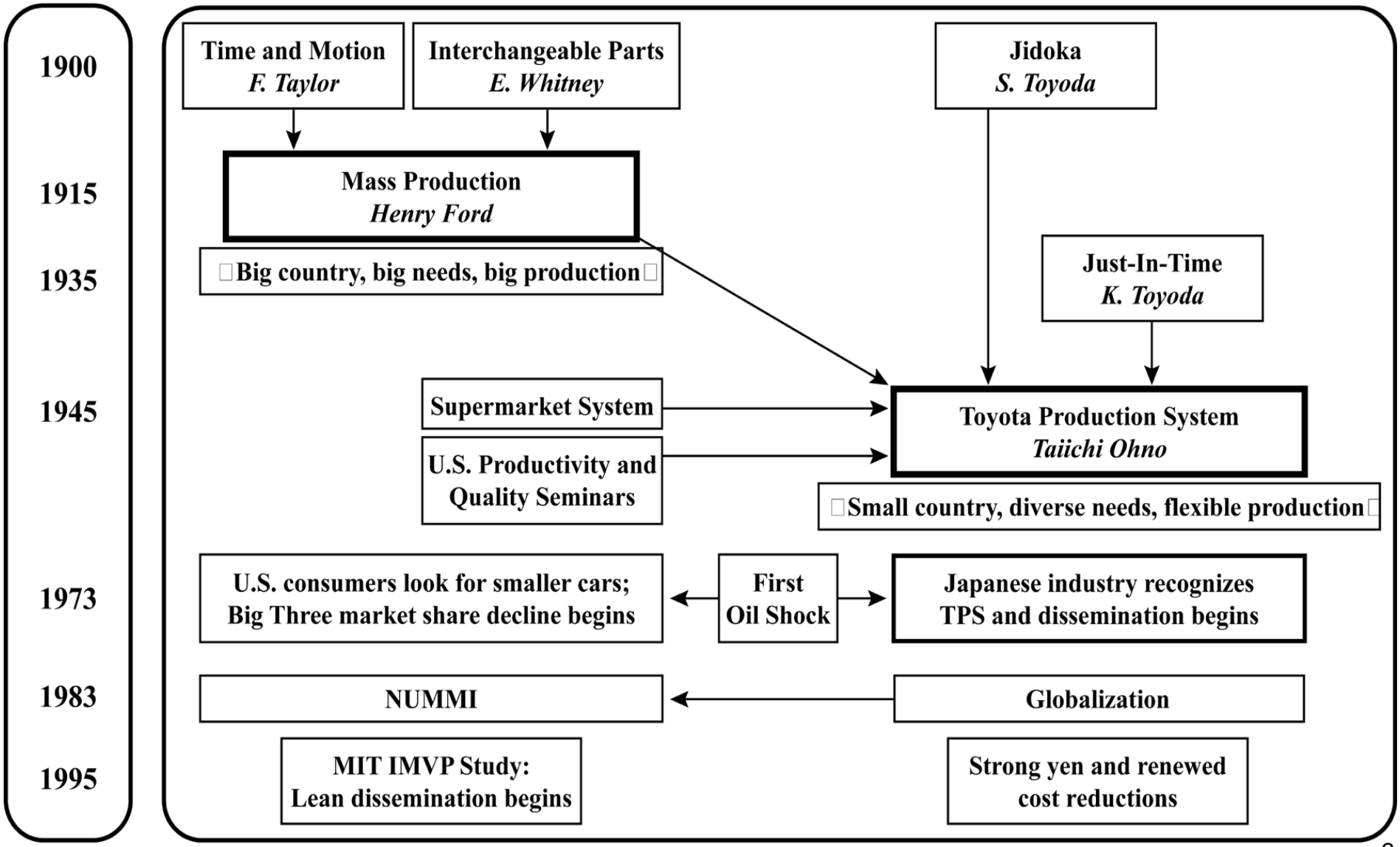
VSM-Value Stream Mapping

Data Collected by: Hamed Ali Mohamed

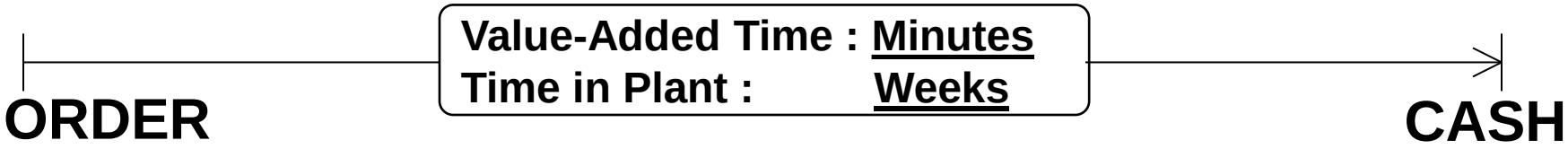
From Mass to Lean: Evolution of the New Paradigm



Hamed.Ali.Mohamed2@gmail.com

Value Added

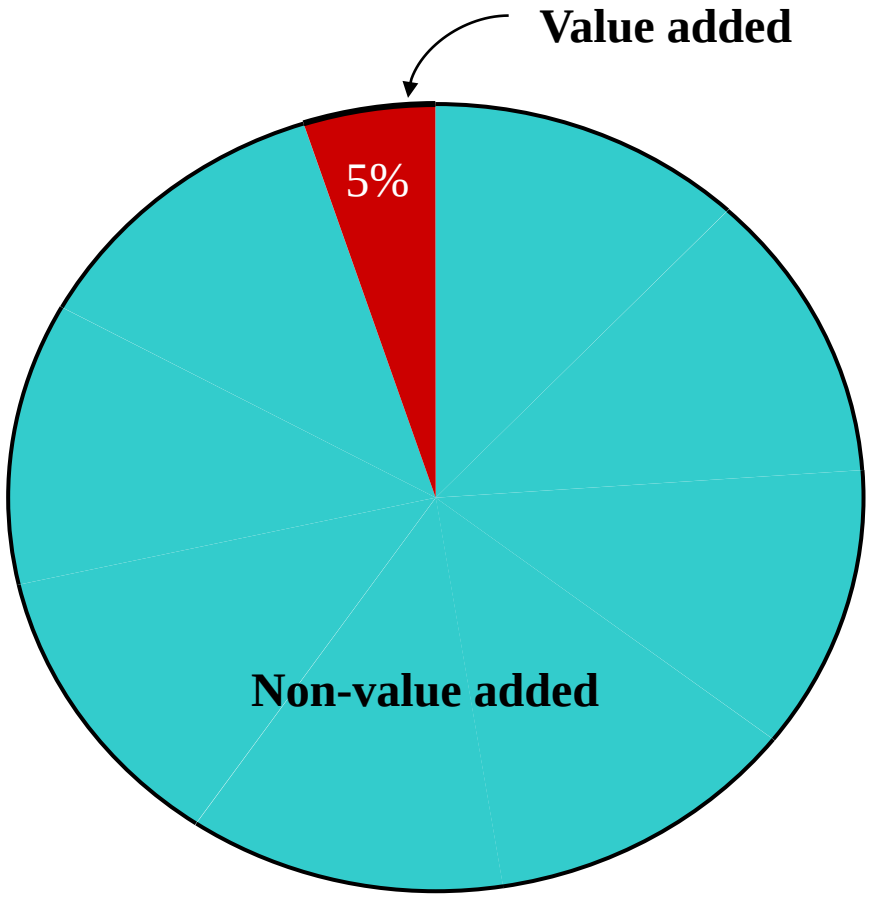
- *Value* is added any time we physically change our product towards what the customer is buying
- If we are not adding value, we are adding cost or waste
- Lean Manufacturing drives the systematic elimination of waste



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

Hamed.Ali.Mohamed2@gmail.com

Value Added vs. Non-Value Added



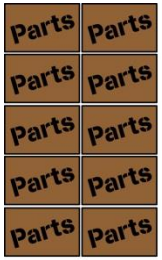
LEAN = ELIMINATING THE 7 WASTES

- Overproduction
- Waiting
- Transportation
- Non-value added processing
- Excess inventory
- Excess motion
- Defects

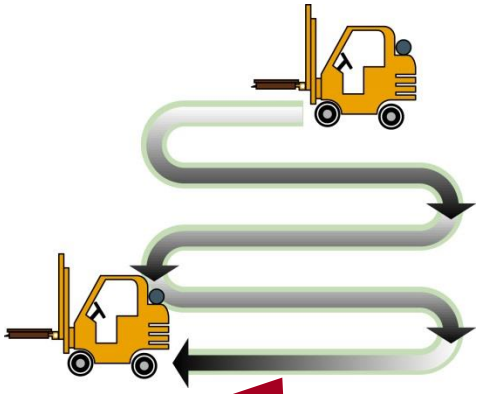
Typically 95% of Total Lead Time is Non-Value Added!!!

Hamed.Ali.Mohamed2@gmail.com

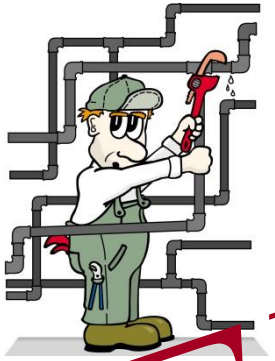
WAITING



OVERPRODUCTION



TRANSPORTATION

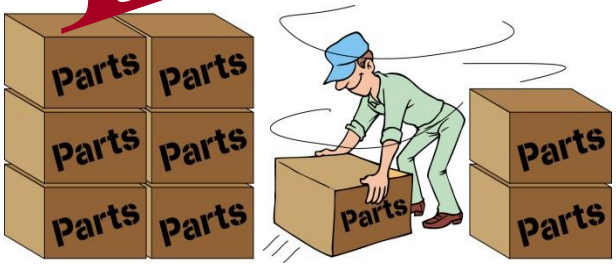


PROCESSING

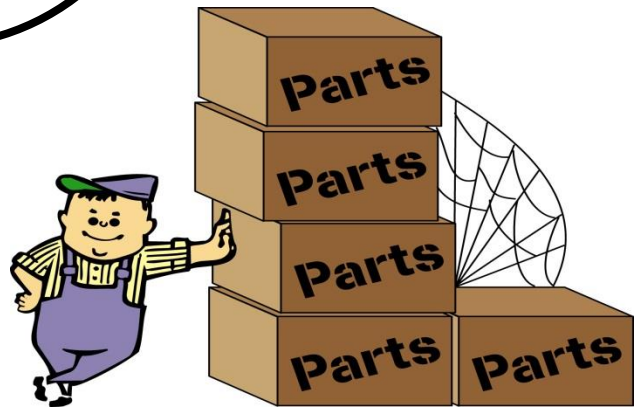
ELIMINATE

7 Wastes

DEFECTS



MOTION



INVENTORY

Hamed.Ali.Mohamed2@gmail.com

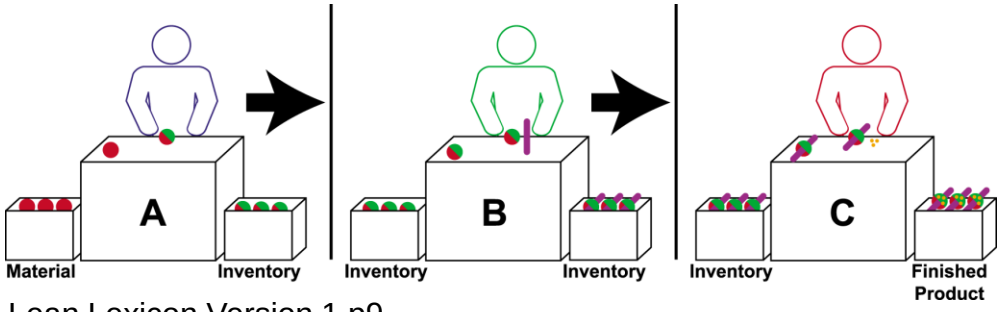
7 Basic Types of Waste (Toyota)

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

What is *Flow* ?

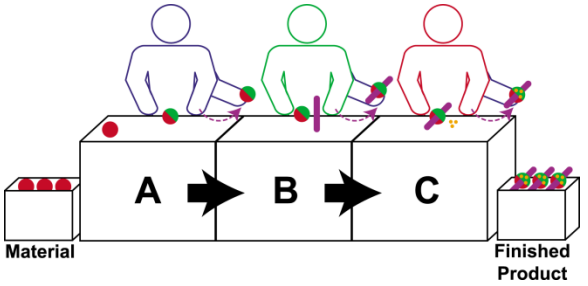
- Producing and moving one item at a time (or a small and consistent batch of items) through a sequence of process steps as continuously as possible, with each step making just what is requested by the next step.

