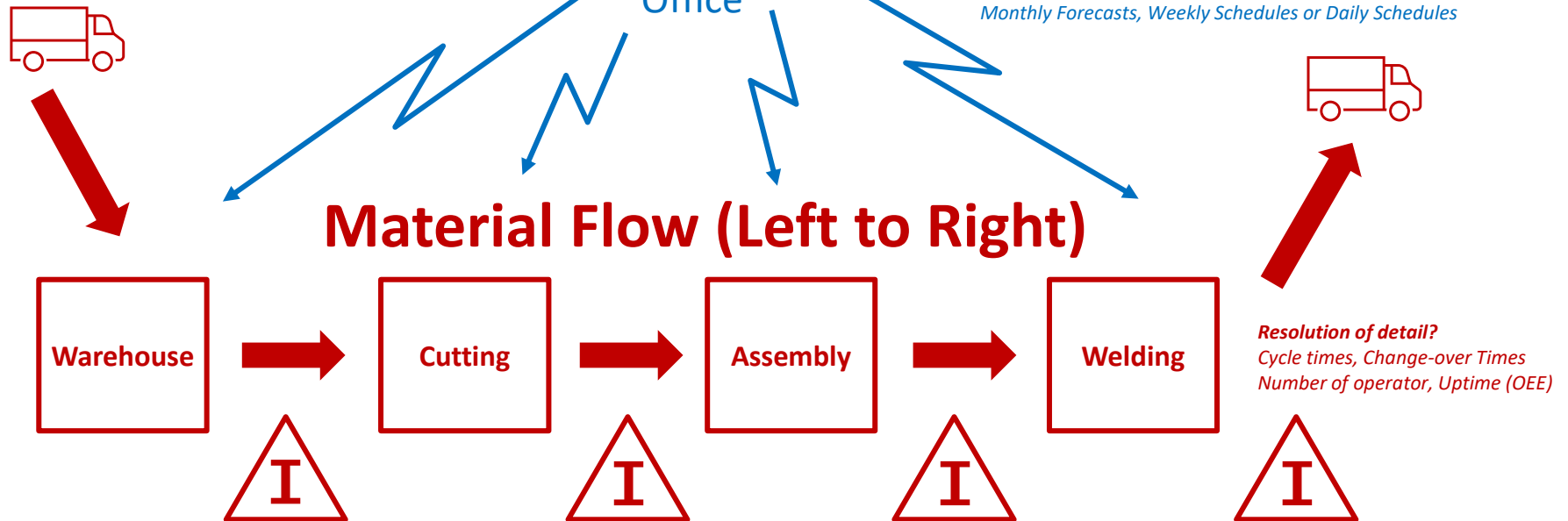


Value Stream Map

Information Flow (Right to Left)



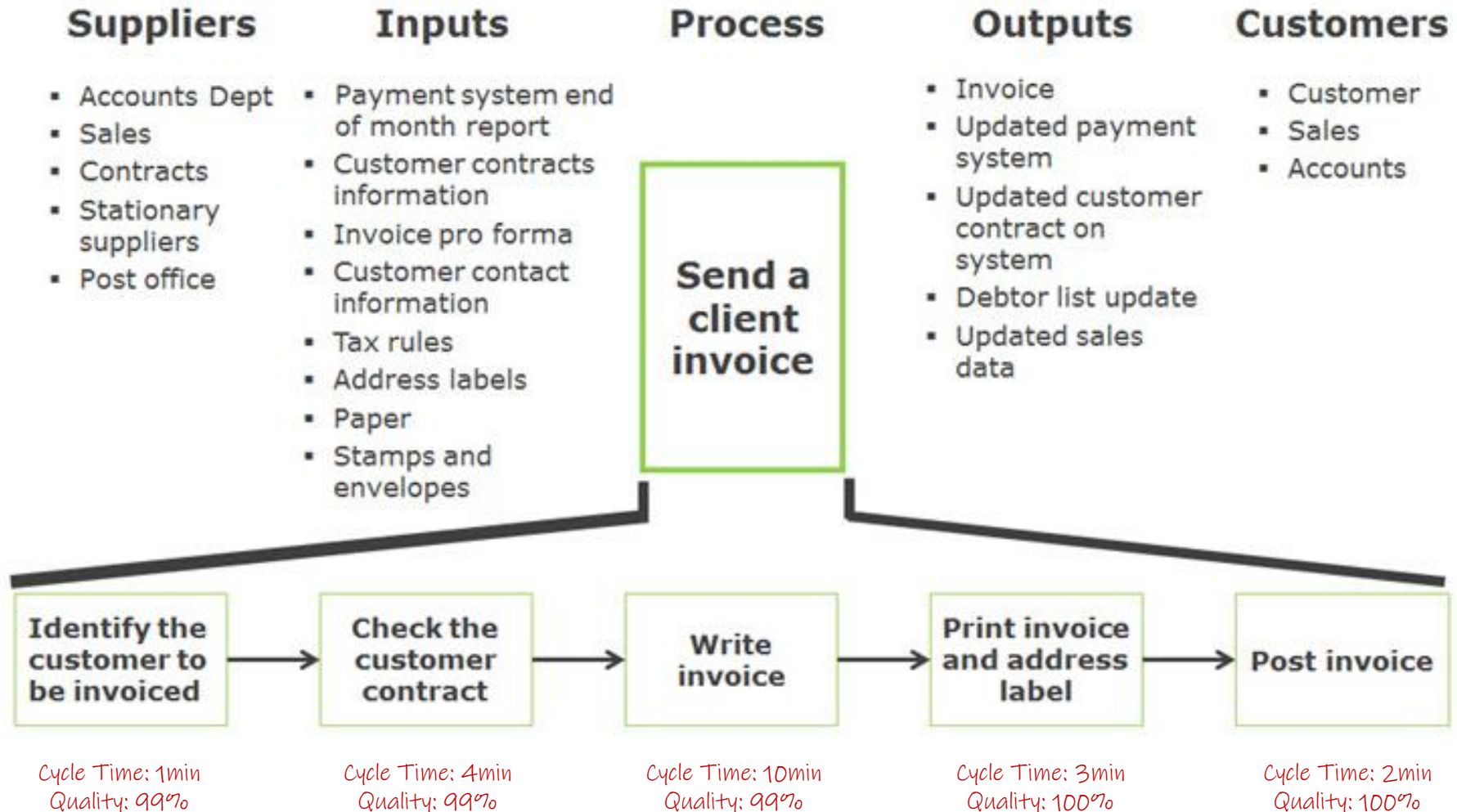
Material Flow (Left to Right)