TRADITIONAL



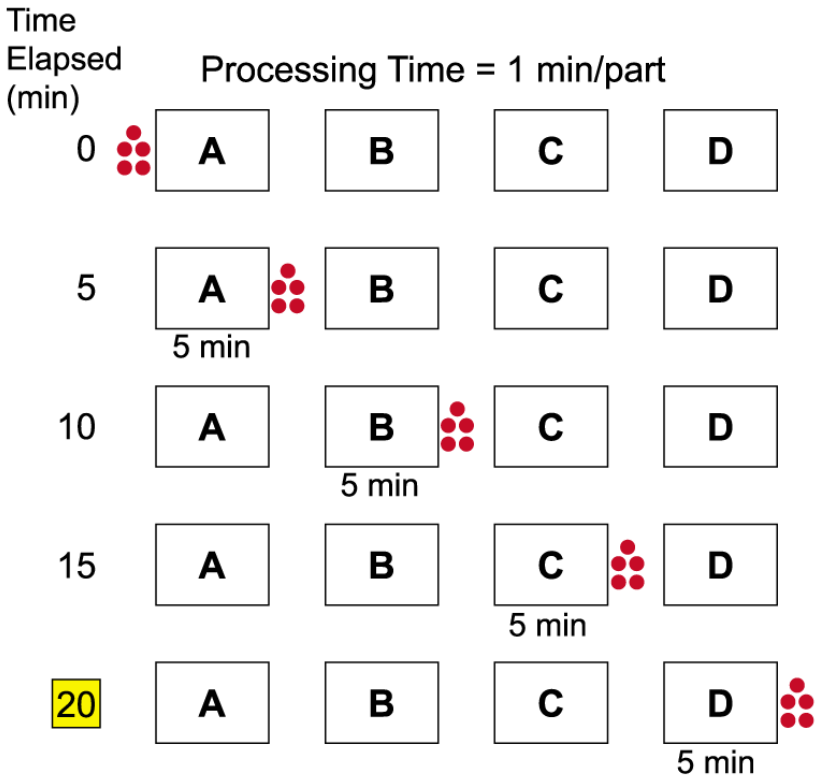
Lean Lexicon Version 1 p9

CONTINUOUS FLOW

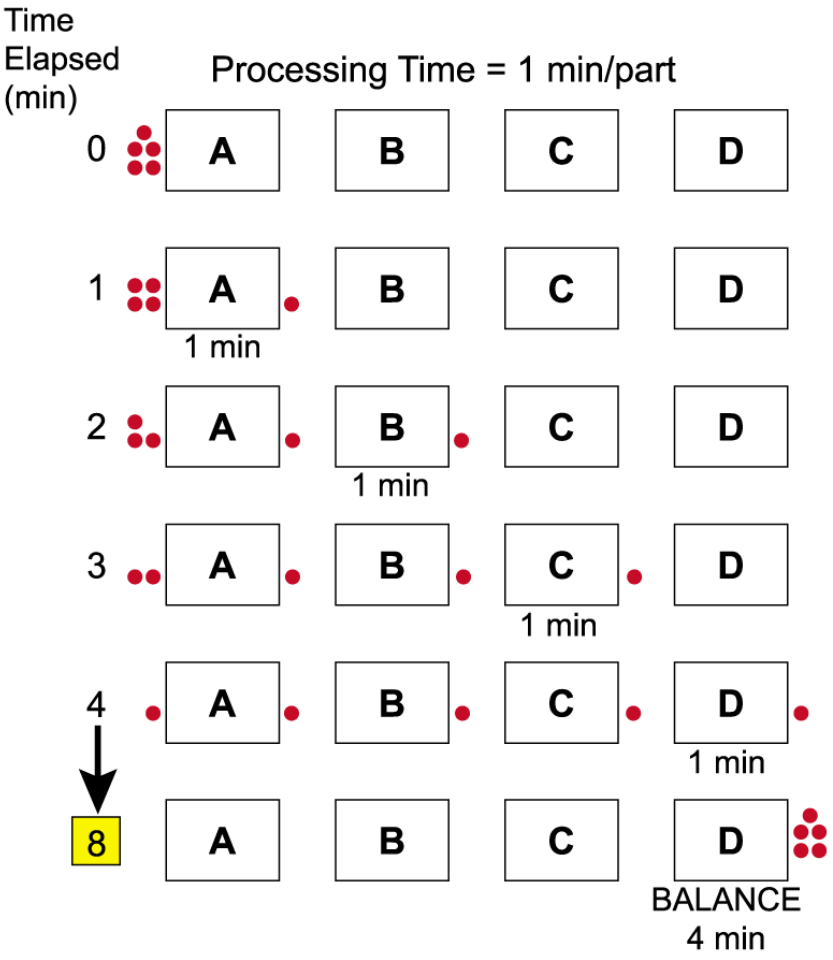


Continuous Flow – More Efficient & Faster

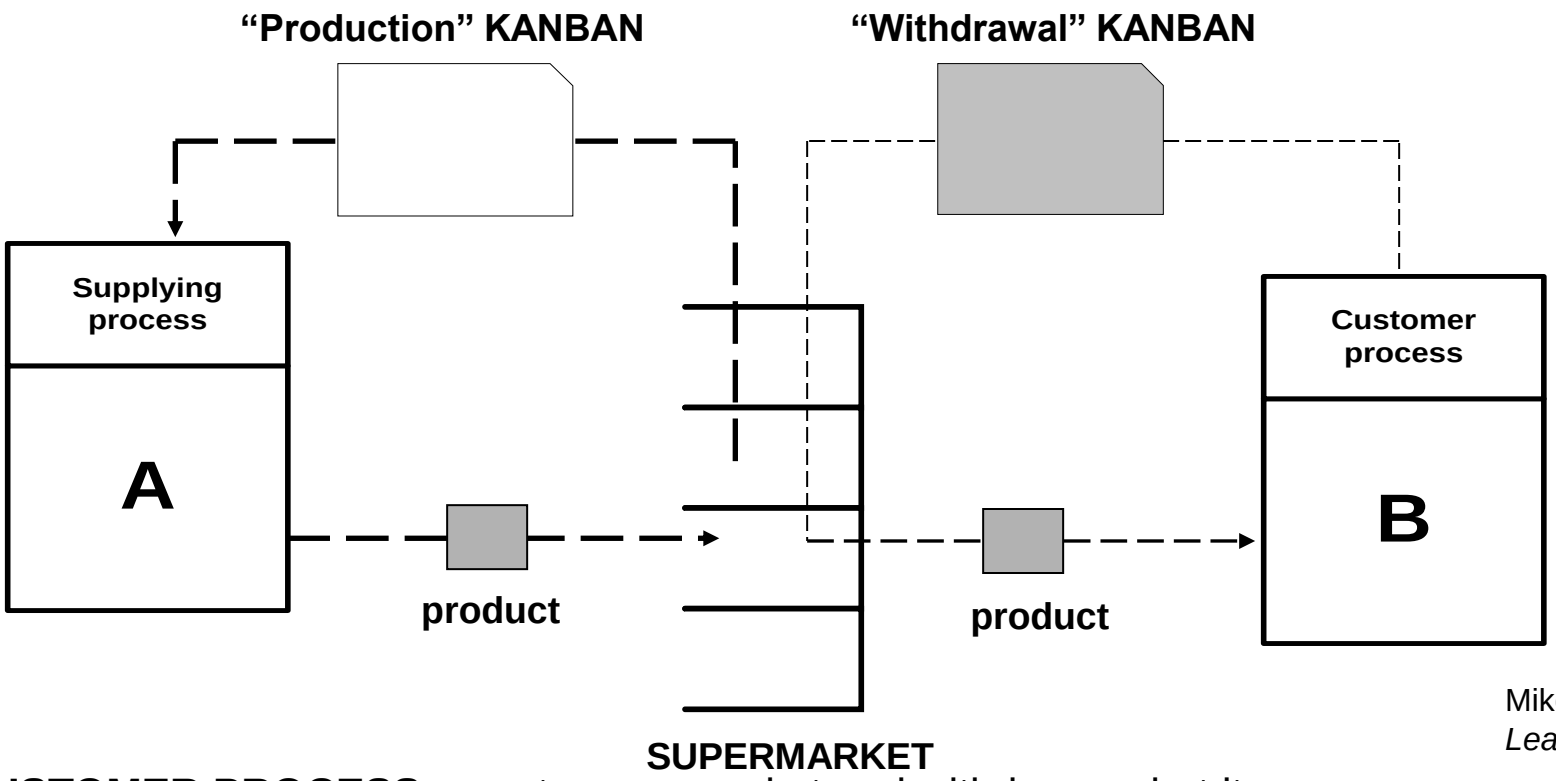
Traditional Batch Layout



Continuous Flow Layout



Supermarket *Pull* System



Mike Rother
Learning to See

CUSTOMER PROCESS goes to supermarket and withdraws what it needs when it needs it.

SUPPLYING PROCESS produces to replenish what was withdrawn.

PURPOSE: Controls production at supplying process without trying to schedule. Controls production between flows.

Takt Time

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

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

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

Hamed.Ali.Mohamed2@gmail.com

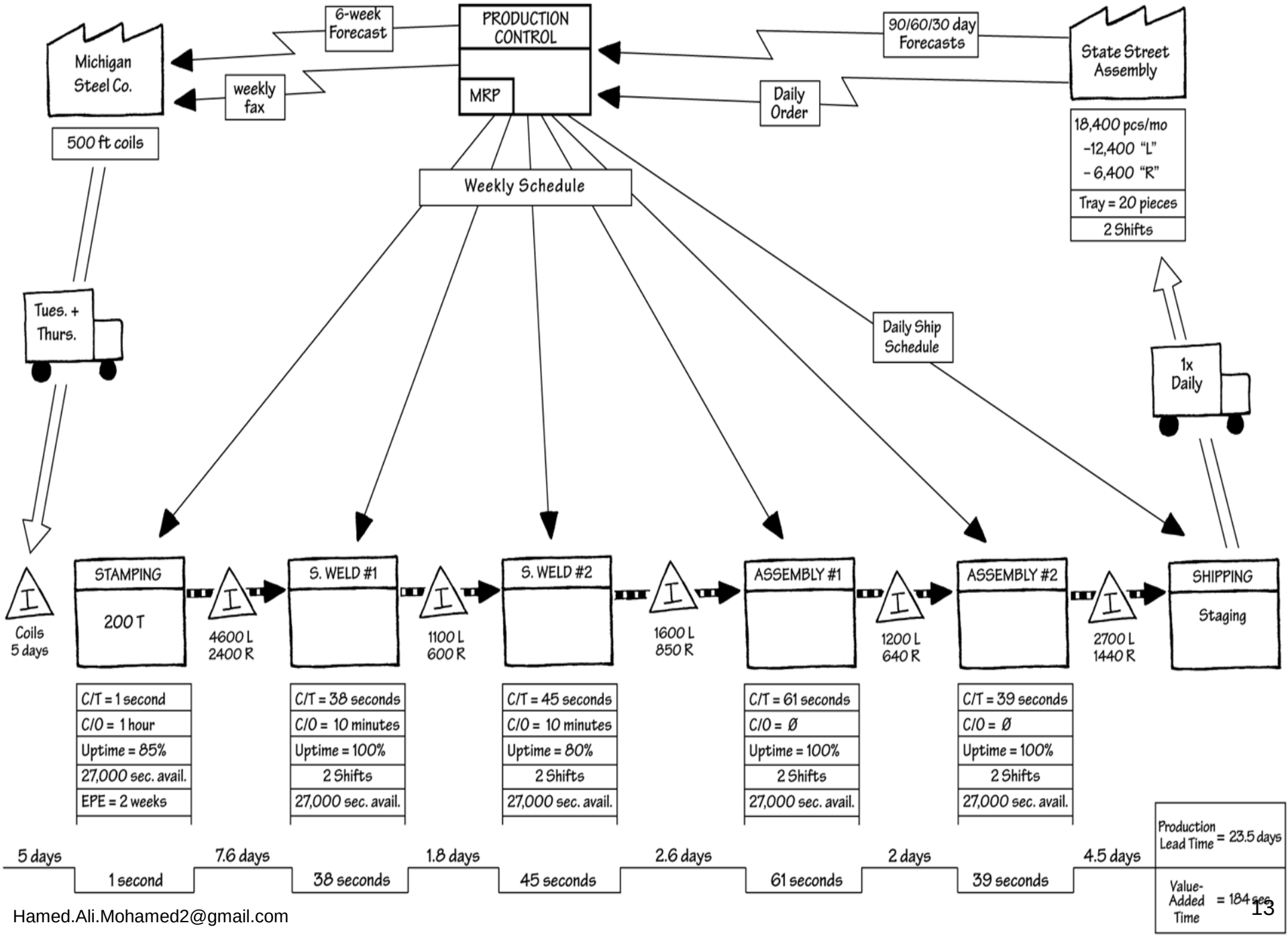
What is a *Value Stream* ?

- 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

Value Stream Mapping

- Follow a “product” or “service” from beginning to end, and draw a visual representation of every process in the material & information flow

- Then, draw (using icons) a “future state” map of how value should flow



Hamed.Ali.Mohamed2@gmail.com

Value Stream Mapping

- 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

Hamed.Ali.Mohamed2@gmail.com

What is *Value Stream* Analysis?

- 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

Hamed.Ali.Mohamed2@gmail.com

The Value Stream Analysis Process

- Phase 1-Pre-event work
- Phase 2-The Main Event
- Phase 3-Accountability Process

Value Stream Analysis Process

Phase 1
Pre-event Planning

Pre-Event Work

- Three weeks prior to the event
  - Determine team members
  - Define the objective of the team
  - Select the area and topic
  - Logistics (conf. Rm., times, facilitator supplies, etc.)
  - Invite team members to the event
  - Clarify roles and responsibilities
    - Event leader-value stream manager from the area (owns resources and results)
    - Event facilitator-CI Leaders who manage the improvement process and share in ownership of results
    - Subject matter experts

Pre-Event Work

- Two weeks prior to the event
  - Part/quantity analysis (select representative part number)
  - Gather and review data (Yield, job closures, CONC, etc.)
  - Determine future demand
  - Review prior event data
  - Review any customer issues
  - Review any requirements for capital equipment
- One week prior to the event
  - Verify customer demand
  - Review above data

Value Stream Analysis Process

Phase 2
The Main Event

The Main Event

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

Hamed.Ali.Mohamed2@gmail.com

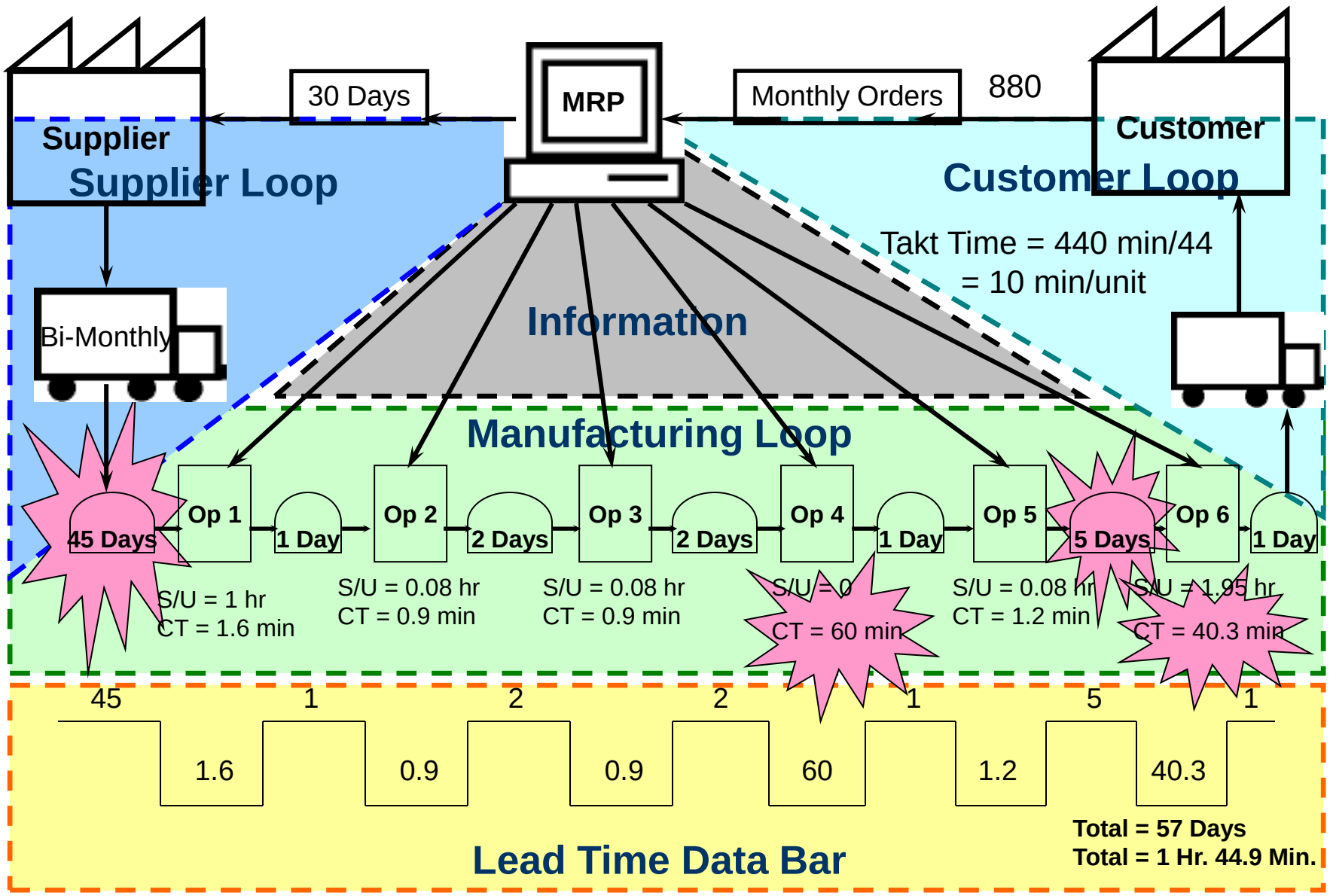
VSM Event Steps 1 &2
Training and Gemba Walk

1. Training
   - The concepts of Lean need to be applied to classroom training as well as our other processes
     - This is a learn by doing process
     - We will minimize classroom learning
2. Gemba Walk
   - Gemba means, “shop floor” or “where the process is”
   - We need to go there so we know what we are mapping

VSM Event Step 3
Current State Map

3. Value Stream Map-Current State
    1. Map the physical flow (manufacturing loop, customer loop, supplier loop)
    2. Map the information flow
    3. Complete the lead time data bar
    4. Visually identify waste
        1. Identify value added/non-value added (red, yellow, green dots)
        2. Visually identify the most significant opportunities with kaizen bursts.
    5. Summarize all information and metrics (date, P/N, times, inventory, OTD, quality, etc.)

Elements of Value Stream Maps

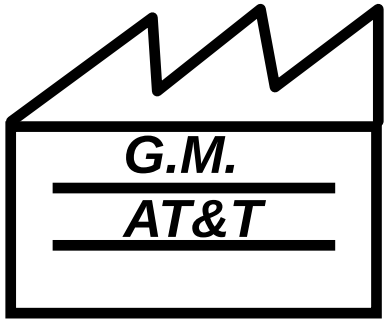


Manufacturing Loop Questions

- 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?

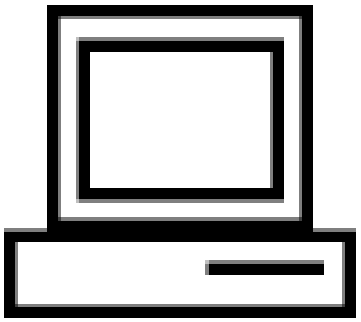
Customer Loop Questions

- 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?



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?



Supplier Loop Questions

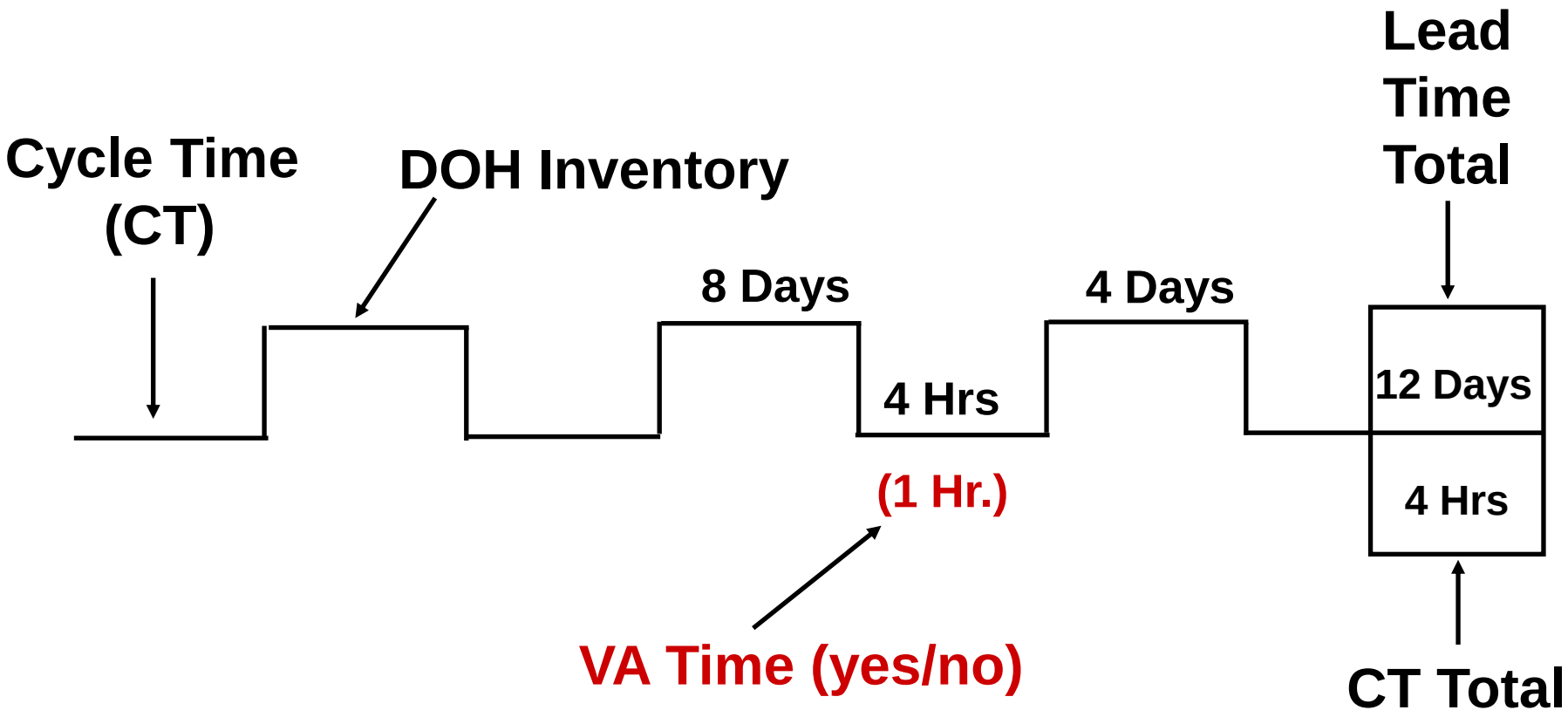
- **#1 question, how do you tell suppliers what to ship, make, etc.?**
- When and how often do they get purchase orders from Customers?
- When and how do we change the purchase order?
- When and how often do suppliers ship product and how? Is it level? (Truck, train, etc.)
- Do we have standard pack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

Hamed.Ali.Mohamed2@gmail.com

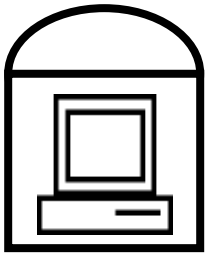
Information Flow Questions

- 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



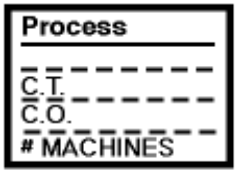
Mapping Icons



COMPUTER WIP

Supplier Parts or Material

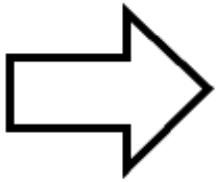
Computer Assisted



Manufacturing Process

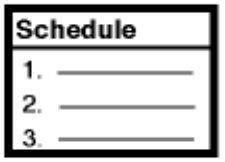
Kanban Cycle

Pull Material Flow

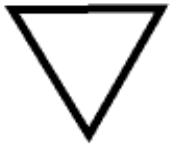


Material Flow

Manual Information Flow



Production Schedule

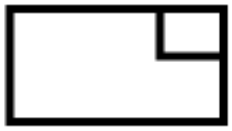


Signal Kanban

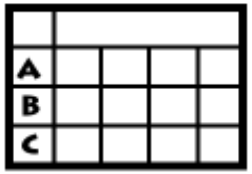
Tablet

Kanban Post

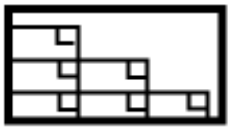
Material Store



Production Kanban



Heijunka Box



Lot Making Board

First In/First Out Material Queue

Electronic Flow Information

Truck Shipment

Quantity Work in Progress or Inventory

Raw Material or Finished Goods

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
  - Identify type 1 waste (waste but unavoidable in the current state) with a yellow dot
  - Identify type 2 waste (pure waste, eliminate immediately) with a red dot
- 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 Event Step 4
Ideal State Map

- 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 Event Step 5
Future State Map (3 months out)

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

VSM Event 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.

Hamed.Ali.Mohamed2@gmail.com

VSM Event Step 7
Management Report Out

- This report out is 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

Hamed.Ali.Mohamed2@gmail.com

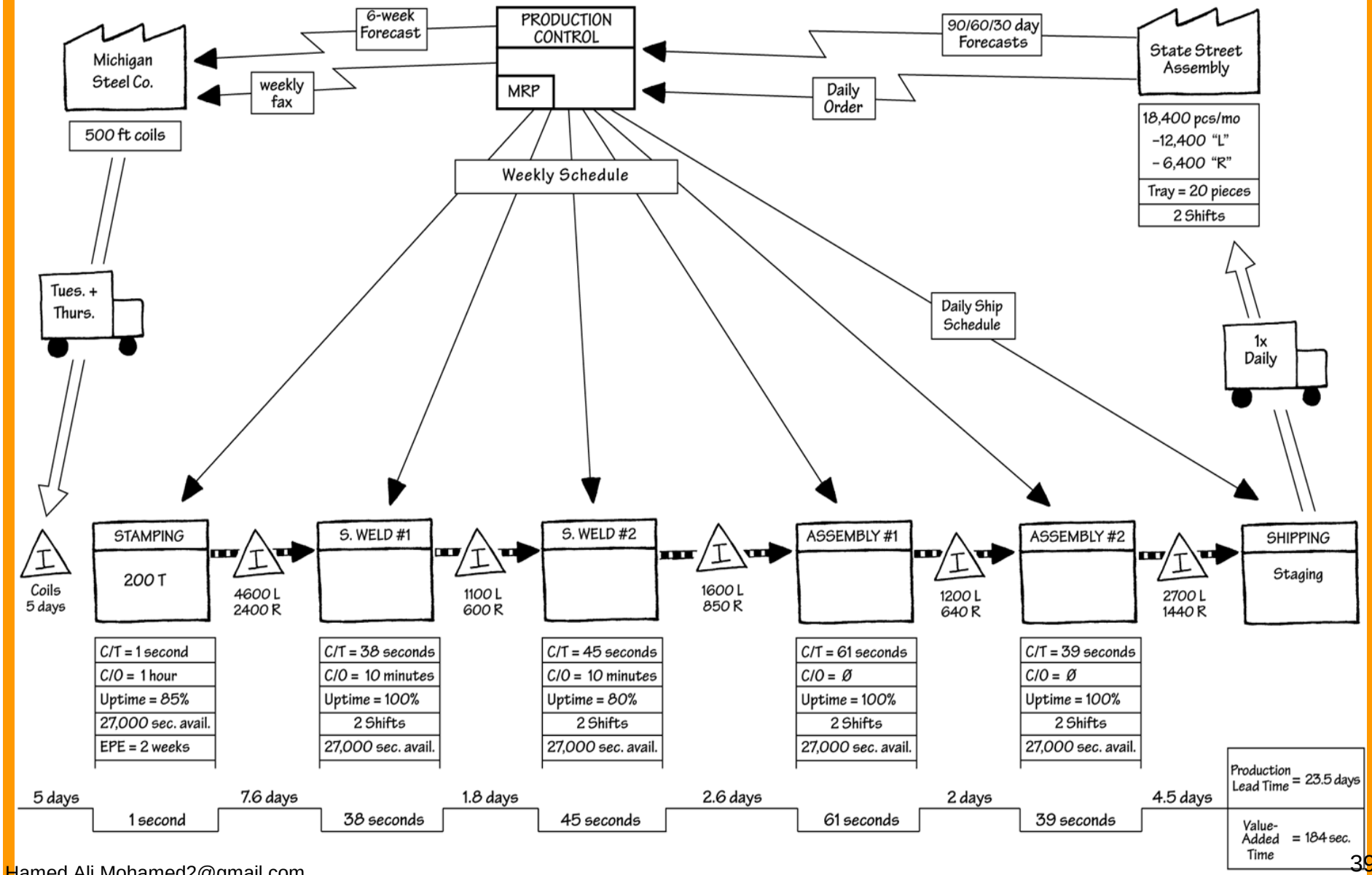
Value Stream Analysis Process

Phase 3 Accountability Process

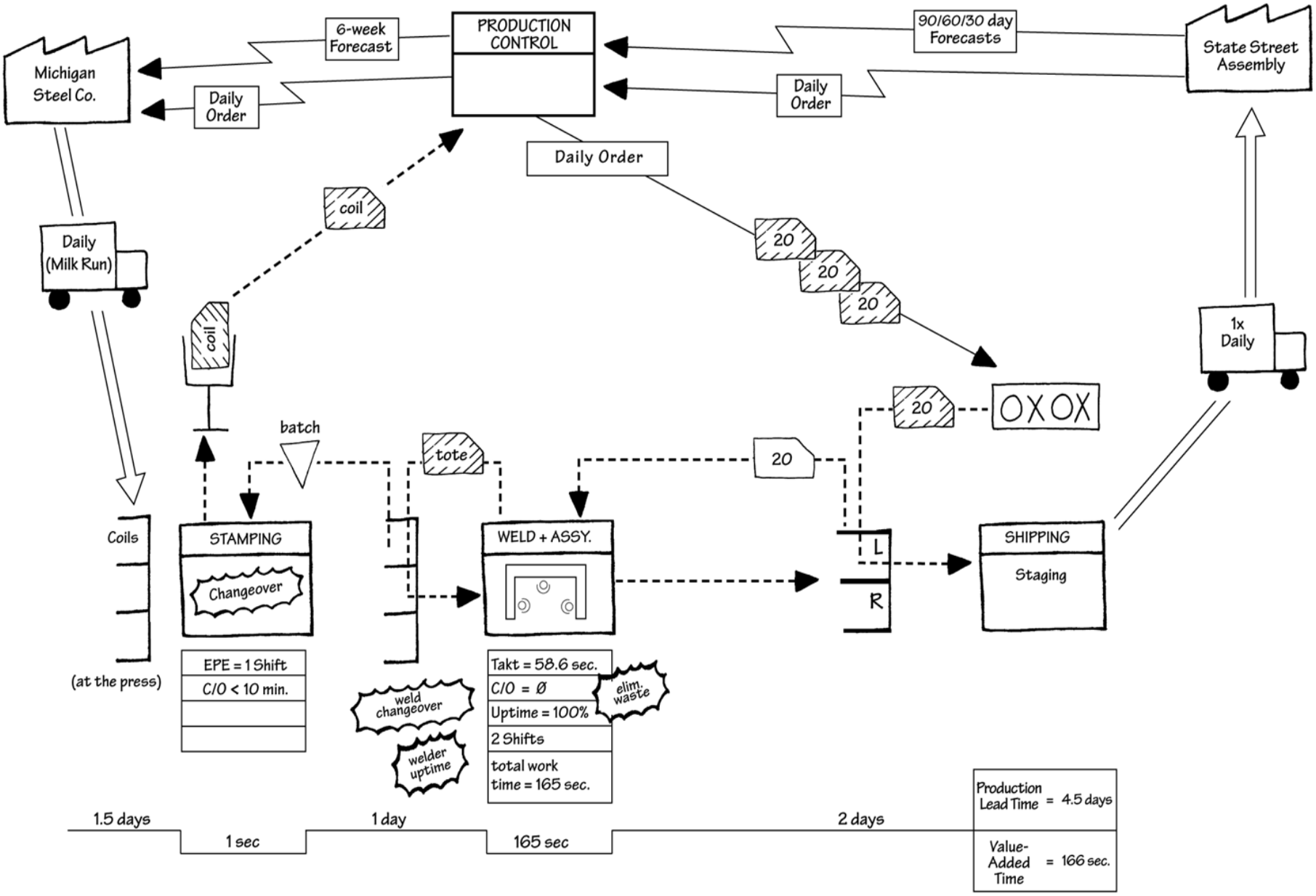
The Accountability Process

- The momentum for improvement is never higher then at the end of the event when everyone can really see the waste. As a result the accountability process must start immediately following the event (next day).
- Display the current state map, future state map and future state plan in the the affected area.
- Commit to a stand up meeting in front of the maps and plan (daily at first, and then less frequent as applicable)
  - Focus on Due date control. Not meeting dates is letting the team down

Current State Value Stream Map



Future State Value Stream Map



Value Stream Mapping : Step by step

Getting Started

Define Team, Scope (Start – End Process),

Key Metrics and Main Process Step

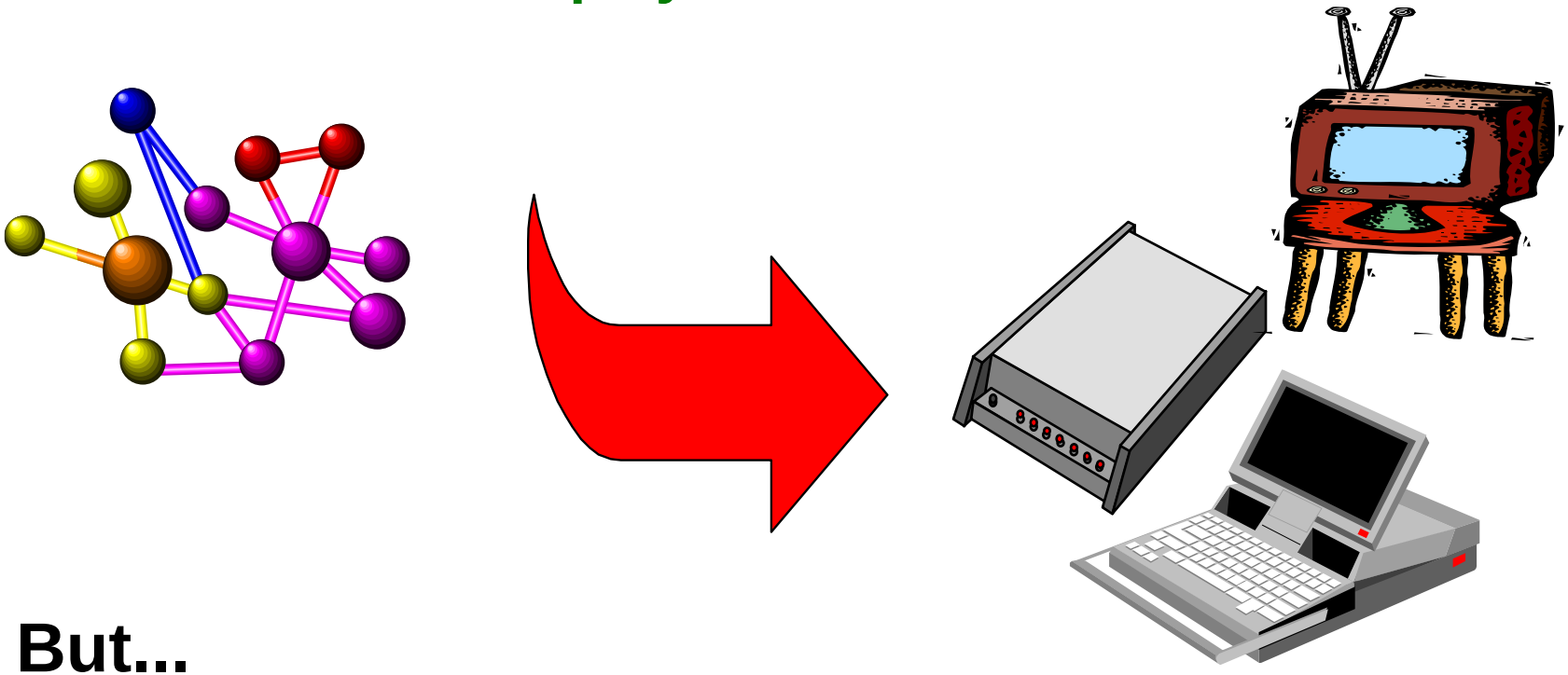
- Identify project Sponsor/Champion
- Identify task force and cross functional team
- Identify the scope business area/process (Start & End)
- Identify key Performance Metrics to be measured-analyzed

Tools:

- Team Charter
- SIPOC/Top- Down Charting/Swim lane Flow Chart

Getting Started

From Sand to Display Product at the customer



But...

Mapping the entire stream is too much for getting started!

10 Steps VSM Analysis

Phase I - Current State VSM

- Step 1 - Select Service/process
- Step 2 - Establish Mapping and Data Collection Ground Rules.
- Step 3 - Map the Process Flow (with Data Box)
- Step 4 - Map the Material Flow
- Step 5 - Indicate Time Pulse
- Step 6 - Map the Information Flow
- Step 7 – Identify VA & NVA

Phase II - Current State VSM with Opportunities

- Step 8 – Identify opportunities through: Value Analysis, Waste Analysis, Root Cause Analysis, etc

Phase III - Future State VSM

- Step 9 - Create future state VSM
- Step 10 - Kaizen action plan

Hamed.Ali.Mohamed2@gmail.com

Step 1: Select Service / Process

Determine what individual product or service, or product group/family you will map

- ✓ Has biggest impact on customer
- ✓ High Impact on volume, quality, cost
- ✓ Has common flow/same steps

Hamed.Ali.Mohamed2@gmail.com

Step 2: Establish Mapping Rules

3 Simple Mapping and Data Collection Ground

1. Go to the **Gemba! - Actual** place where the process is performed.
2. Talk to the **Actual** people involved in the process and get the real facts.
3. Observe and chart the **Actual** process.
   - Reality is invariably different from perception; Few processes work the way we think they do.
   - The purpose of value stream mapping is to identify waste, not to develop the perfect process map.

Understand the process through facts and data!