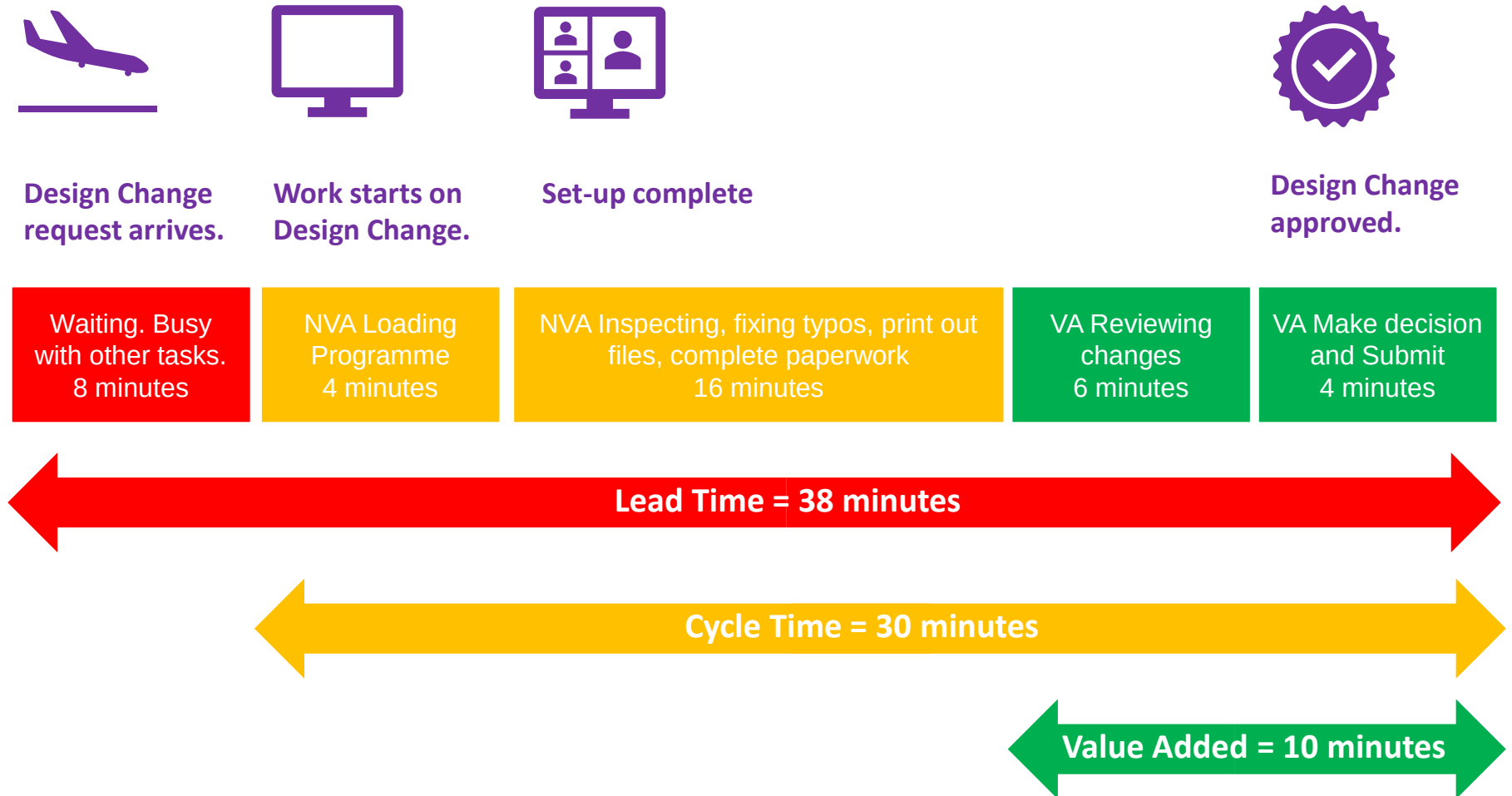
Value Added & Non-Value Added



SIPOC Mapping example – Sending an Invoice



Design Change Review



**Process
Name**

**Review Design
Change**

Lead Time

38 mins

Cycle (Working) Time

30 mins

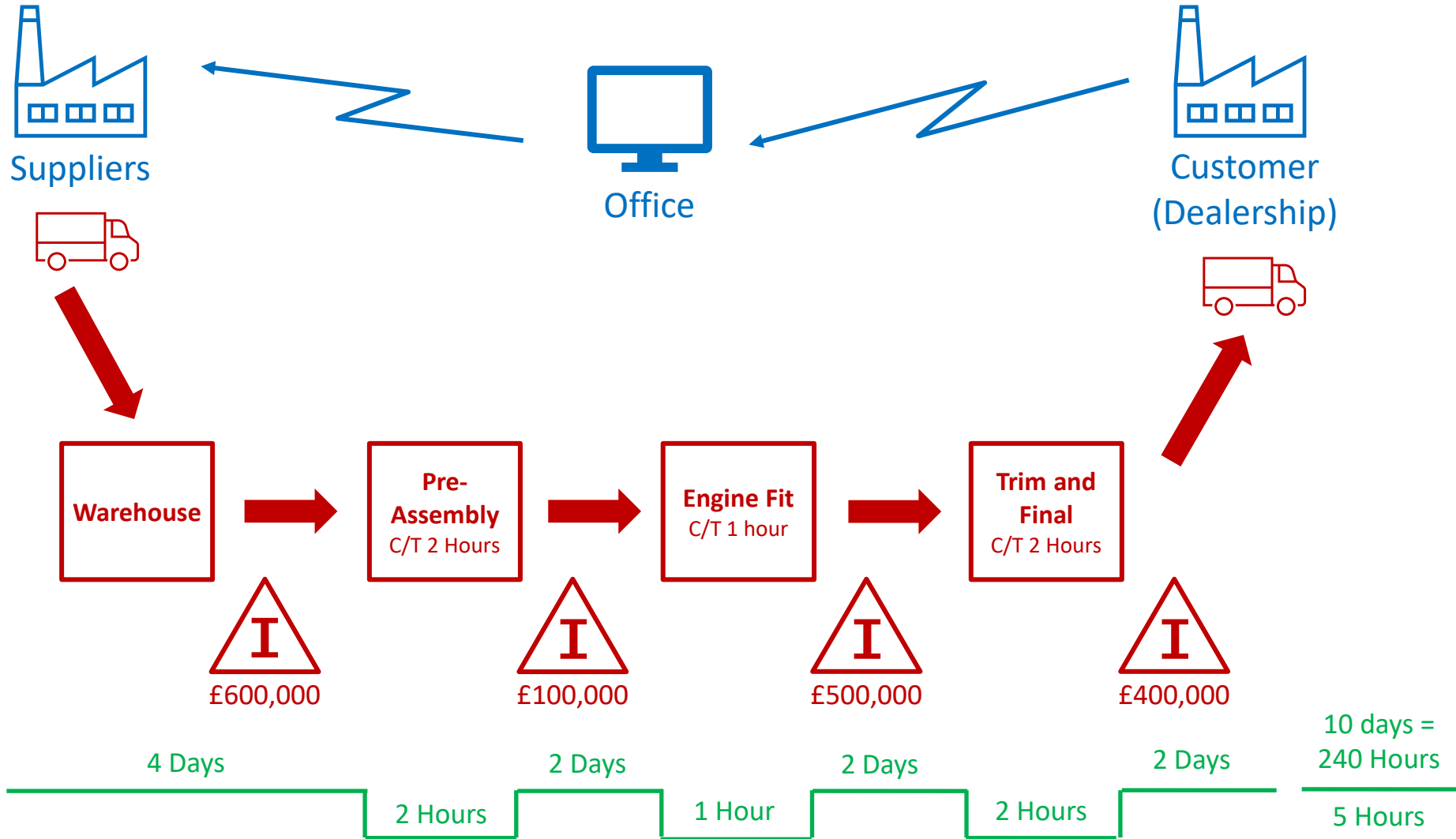
Value Added Time

10 mins

- You manufacture 10 Motorcycles per day
- There's a 10-day cycle time from order from the Customer (Dealership)
- You sell each bike for £20,000