Hamed.Ali.Mohamed2@gmail.com

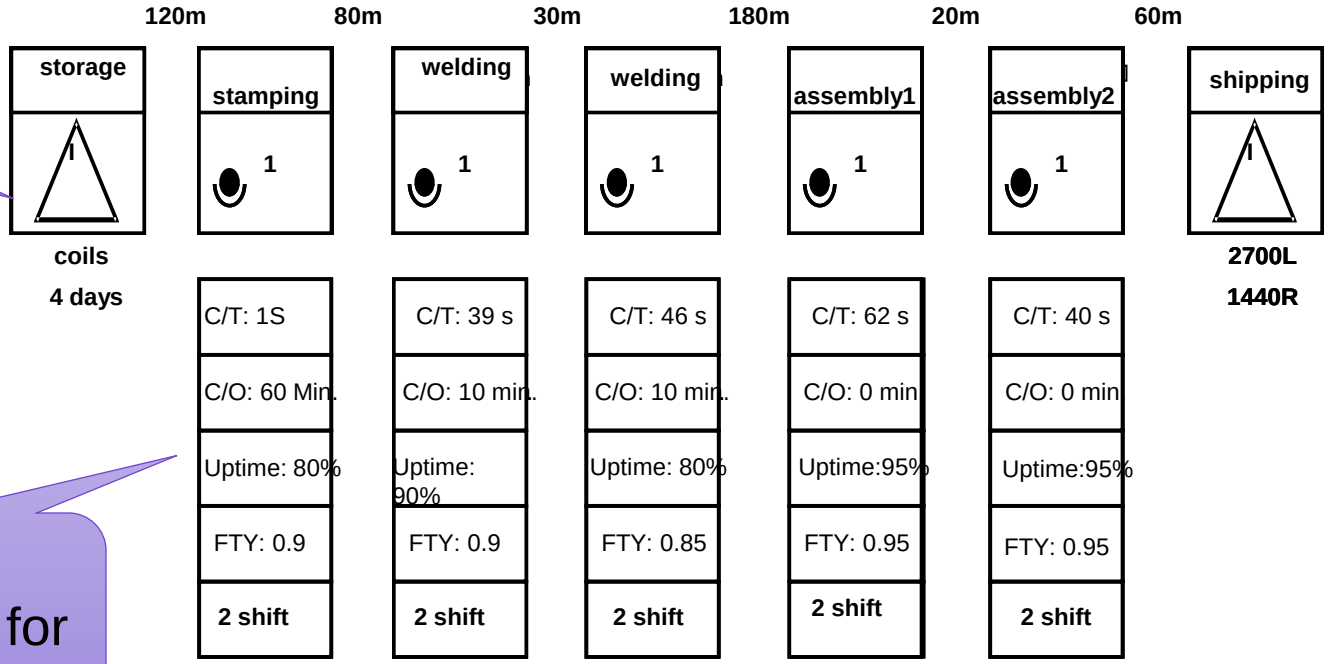
Value Stream Mapping
Best Practices

- Always map in paper and pencil - rough out 1st, clean later.
- Walk the actual material and information flows yourself.
- Start with a quick walk, to get a feel for the flow and sequence then, go back and talk to the right people for each step. (Don't forget second and third shifts)
- Color Code the operations. (Red, Yellow, Green)
- Always collect 'current-state' information while waking along the actual pathways of material and information flows.
- Involve the Management team totally.

Don't map the organization. Map the flows through the organization.

Step 3: Map the Process Flow (with Data Box)

Identify the major process steps and start mapping



Collect information for Data Box

Example ABC company:
The sequence of the several processes will be drafted after the first overview has been carried out and the appropriate data will be added in the proper data boxes.

Hamed.Ali.Mohamed2@gmail.com

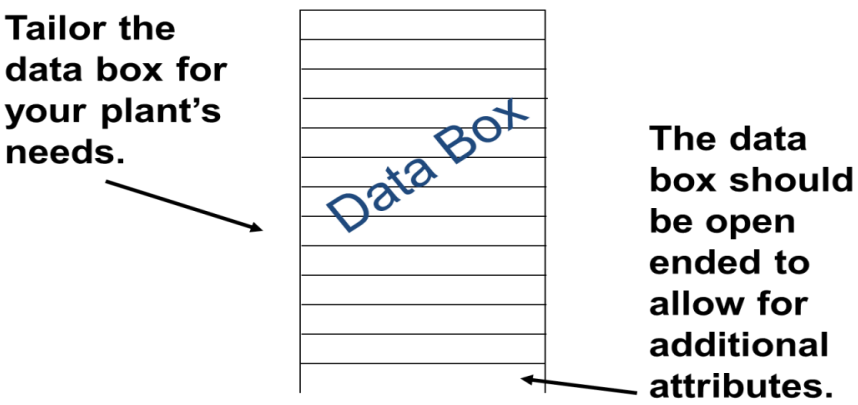
Data Box: Select Data Attributes

What to measure?

- Should support a company's objectives for the cost, service, and quality
- Should highlight waste

Be flexible

- Revise as necessary as the process tasks are defined
- Select ones you may already be using
- If there is time, seek out some baseline measures



Defect Rate = 1%
Turnaround Time = 50 Minutes
Total Cycle Time = 200 seconds
VA Time = 20 seconds
NVA Timee = 180 seconds
Units Produced = 16/hour
Total Uptime = 88%
Work-In-Progress = 5 bags

Data Collection

Attribute Data to Collect

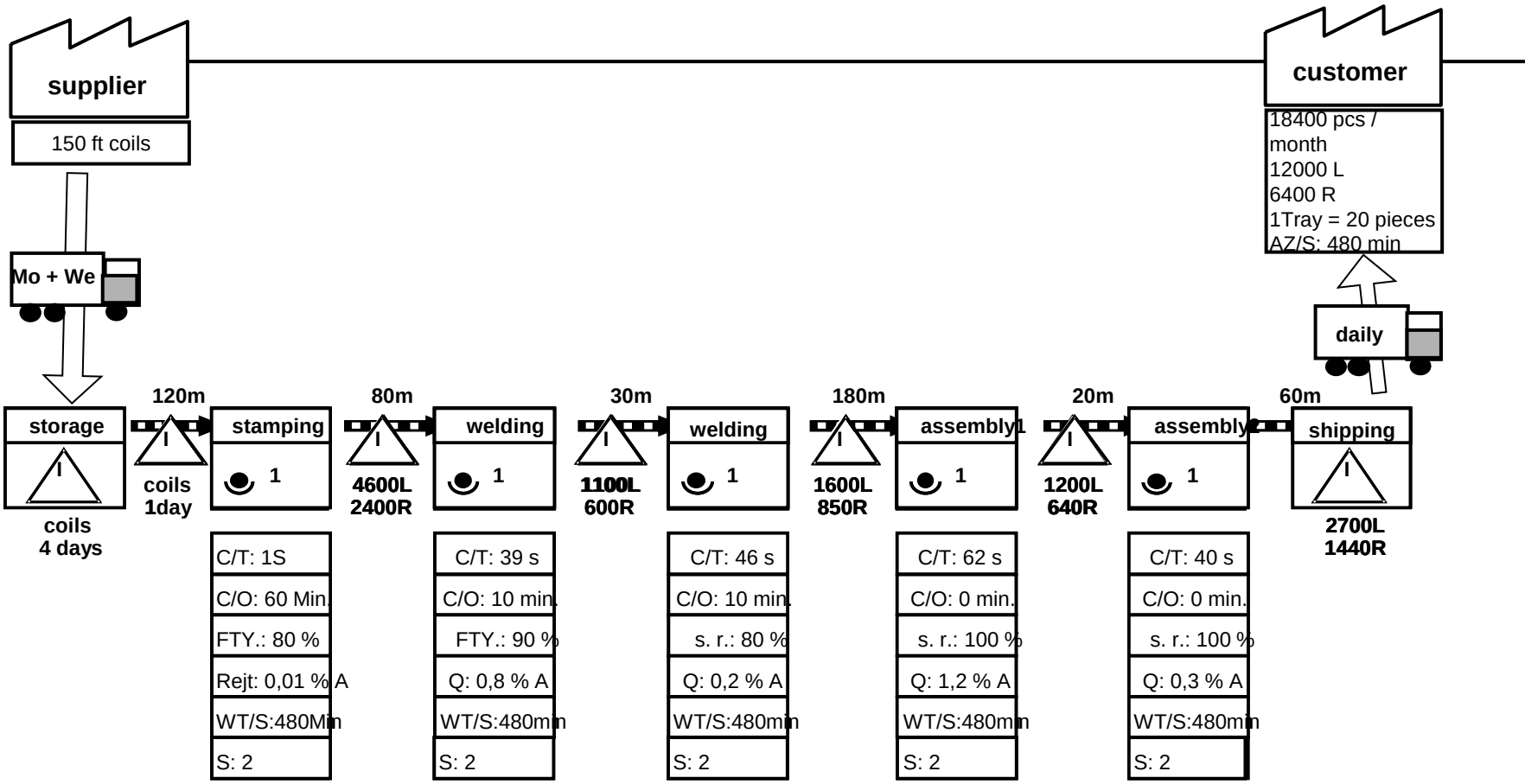
- Shipping/Receiving schedules
- Pack sizes at each process
- **Demand rates by process** (Takt Time)
- Working hours and breaks
- Inventory Points (location & size)
- **How Operations are scheduled**
- Work-in-process inventory
- Overtime per week
- **Process cycle times**
- Number of product variations at each step
- Batch (lot) sizes
- Changeover times/frequencies
- C/O (changeover time)
- OEE(Overall Equipment Effectiveness)
- **FTY (First Time Yield)**
- Scrap rate
- **Defect/Rework Rate**
- **VA/ NVA Time**
- Batch Size/ Pack Size
- Distance Traveled
- Downtime
- Etc..

LEAN GOVERNMENT PROCESS METRICS

Time Metrics	*Cost Metrics*	*Quality Metrics*
⇨ Lead Time ⇨ Best and Worst Completion Time ⇨ Percent On-Time Delivery ⇨ Processing Time ⇨ Activity Ratio ⇨ Value Added Time ⇨ Non-Value Added Time ⇨ Non-Value Added but Necessary Time ⇨ Percent Value Added Time	⇨ Labor Savings ⇨ Cost Savings ⇨ Cost per Product	⇨ Customer Satisfaction ⇨ Rework ⇨ Percent Complete and Accurate ⇨ Rolling First Pass Yield
Output Metrics	*Process Complexity Metrics*	
⇨ Production ⇨ Backlog ⇨ Work in Process ⇨ Inventory	⇨ Process Steps ⇨ Value Added Process Steps ⇨ Decisions ⇨ Delays ⇨ Handoffs ⇨ Loops ⇨ Black Holes	

FTQ

Step 4: Map the Material Flow



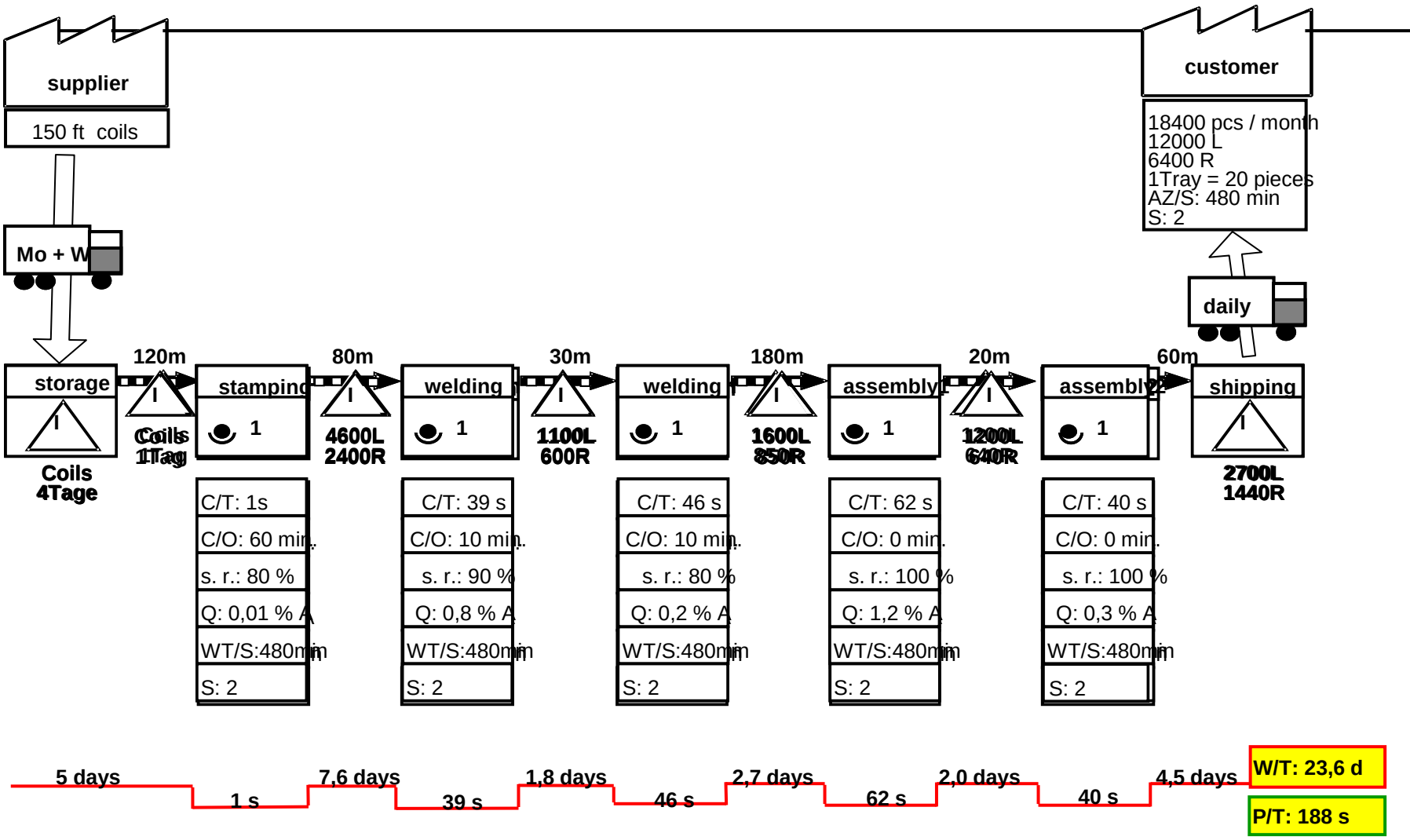
Example ABC company:

Now the entire material flow from the supplier across the manufacturing to the customer will be added to the actual map.

The arrows of the material flow symbolize a push-system.

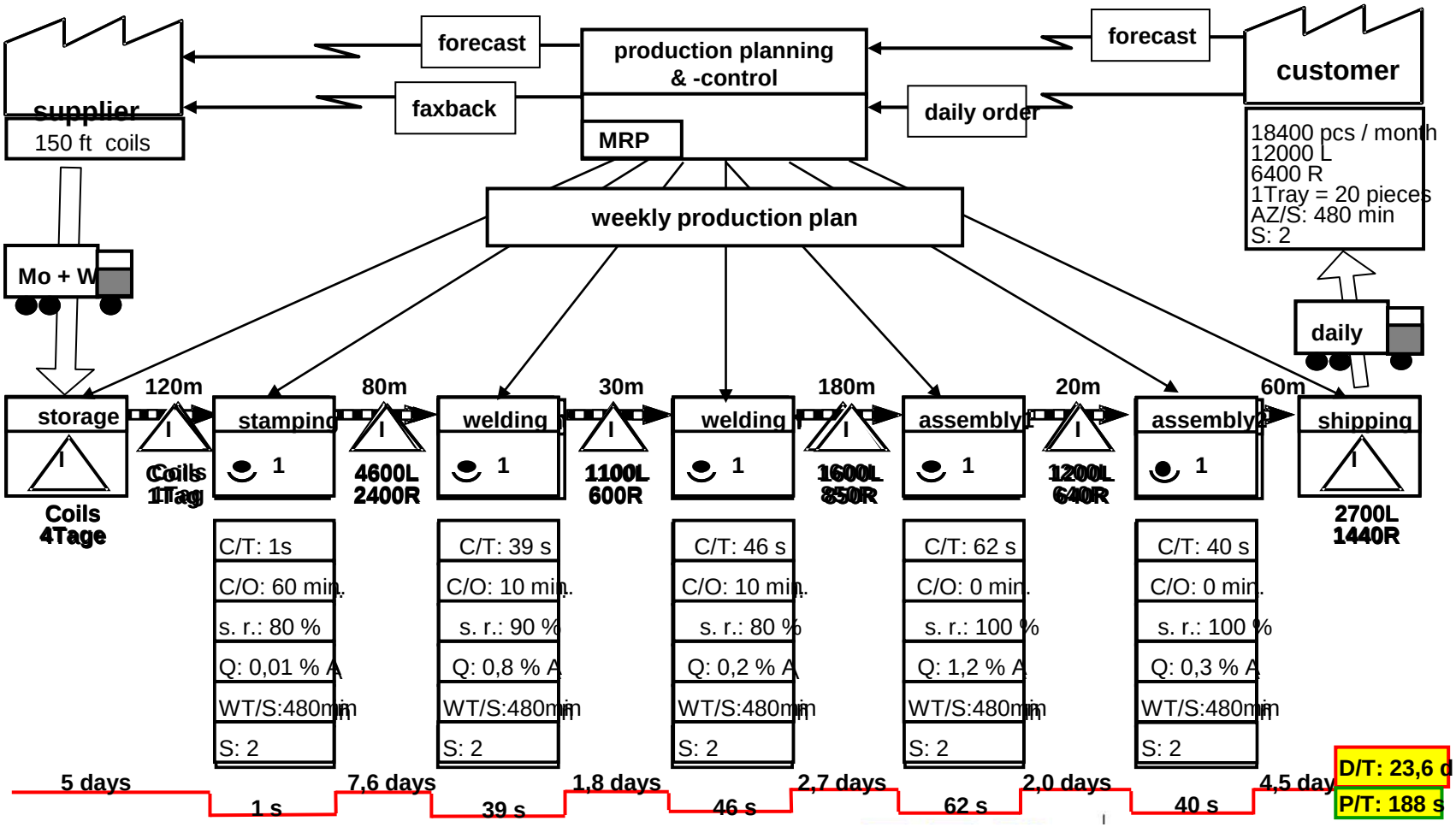
Step 5: Indicate Time Pulse

(Cycle Time, Waiting Time and Lead time)