Motorcycle Assembly

MADE



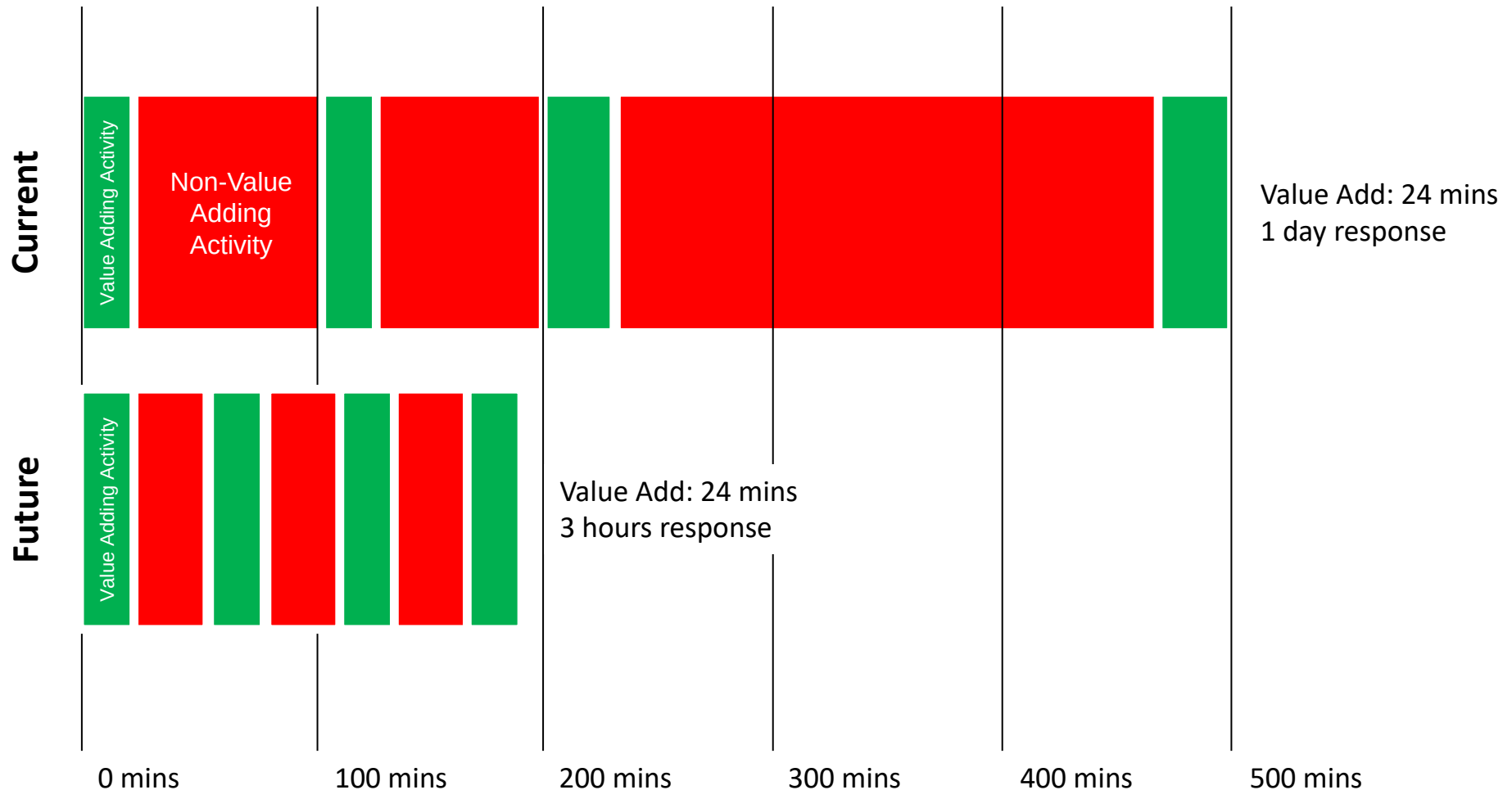
5 hours / 240 hours = 2% Value Add Time

- How do our customers see our organization?
- How do our processes effect what the customer experiences?
- Looking horizontally across a company at system level.
- Highlight areas where the product or service flow stops or is constrained.
- Reduces sub-optimization.
- Team building and networking.
- Improved communication.

- Waste often hides in plain sight, often designed into processes.
- We cannot eliminate waste unless we recognize it as waste.
- Often a task consists of 99% waste;
 - 1 hour task that takes 1 week to provide customer what they requested.



Value Vs. Non-Value Added



Remove Non-Value Adding activity (Red) items before tackling Value Adding activity (Green)

Steps to creating a VSM

- Define key product or service
- Define product family
- Determine improvements needed.
- Schedule event with key team members
- Gather data (preparation)
- Conduct event
- Development Action Plan
- Conduct Event
- Develop Action Plan
- Follow-up (30, 60 and 90 days)
- Schedule VSM Refresher

Define key product or service

- Most frequent requests
- Highest volume of work
- Most critical product or service
- Area with the most issues / problems
- Future growth areas
- High visibility to customers
- Other Strategic decisions

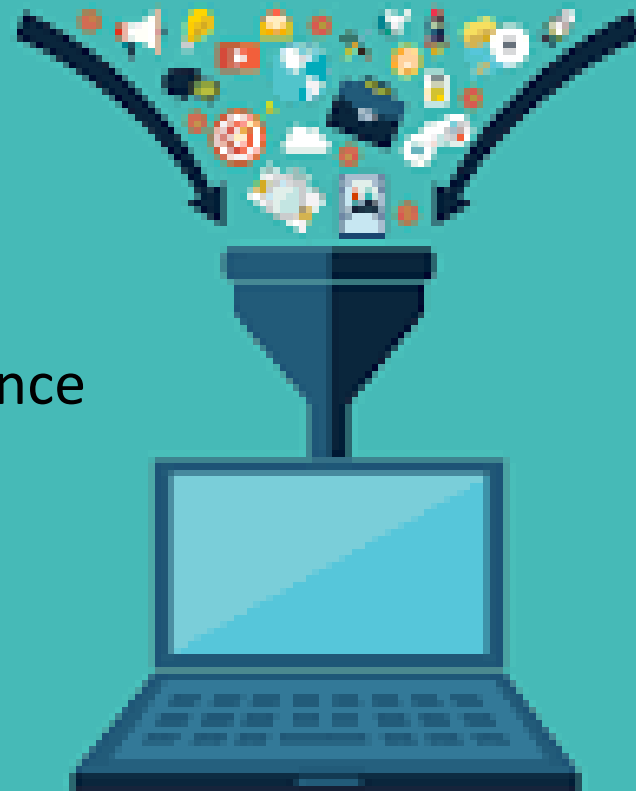
	Assembly Steps and Key Equipment							
	1	2	3	4	5	6	7	8
Product A	✓	✓	✓			✓	✓	
Product B	✓	✓	✓	✓	✓	✓	✓	
Product C	✓	✓	✓		✓	✓	✓	