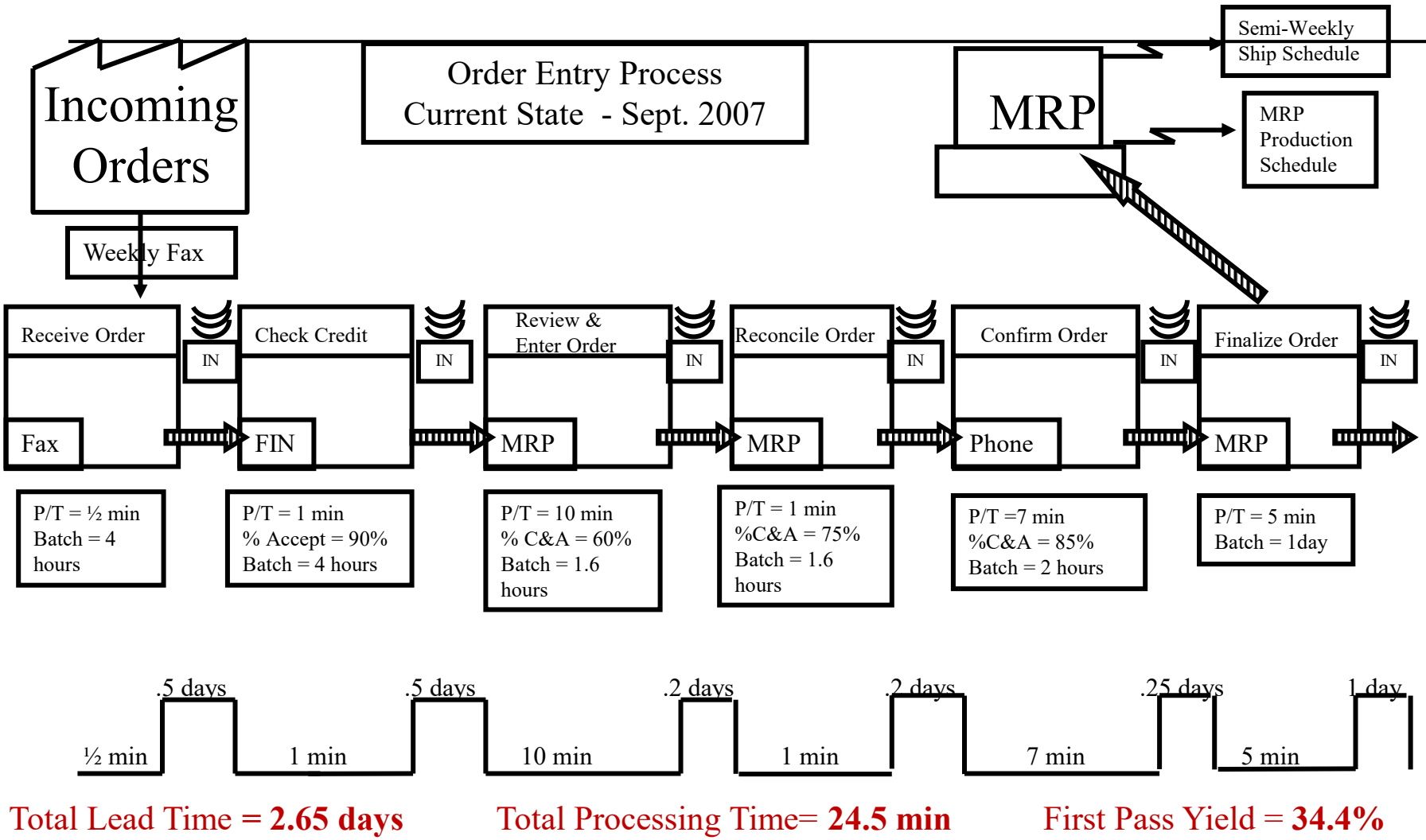


Step 6 - Map the Information Flow

Example ABC company:
Now the entire information flow from the supplier across the manufacturing to the customer will be added to the actual map.

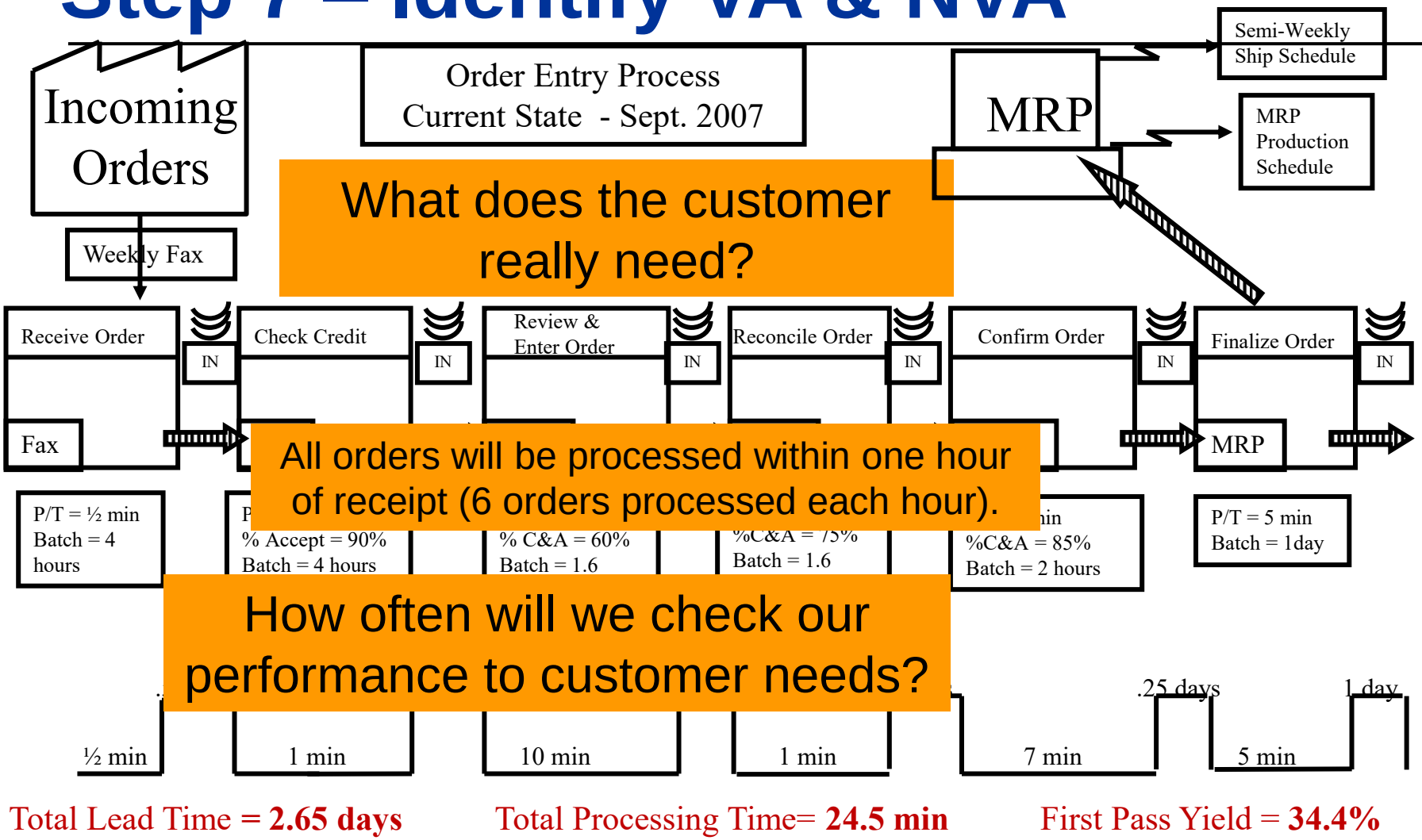


Example VSM in action



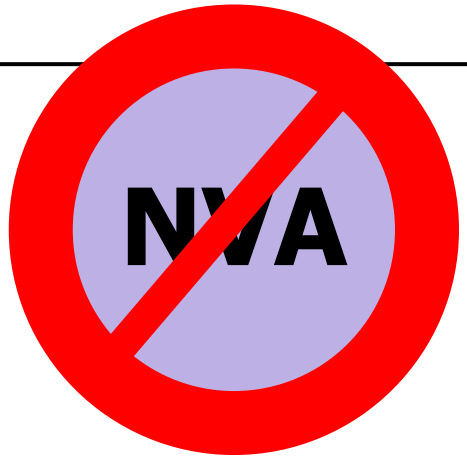
Total Lead Time = **2.65 days** Total Processing Time= **24.5 min** First Pass Yield = **34.4%**

Step 7 – Identify VA & NVA



Total Lead Time = **2.65 days** Total Processing Time= **24.5 min** First Pass Yield = **34.4%**

Process Streamlining – Removing NVA



Eliminate Non-Value Add Tasks:

- Handling
- Paperwork
- Counting, Issuing, Retrieving
- Wait
- Proofreading
- Inspection and checking
- Sorting work
- Logging information
- Checking calculations
- Reviewing and approving
- Moving and set-up
- Monitoring work
- Any type of rework

Hamed.Ali.Mohamed2@gmail.com

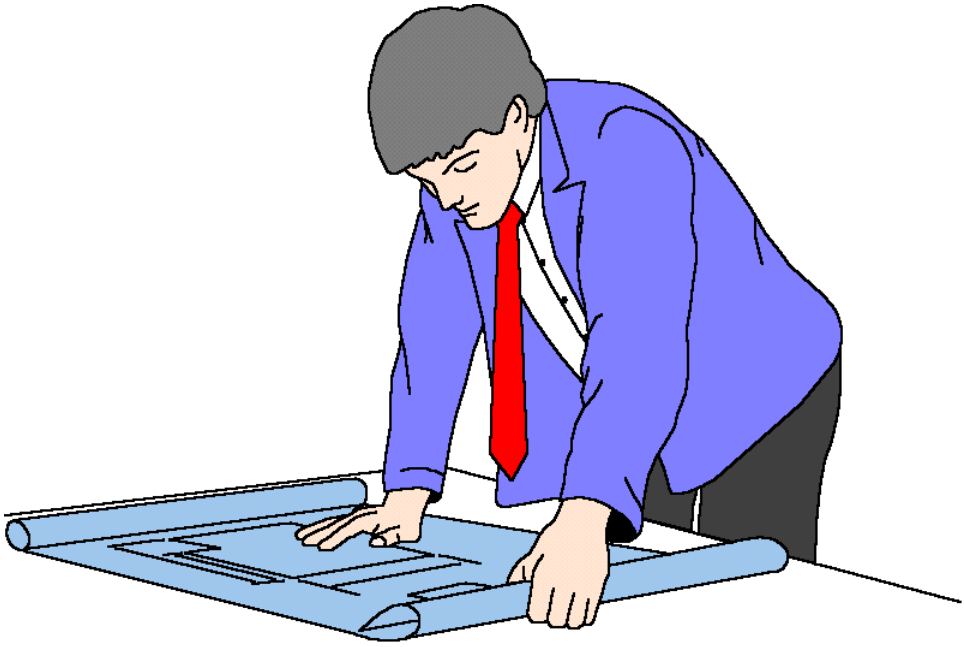
Analysis Tools to identify opportunities

- Value Analysis
- Waste Analysis
- Root Cause Analysis
  - 5 Whys
  - Fishbone Diagram
  - Fault Tree Analysis
- Eliminate, Combine, Rearrange or Simplify

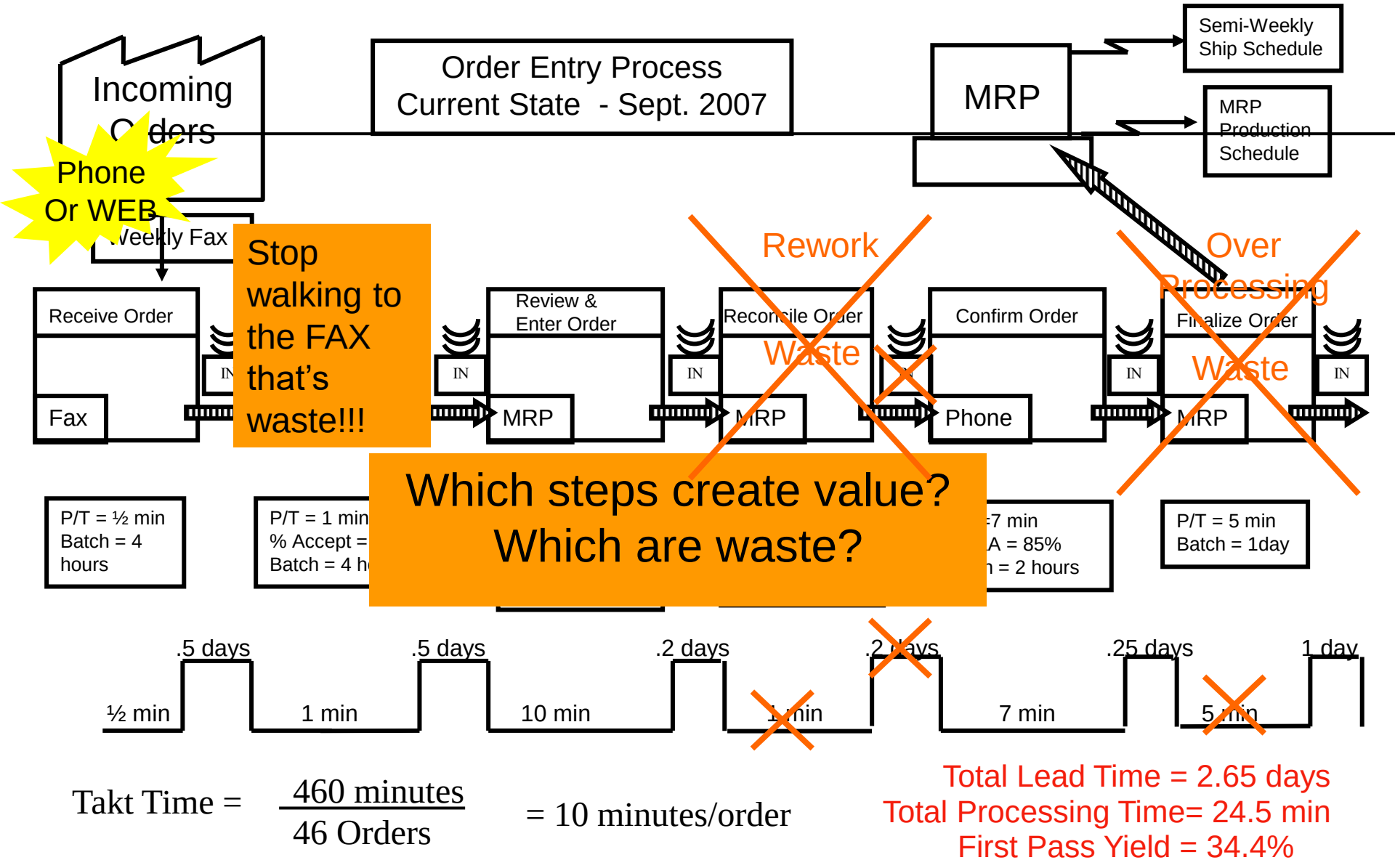
Hamed.Ali.Mohamed2@gmail.com

Design Future State - Purpose

- Define how the plant will operate in the future
- Serve as the blueprint for implementation

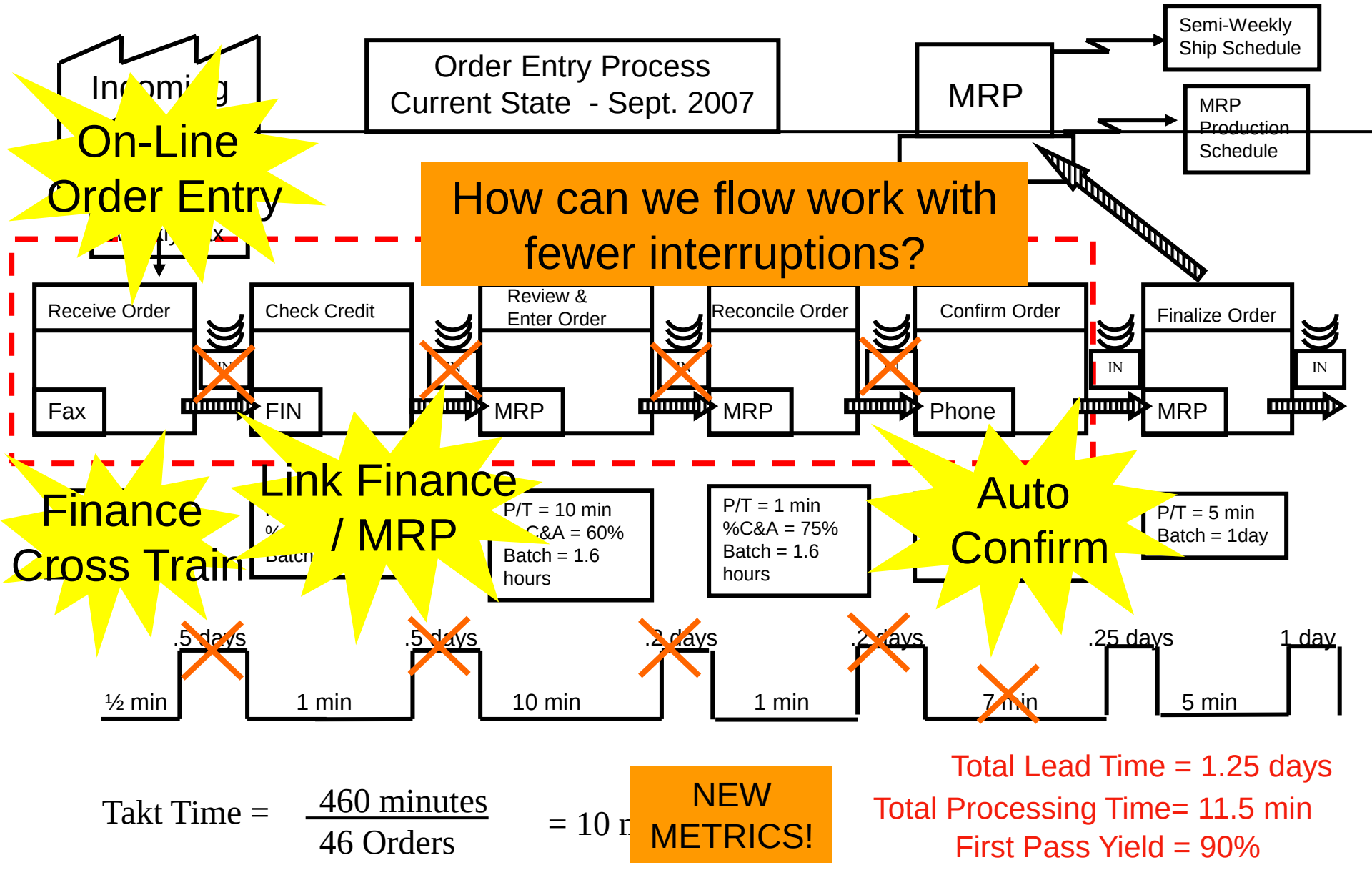


Without it, the Current State Map is nothing more than wallpaper!