Product D		✓	✓	✓		✓		✓
Product E		✓	✓	✓				✓
Product F	✓			✓	✓	✓		
Product G	✓			✓	✓	✓		

- Customer complaints and issues
- Financial issues
 - Overtime, margin, inventory, scrap, warranty
- Flow Issues
 - Bottlenecks, missed deliveries, shortages, rework
- Employee complaints and issues
 - Absenteeism, tools, training, interruptions

- Identify key resources across the value stream
 - Use SIPOC diagram
- Find people with most experience
 - Delay event if not available.
- Confirm attendance and expectations
- Review their responsibilities and who they represent.

Gather Data (Preparation)

- Issues and Complaints
- Interviews and focus groups
- Observations and timings
- Historical data
- Inventory levels
- Your KPI's and financial performance



- Typically, 3 to 5 days
- Major Phases
 - Training
 - Gemba Walk
 - Current State Map
 - Identify Waste and Opportunities
 - Ideal State
 - Future State Map (Step 1)
 - Future State Map (Next Steps if appropriate)

- Overview only to get everyone on the same page, not expert level.
- Most learning will be hands-on during the event.
- Focus on the tools used in the event.
- Interactive with simulations and videos is ideal.



Go to Gemba

“Go see, ask why and show respect.”

Fujio Cho, Toyota Chairman

Go to Gemba

- Japanese word for "the real place"
- Go to where the actual work is being done, interact with the workers to improve decision making and problem solving.
- Shows respect for the workers to understand what they do.
- Referred to as the "Gemba Walk" or "Go and See."

- What is happening today? Take a snapshot.
- 80% of what is typically done
 - Not exceptions and one-off situations
- Based on data gathering and interviews during the event.
- Capture problems, not solutions.
- Must thoroughly understand current state before making improvements.
- Identify opportunities with burst symbol.



- Customer satisfaction
- 8 Forms of Waste (TIM WOODS)
- Longest Lead Times
- Longest Cycle Times
- Most inventory (bottlenecks)
- Frustration areas
- Overburden (Muri)
- Instability / Variation (Mura)

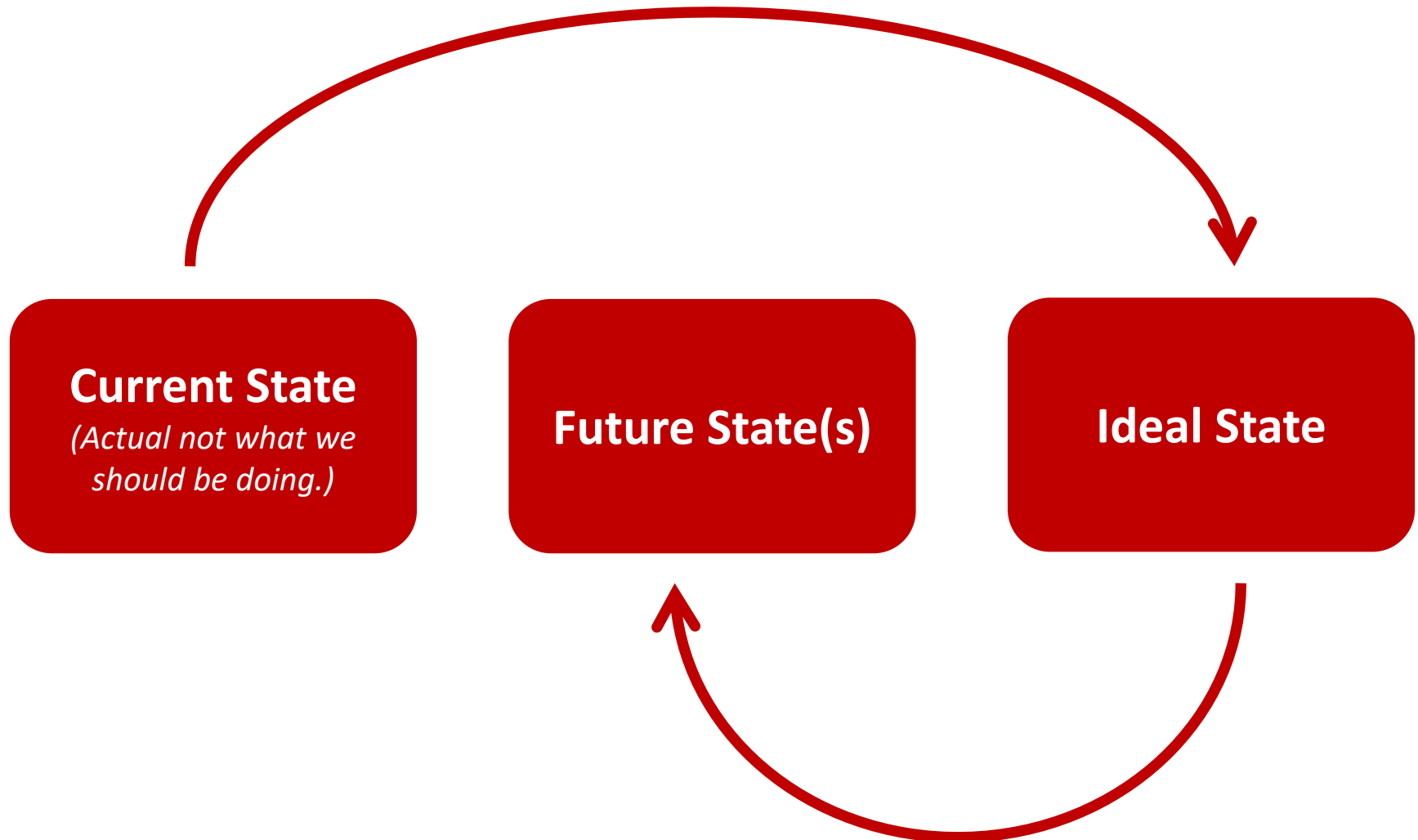
Ideal State

How would you set-up this process if you were starting from scratch, with no boundaries, all the money, all the people, all the resources you wanted, along with the following principles in place?

- Defect Free
- Just In Time
- One piece flow
- Minimal Inventory
- Lowest Cost
- All Value-Added processes
- Minimal Space



- Come back to reality from Ideal State
- How close can you get to Ideal State, given
 - Limited Time (6 to 12 months)
 - Limited Budget (Medium to High Impact / Low to Medium Effort)
 - Limited Resources
 - Current Limitations (Regulations, Agencies, Customers, Procedures and Policies.)



- Identify potential solutions.
- Determine impact and ease of implementation.
- Vote on the best ideas.
- Create action plan with names, dates and deliverables.

Ideas!

1. Turn down water temp on part wash machine.
2. Dry sweep implementation
3. Water flow in bathroom sinks
4. Drip irrigation in landscaping
5. Reuse water in stress testing equipment
6. Water flow in toilets
7. Part wash machine pipe insulation
8. Water pipe leak fixed
9. Upgrade chiller

- Don't wait for 30 days to follow-up.
- Schedule immediate the week after the event, and each week for the first month.
- Suggest meeting weekly for the first 90 days.
- Some actions may require kaizen events to complete.
 - Schedule and help facilitate events.
- Track progress after improvements
 - May be delayed due to backlog of work and metrics.

- Typically, updated every 6 to 18 months.
 - Depends on how much improvement is made.
- Put it into the calendars immediately, including the preparation time.
- Captures benefits since the last event.
- Start from the beginning, don't update maps.
- Unless of course, nothing has changed.