$$\text{Takt Time} = \frac{460 \text{ minutes}}{46 \text{ Orders}} = 10 \text{ minutes/order}$$

Total Lead Time = 2.65 days
Total Processing Time= 24.5 min
First Pass Yield = 34.4%

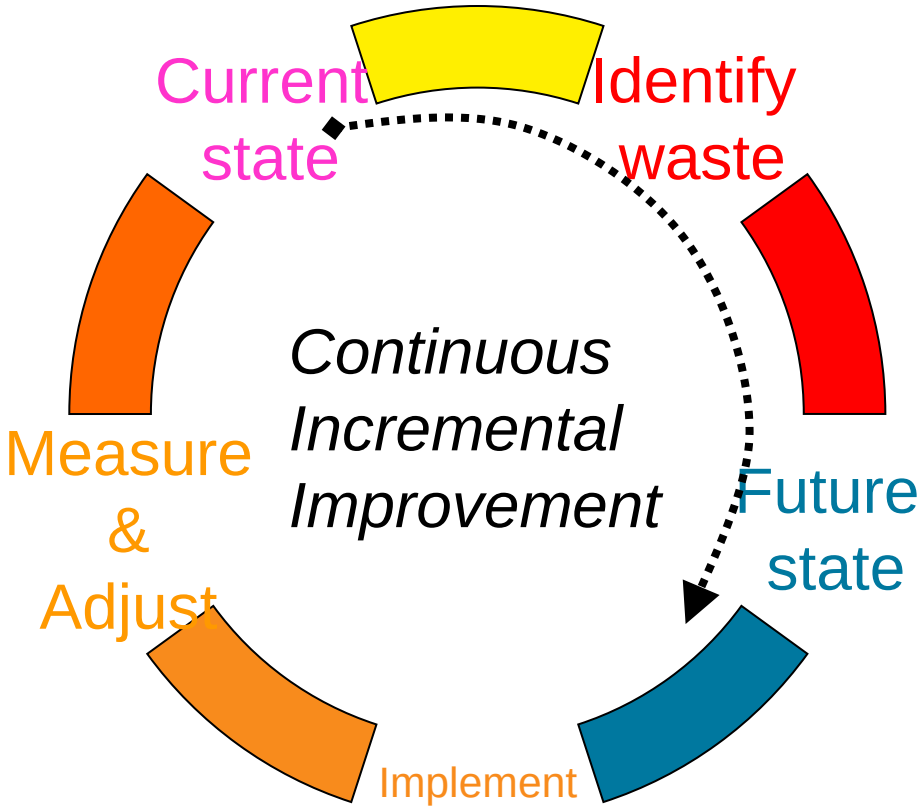


Takt Time = $\frac{460 \text{ minutes}}{46 \text{ Orders}}$ = 10 m

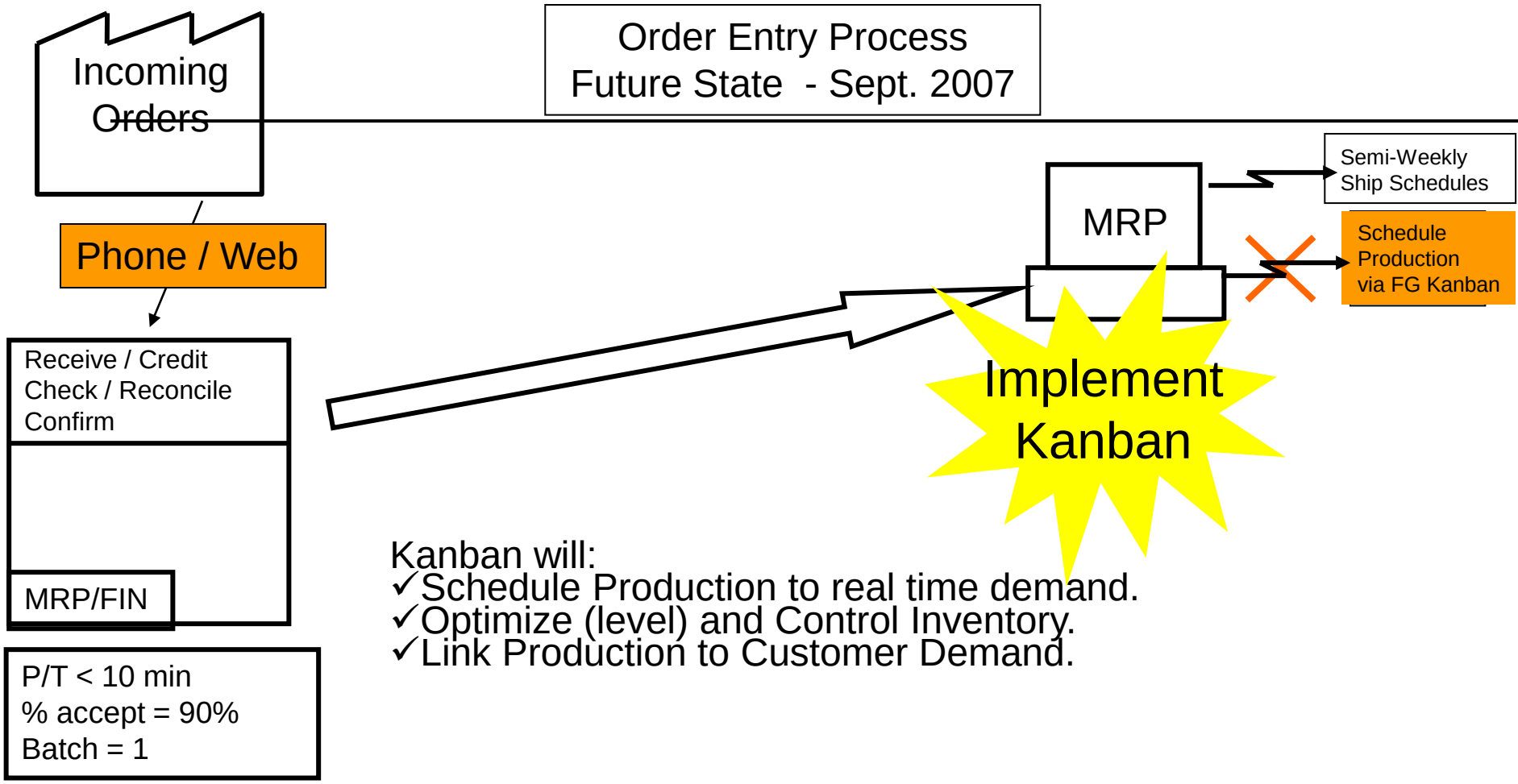
NEW METRICS!

Total Lead Time = 1.25 days
Total Processing Time= 11.5 min
First Pass Yield = 90%

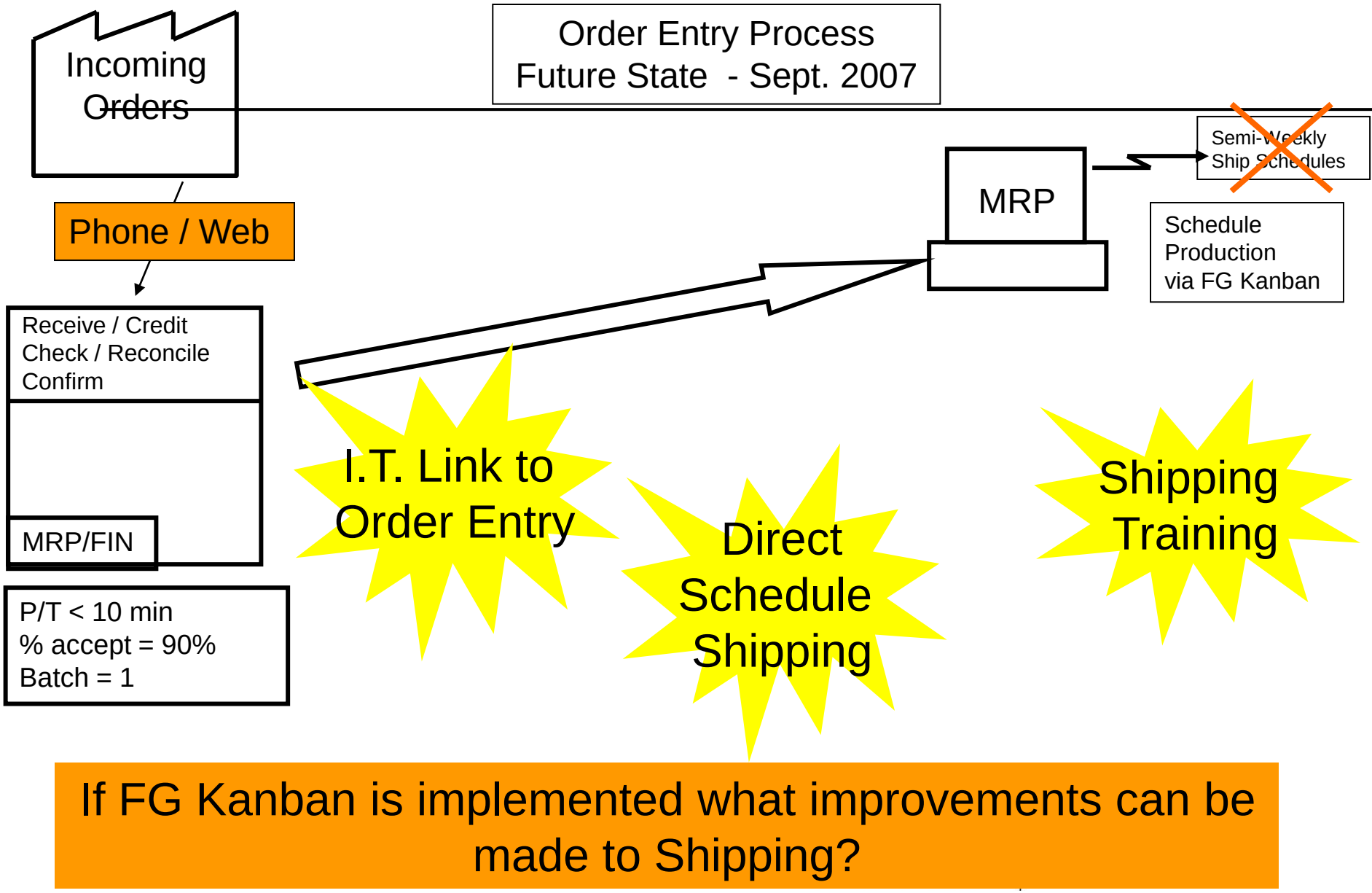
Continuous Improvement through VSM



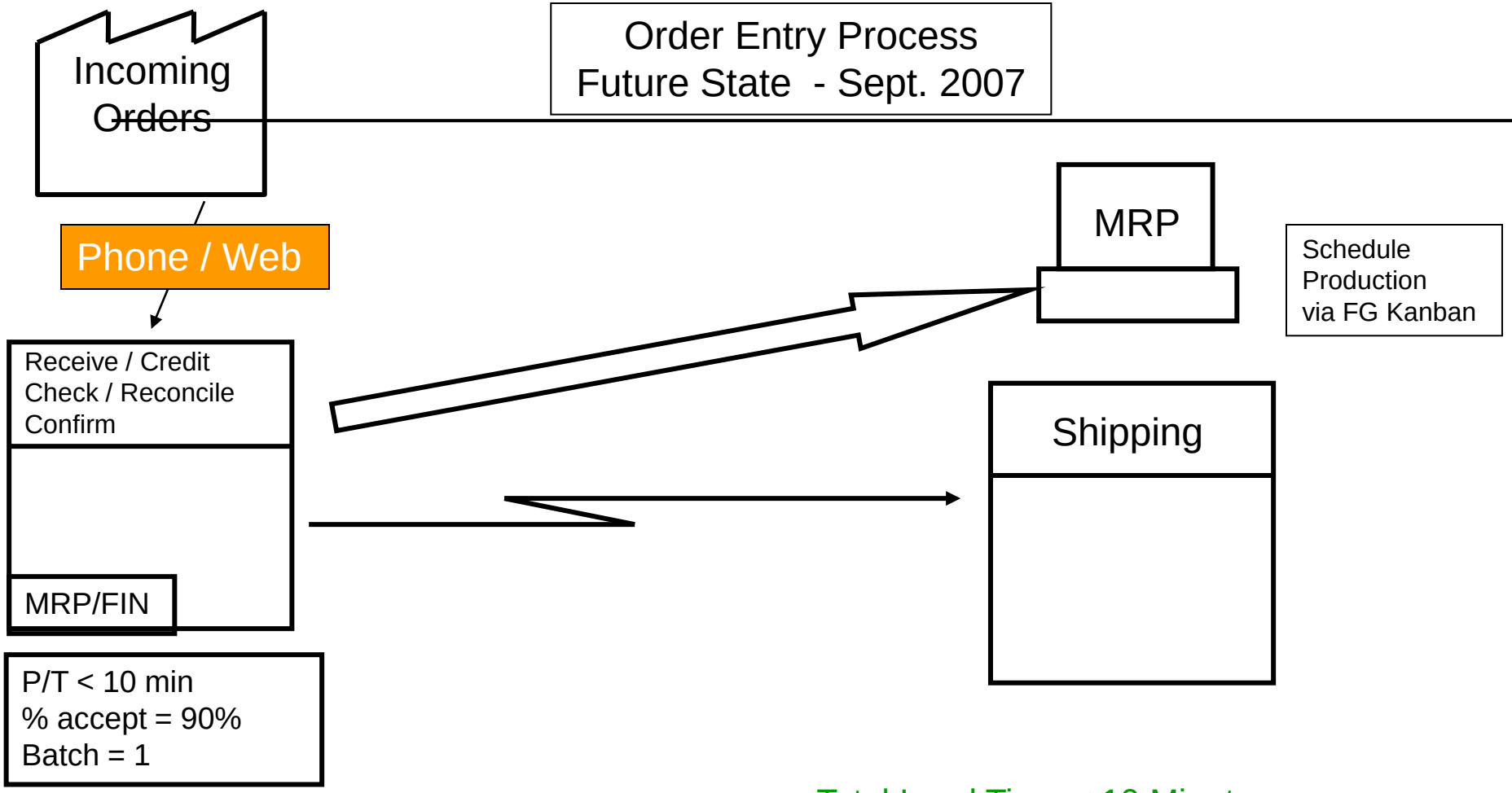
Hamed.Ali.Mohamed2@gmail.com



How can we control work between interruptions?



If FG Kanban is implemented what improvements can be made to Shipping?