VSM Symbols - Process

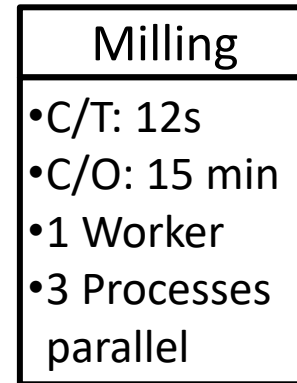
Process Box



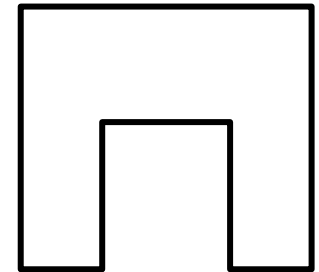
Process Box (shared with other value streams)



Process Box



Work Cell



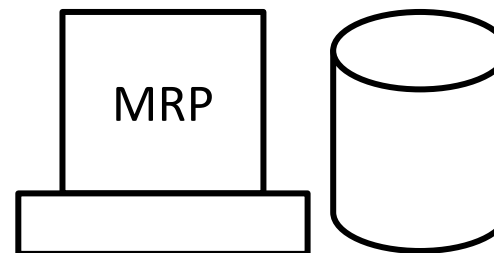
Customer



Supplier



Data Process Box (and Alternative)

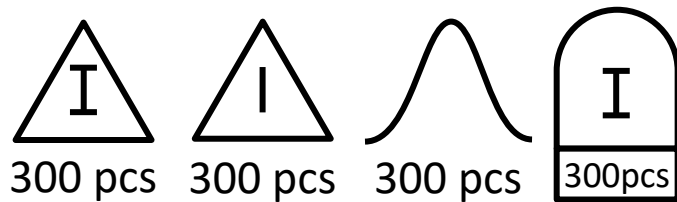


Worker

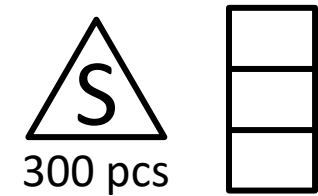


VSM Symbols - Inventory

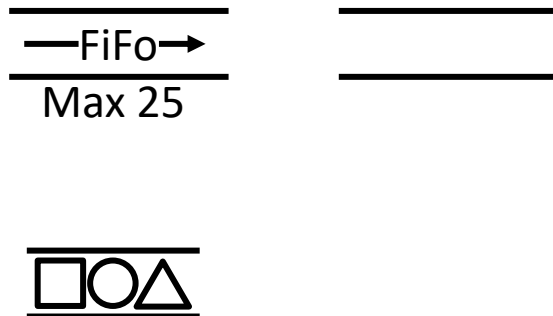
Unstructured Inventory
(and alternatives)



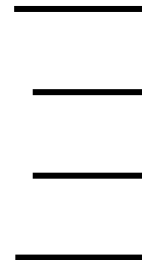
Safety Stock
(and alternatives)



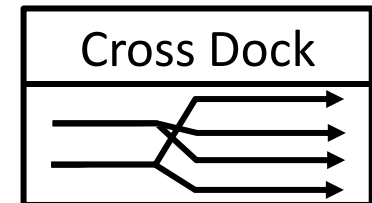
FIFO Lane
(and alternatives)



Supermarket



Cross Dock

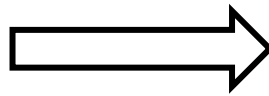


VSM Symbols – Material Flow

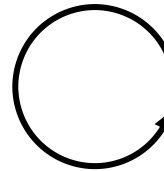
Push Arrow



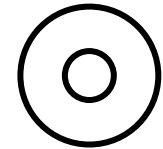
Transport
Finished Goods



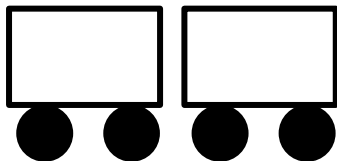
Withdrawal



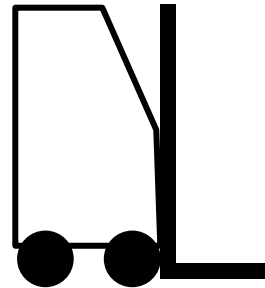
Sequenced Pull Ball



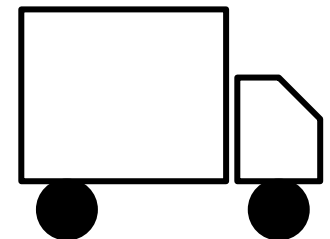
Milk Run



Fork Lift



Truck

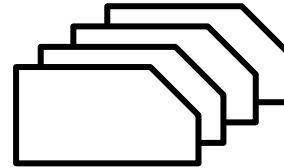


VSM Symbols – Information Flow

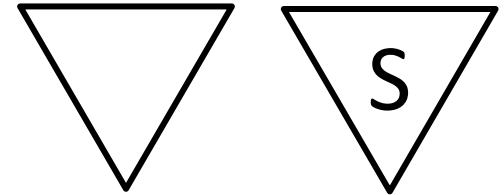
(Production) Kanban (and alternative)



Batch (Production) Kanban



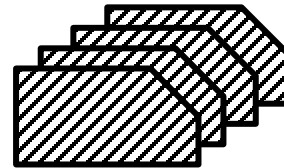
Triangle/Signal Kanban (and alternative)



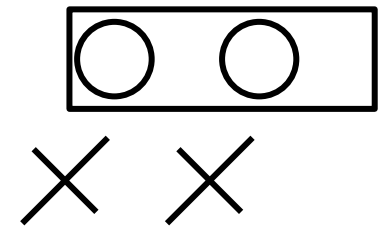
Withdrawal Kanban (and alternative)



Batch Withdrawal Kanban



Levelling



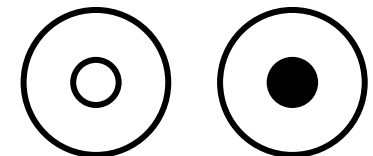
Manual Information Flow



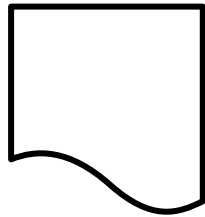
Digital Information Flow



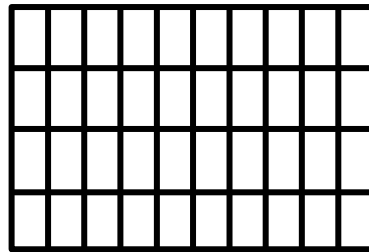
Sequenced Pull Ball (and alternative)



Document



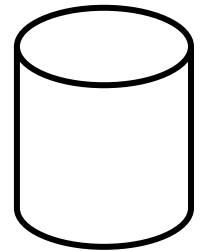
Leveling Board



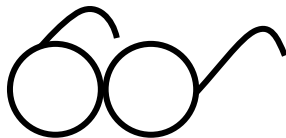
Kanban Post



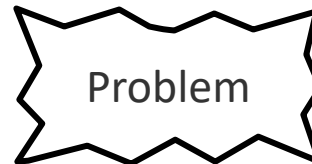
Database



Manual Observation



Problem

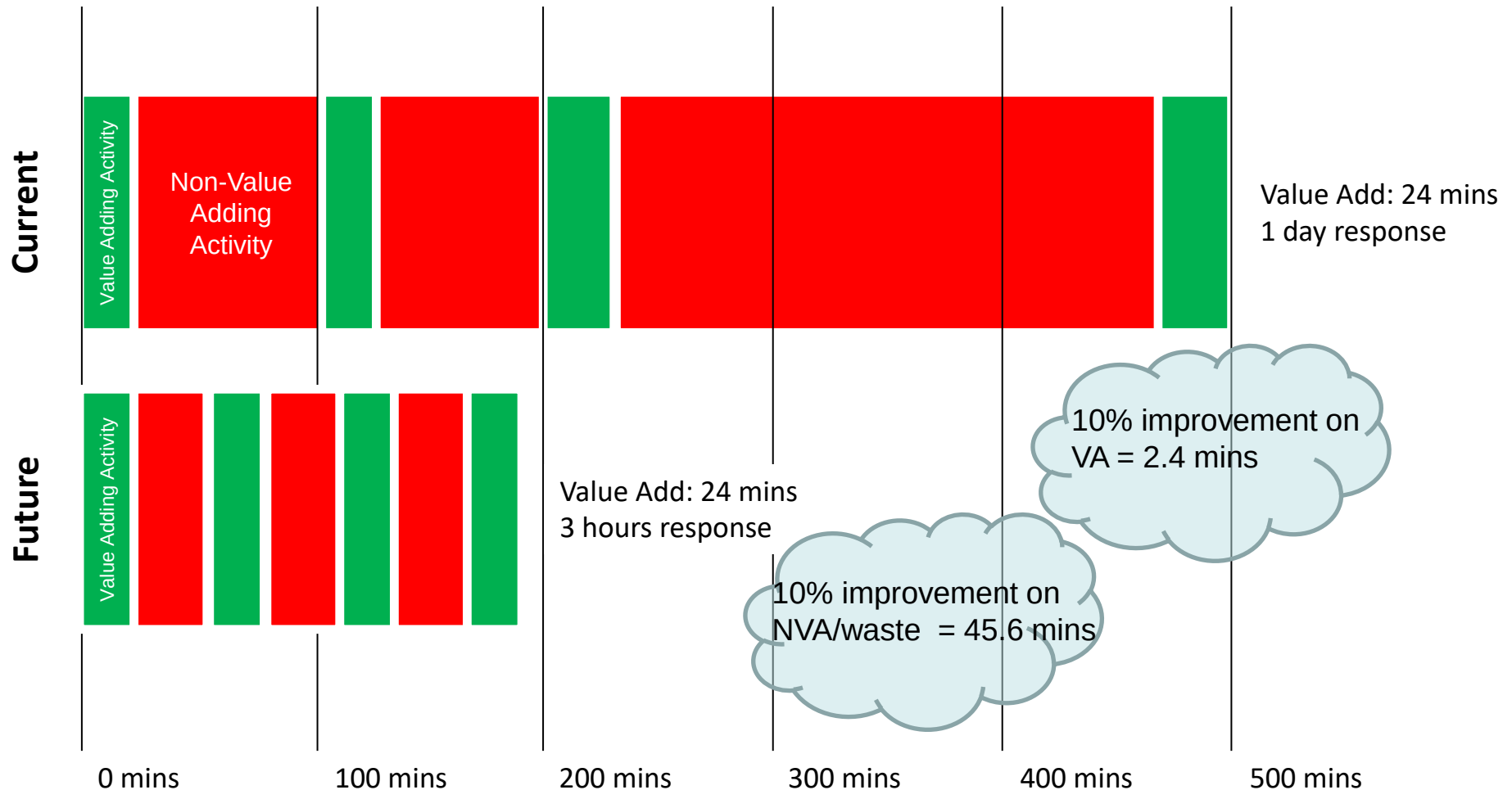


Improvement Idea



- VSM is a good tool for bringing teams together and alignment.
- Always looking at everything from the customer's perspective.
- Leads to plans that can reduce lead-times by 50% or more.
- Takes significant effort, but incredibly valuable.
- Conduct current, ideal and future states mapping.
- Key is the follow-up with the Action plan.
- Driven by Process Owners and not Facilitators.
- Look for the waste!

Value Vs. Non-Value Added



Remove Non-Value Adding activity (Red) items
before tackling Value Adding activity (Green)

HAVE YOU MET
TIM WOODS?