Order Entry Process
Future State - Sept. 2007
Incoming Orders
Phone / Web
Receive / Credit
Check / Reconcile
Confirm
MRP/FIN
P/T < 10 min
% accept = 90%
Batch = 1
MRP
Schedule
Production
via FG Kanban
Shipping
Future State Metrics!
Total Lead Time < 10 Minutes
Total Processing Time < 10 Minutes
First Pass Yield > 90%

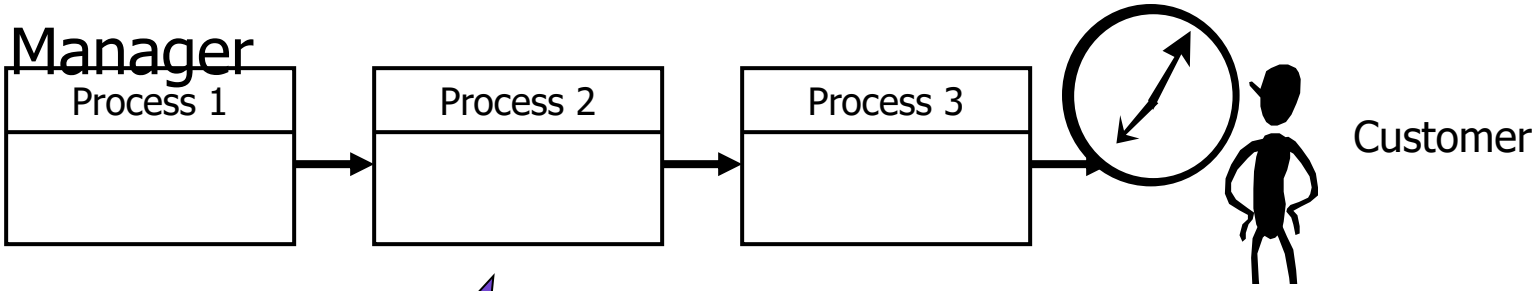
Step 10: Improvement Activities to achieve the future state

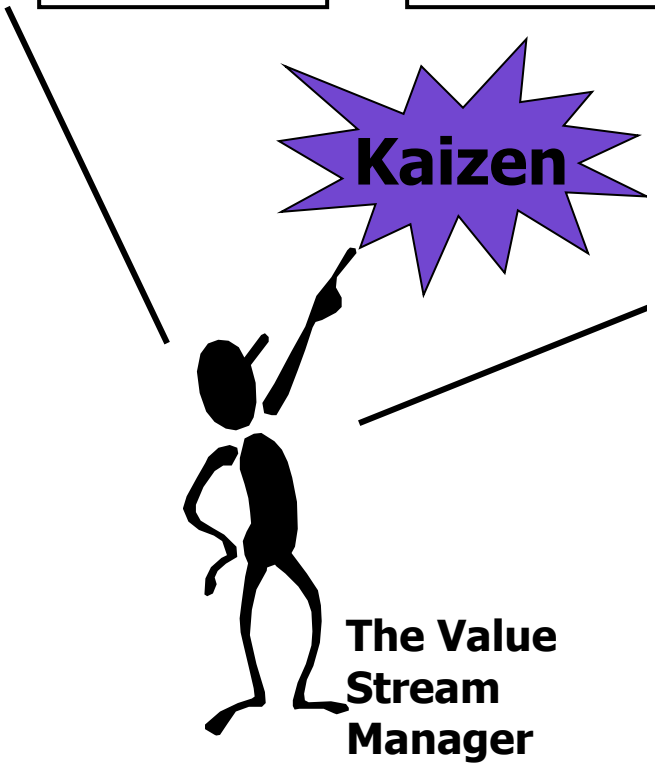
Week	Date		Department	Subject	Method / Tool						Category						Responsible	Consultant	Status
	WS Start	WS End			Value Stream Analysis	Kaizen Workshop	Set-up Kaizen	ViT	TPM	others	Material flow	Process Optimization	Layout	Set-up	Quality	Ressources			
8	20.02.06	23.02.06	Inspection	Inspection: Work in Team		x									x	x	Izat Hifni	Azman Shah	done
12	20.03.06	23.03.06	Cleaning, NDT & Lab	Chemical Cleaning, NDT & Lab: Process Optimization and Consolidation		x					x	x				x	Azmin Hasan	Azmin Hasan	done
16	17.04.06	20.04.06	Machining	Machining: Blohm Machine Setup Reduction and Changeover		x	x							x			Azmin Hasan	Azmin Hasan	open
19	08.05.06	11.05.06	Manual Grinding	Manual Grinding: Blending and Welding Preparation		x	x		x			x	x	x			Azmin Hasan	Azmin Hasan	open
23	05.06.06	08.06.06	Inspection	Inspection: Process Optimization		x						x	x			x	Azmin Hasan	Azmin Hasan	open
28	10.07.06	13.07.06	Welding	Welding: Process Optimization		x						x	x	x			Azmin Hasan	Azmin Hasan	open
33	14.08.06	17.08.06	Inspection	Inspection: Process Optimization		x						x	x				Azmin Hasan	Azman Shah	open

A Yearly Value Steam Project Pipeline

Value Stream Managers

Each Value Stream Needs a Value Stream Manager



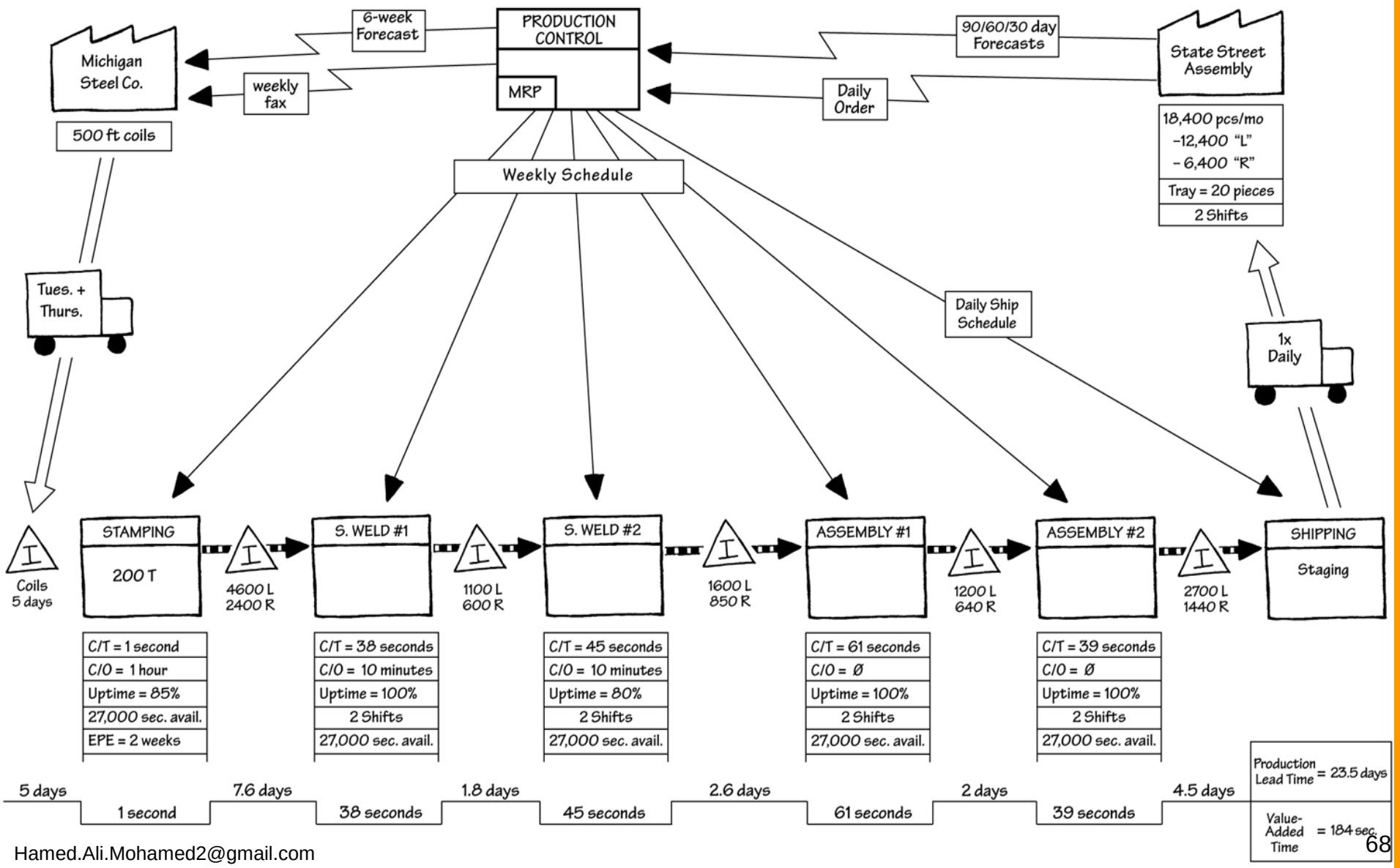


For product ownership beyond functions

Assign responsibility for the future state mapping and implementing lean value streams to line managers with the capability to make change happen across functional and departmental boundaries.

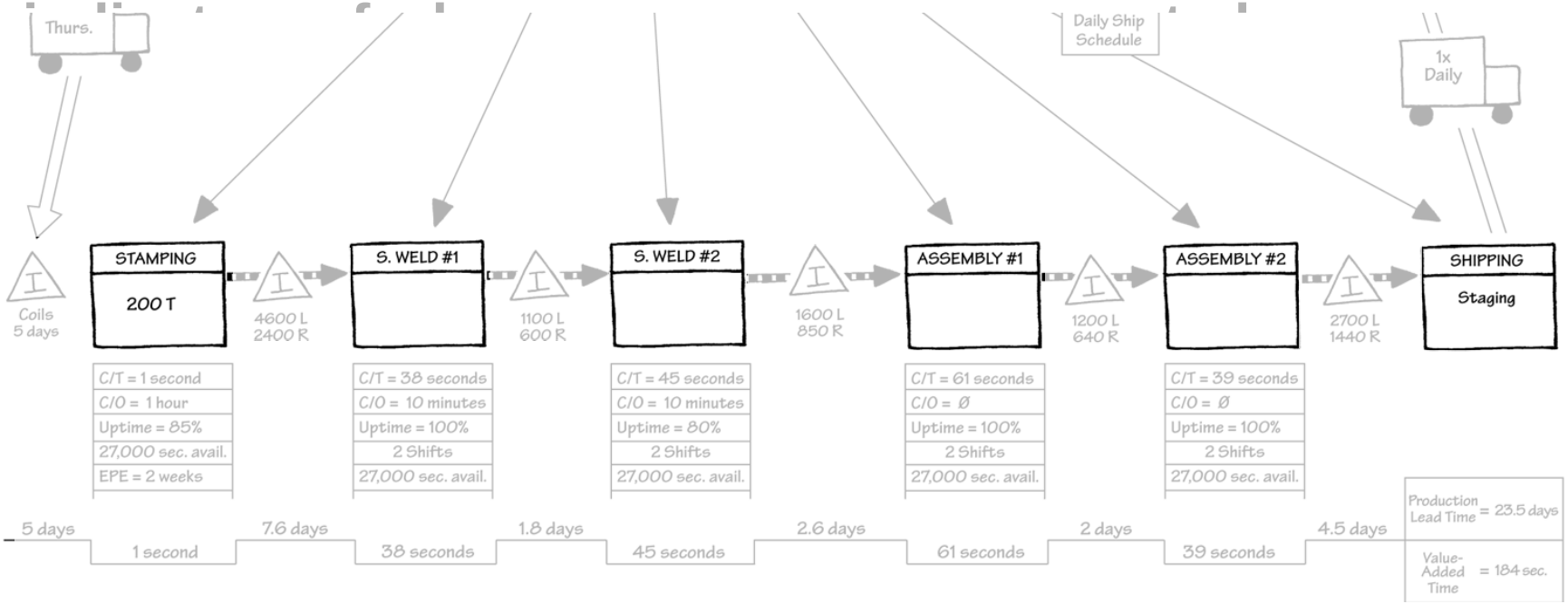
Value stream managers should make their progress reports to the top manager on site.

Present State Value Stream Map



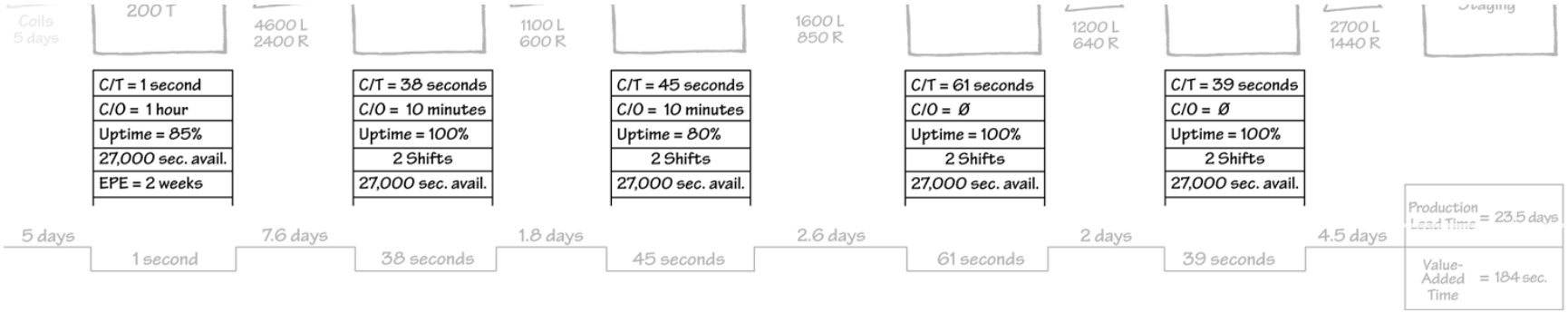
The Process Box

- Indicates basic production process.
- One box for each major material flow, not for each processing step.
- Process disconnection and inventory accumulation are



The Data Box

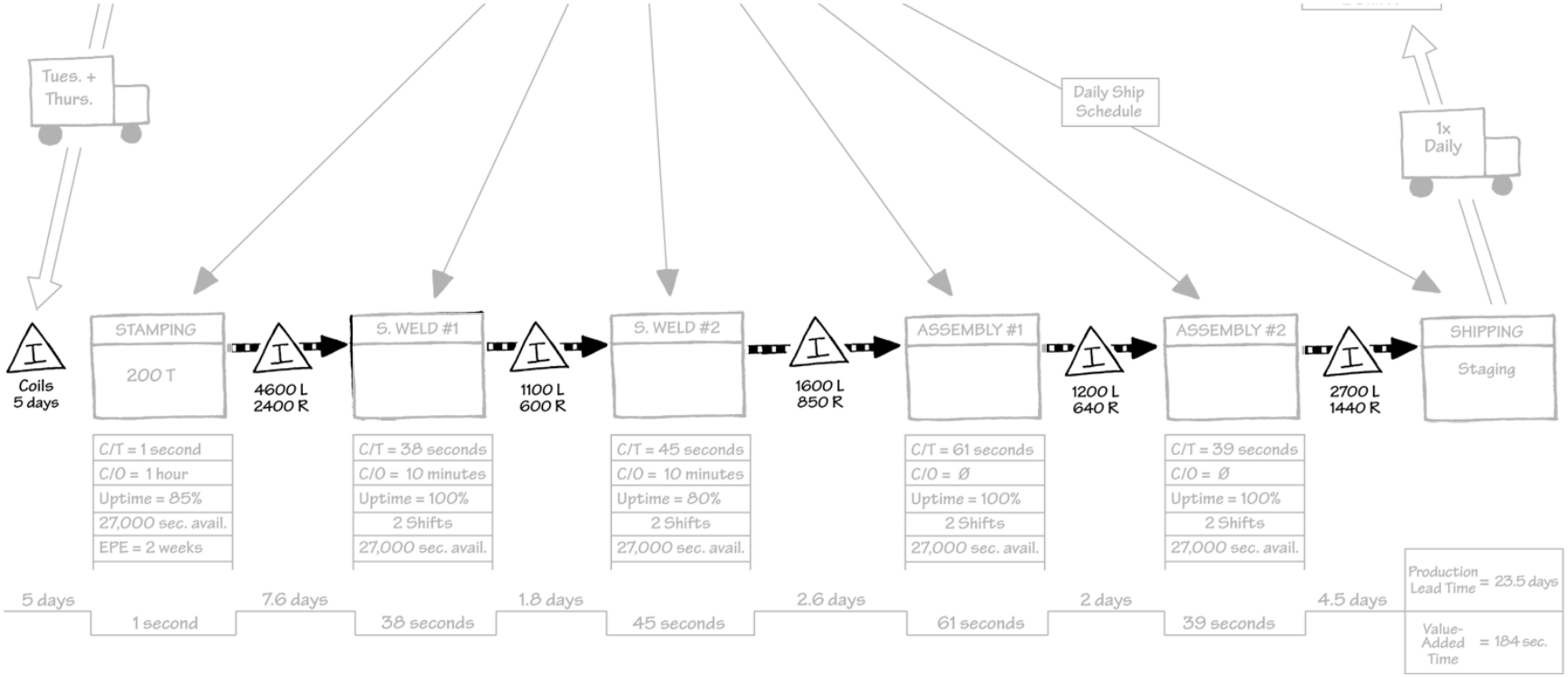
- **The Data Box stores process information**
  - **Cycle Time (C/T).** Rate at which a part or product is completed by a process.
  - **Changeover Time (C/O).** Amount of time to switch from one product type to another.
  - **Uptime**. Measure of machine use (100% = Always running).
  - **Every Part Every (EPE).** Measure of batch sizes and changeover cycles.
  - **Available Work Time.** Per shift of a process (in seconds, minus break, meeting, and cleanup times.)
  - **Quality Level.** % First time yield.
  - **Number of Operators.** Required personnel for a process.



Hamed Mohamed2@gmail.com

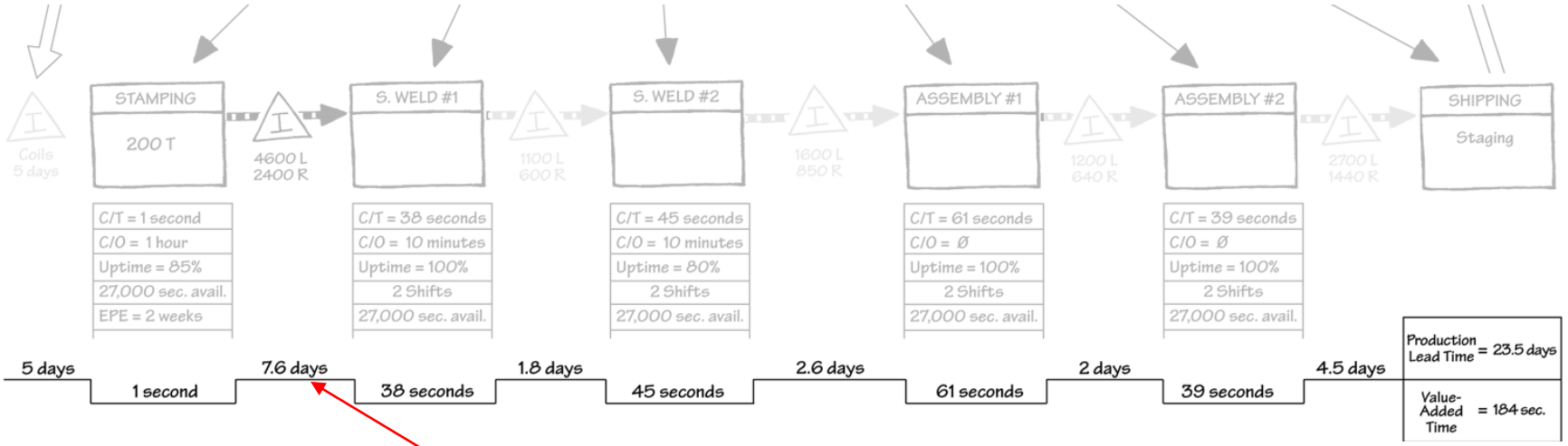
Inventory Triangle and Push Movement Arrow

- An ~~Inventory Triangle captures the location and amount of inventory~~
- A striped arrow indicates a Push movement of inventory according to a predefined schedule



Lead Time Bars

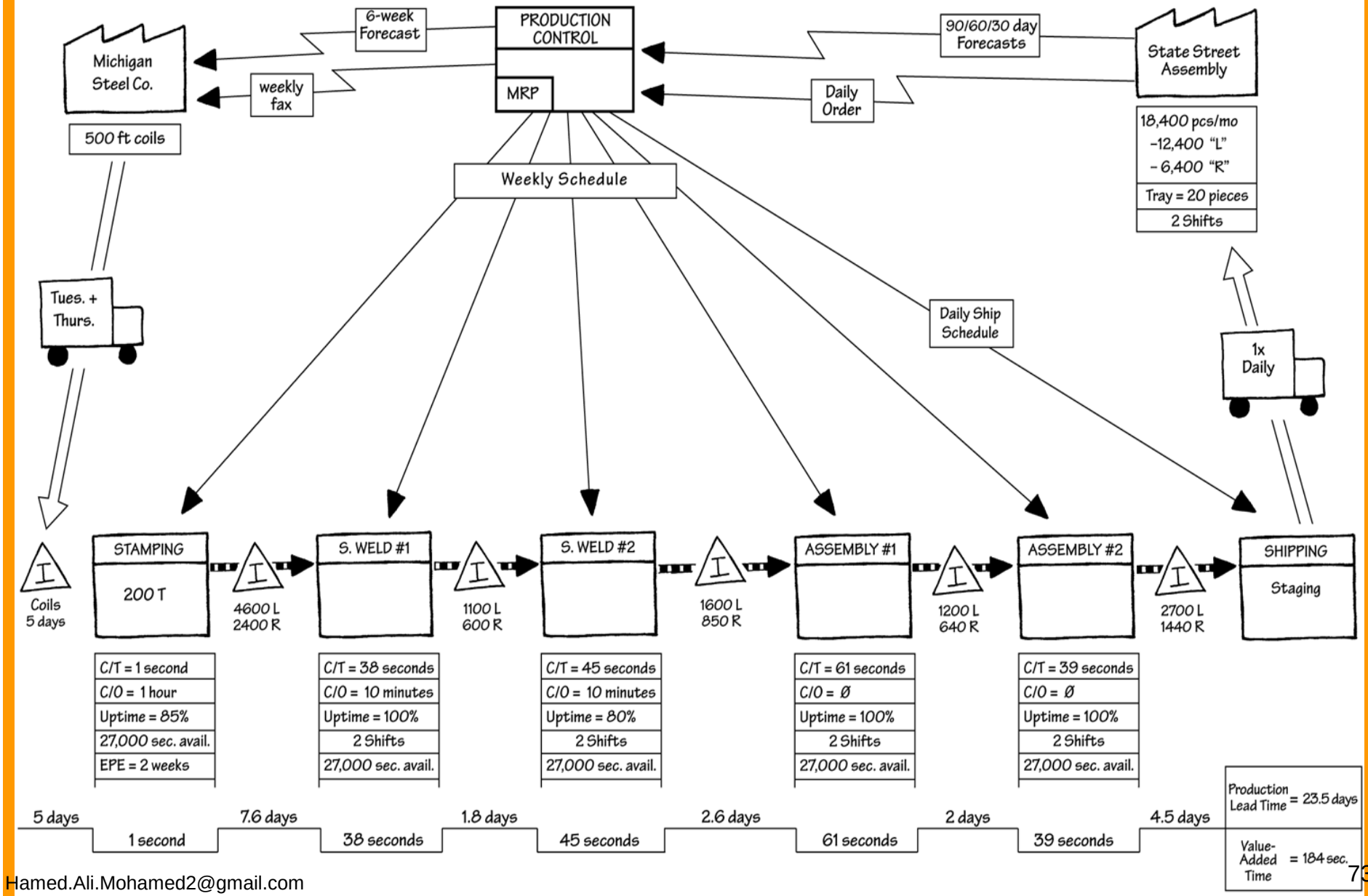
- **Lead time indicates total time for a process or series of process.**
  - **Production/Manufacturing Lead Time (MLT).** Lead time through entire production.
  - **Process Lead Time.** Lead time though each process, including time in inventory. Calculated as inventory quantity divided by daily customer requirement.
  - **Processing Time = Value Added Time.** Actual time spent processing the part or product.



(7000 pcs)/(28400 pcs/month)x(20 workdays/month)

Hamed.Mohamed2@gmail.com

Present State Value Stream Map



Establish Takt Time

- **Synchronizes pace of production to match pace of sales.**

$$\text{Takt Time} = \text{Demand Rate}$$

$$\text{Takt Time} = \frac{\text{Work Time Available}}{\text{Number of Units Sold}}$$

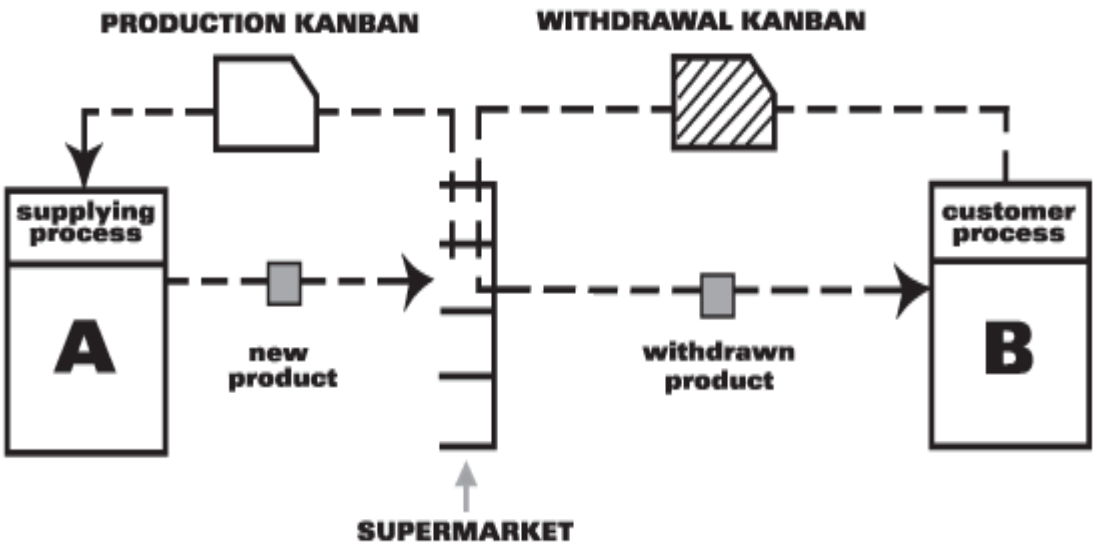
$$\text{Takt Time} = \frac{900 \text{ Seconds}}{85 \text{ Boards}} = 10.6 \text{ Sec/Board}$$

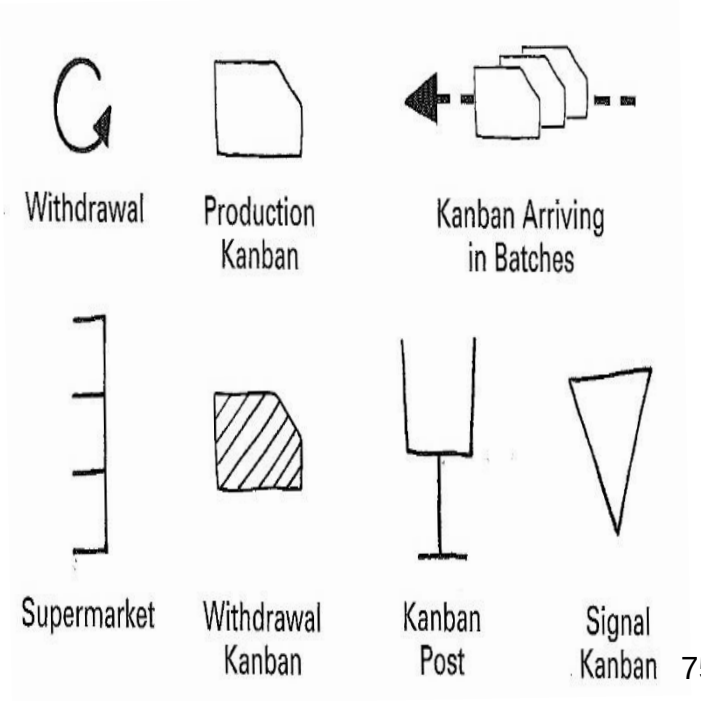
$$\frac{\text{Cycle Time}}{\text{Takt Time}} = \text{Minimum \# of People}$$

GOAL: Produce to Demand

Supermarket Pull System

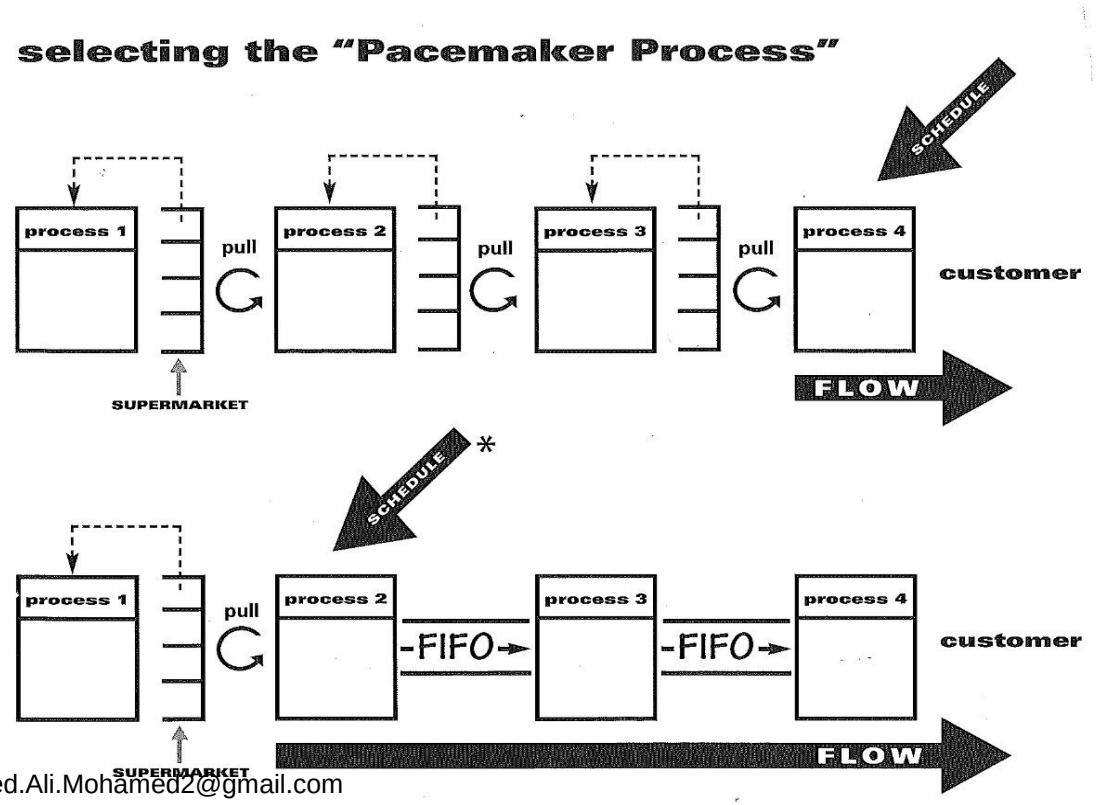
- Used to control production where continuous flow does not extend upstream.
- Example Reasons for Supermarkets:
  - Process that operate at very fast or slow cycle times and need to change over to serve multiple product families
  - Some processes, such as those at suppliers, are far away and shipping one piece at a time does not make sense.
  - Some processes have too much lead time or are too unreliable to couple directly to other processes in a continuous flow.





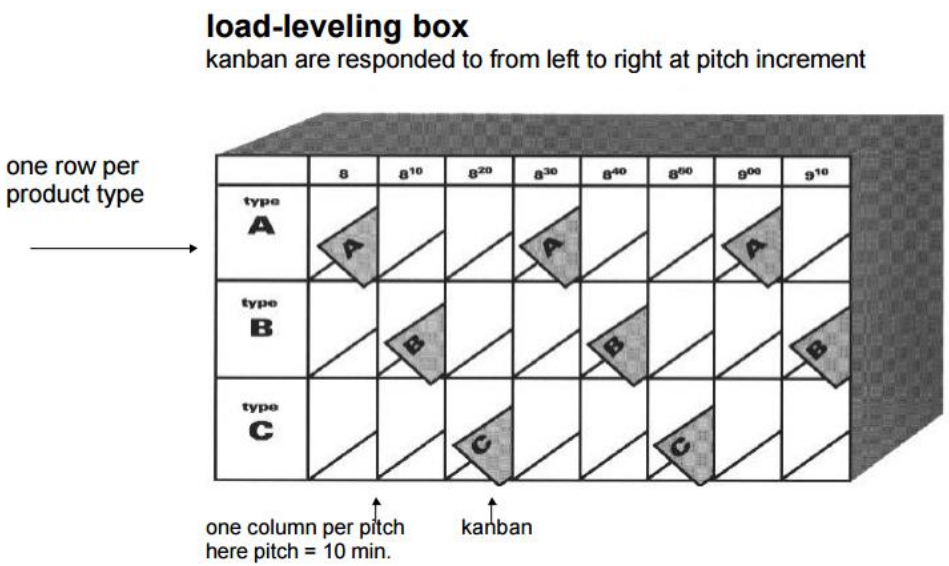
Pacemaker Process

- A pacemaker process is single point in the manufacturing value stream that sets the production pace for the entire process.
- The pacemaker process is frequently the most downstream continuous-flow process.
- On the future-state map, the pacemaker process is the production process that is controlled by the outside customer's orders.



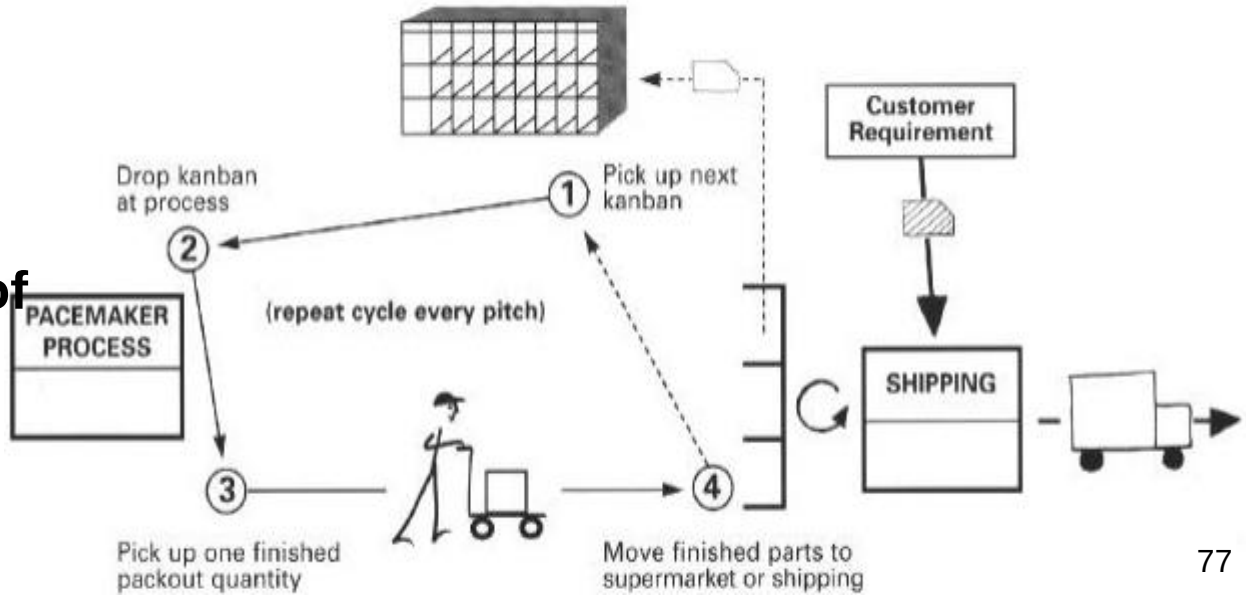
- Load-leveling means distributing the production of different products evenly over a time period, creating a product "mix".
- The schedule should create an "initial pull" by releasing and withdrawing a small, consistent increment of work, called the "Pitch".

Load Leveling and Paced Withdrawl



- **Load-leveling means distributing the production of different products evenly over a time period, creating a product "mix".**

- **The schedule should create an "initial pull" by releasing and withdrawing a small, consistent increment of work, called the "Pitch".**



Future State Value Stream Map