8 WASTES OF LEAN



Eight Wastes (Muda)



Transport



Inventory



Motion



Waiting



Over-
Production



Over-
Processing



Defects



Unutilized
Talent

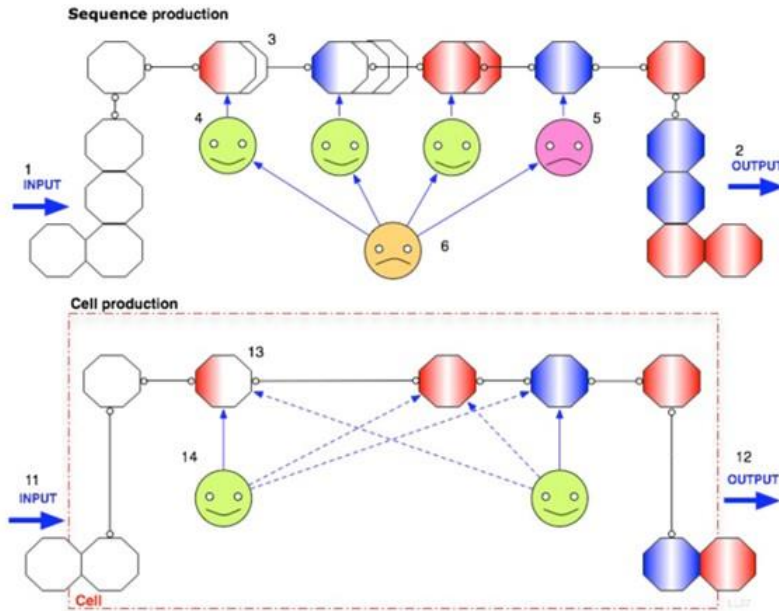


Unnecessary transportation of materials

Poor workplace layout



Too much inventory in work place – cluttered, unsafe areas, difficult to see which is the next priority, could indicate process bottlenecks



[This Photo](#) by Unknown Author is licensed under [CC BY-SA](#)

Too much motion within work area –
Poor workplace layout, machines in
wrong place

Waiting



[This Photo](#) by Unknown Author is licensed under [CC BY-NC-ND](#)

Waiting for work – lack of materials at workstation, bottlenecks further back in process stream, poor planning

Over production



Making more parts than needed – long changeovers so ‘more efficient’, poor planning, lack of correct parts so work on what’s available

Over processing



Doing more work than needed –
painting components when not needed,
over polishing, tolerances too tight for
function of component



Producing defects – making scrap, re-working, using additional capacity, using more resources, lack of supply to customer

Under utilized skills

"The greatest waste, is failure to use the abilities of people, to learn about their frustrations and about the contributions that they are eager to make."

Dr W Edwards Deming



- Have a look around your work-places, shopfloor or offices see if you can identify waste and which types they are!

Let us map the Value Stream



Making and attending a Dentist's appointment



Monday 2nd November

Phone call to dentist to make appointment. (10 mins waiting, 2min conversation.)

Thursday 19th November

Arrive in Swansea at 13:40pm, 10 minutes searching for car parking space.

Arrive at Dentist surgery for 2pm appointment after walking from car park.

Dentist running behind schedule so in Waiting Room for 25 minutes.

Sitting in the dreaded dentist chair by 2:25pm for drilling to start.

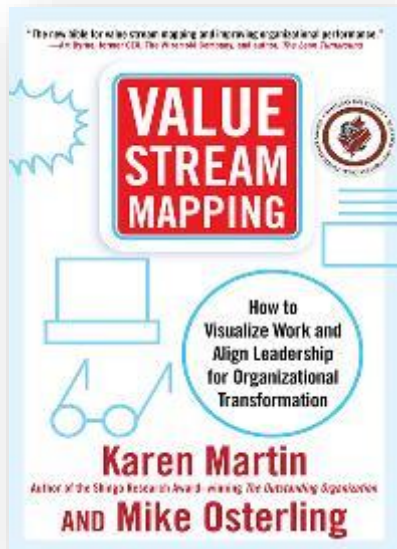
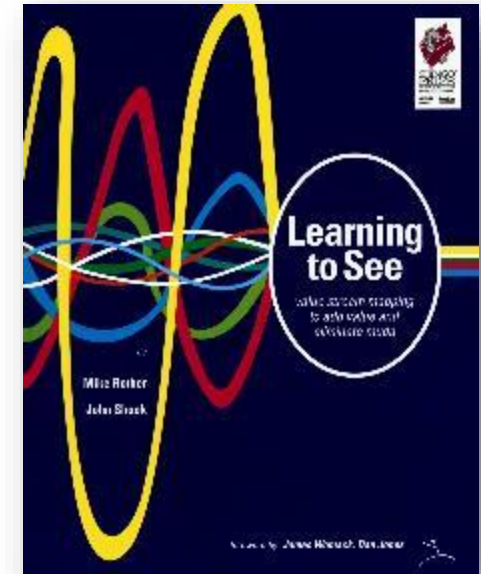
Back at Reception by 2:50pm to book follow-up appointment for additional work identified.

Further reading

Rother & Shook (1998) Learning to See

This simple tool makes it possible for you to see through the clutter of a complex plant. You'll soon be able to identify all of the processing steps along the path from raw materials to finished goods for each product and all of the information flows going back from the customer through the plant and upstream to suppliers.

With this knowledge in hand it is much easier to envision a "future state" for each product family in which wasteful actions are eliminated and production can be pulled smoothly ahead by the customer.



Martin & Osterling (2014) Value Stream Mapping

In most organisations, no one person can describe the complete series of events required to transform a customer request into a good or service. At least not with the level of detail around organisational performance. This gap in understanding is the kind of problem that leads to making improvements in one functional area only to create new problems in another area.

“Wherever there is a request and a deliverable, there is a Value Stream.”