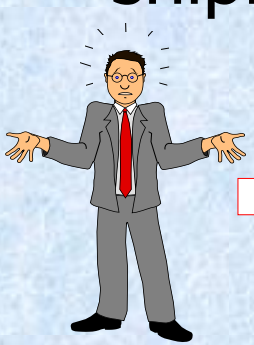
Value Stream Mapping Case Study Step By Step Explained

Agenda

- Understanding “Value Stream Mapping”
- Material and Information Flow
- Drawing the Current State Map
- Using the Mapping Tool
- Identifying the MUDA
- Guidelines for eliminating MUDA
- Drawing Future State Map

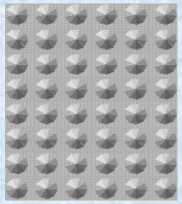
Value Stream

A Value Stream is all the actions (both value added and non-value added) that occur to a product beginning with its inception(at design) through to shipment to the customer.

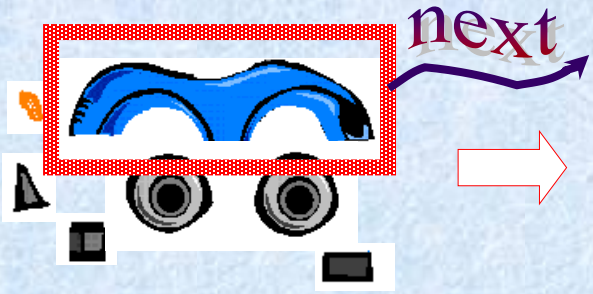


Requirements

Design



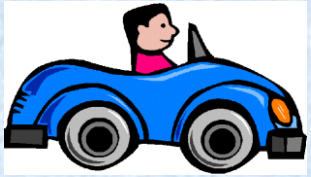
Raw Materials



Parts Manufacturing

Assembly Plants

Distribution



Customer

Components of Flow Kaizen

Value	• Specify Value from the end customer's perspective.
Value Stream	• Identify the Value Stream
Flow	• Make the Product/Service Flow through the Value Stream.
Pull	• So that customer can Pull from the producer.
Perfection	• Constantly pursue Perfection.

Value

Specify Value from the end customer's perspective

Define Customer	Define Value	Understand unmet needs
clearly understand who the customer is.	Quality, schedule/ Cycle Time, target cost etc.	Ask how your current processes dissatisfy your customers

Value Stream

Understand and Map the Current Steps

Process Flow

- Sequence of Major Steps

Material Flow

- Movement of things (material/document etc…) on which Value to be added

Information Flow

- Information about quantity to be produced/ delivered
- Work Scheduling

Flow

Understand the Flow and Blockage

Flow should not be interrupted at any point from the beginning to delivery of product/ service

Flow

Line-up all the steps that truly create value so they occur in rapid sequence;

- Challenge every step: Why is this necessary?.
- Eliminate / Minimize NVA activities.
- Process, in direct proportion to demand (need).
- Make every process:
  - Capable (No Defect)
  - Available (No down time)
  - Adequate, with capacity (to meet demand- Takt time)
  - Efficient (No NVAs)

Pull: Remove Blockage

Customer should Pull value through the Value Stream

Through Lead Time Reduction & correct value specification,

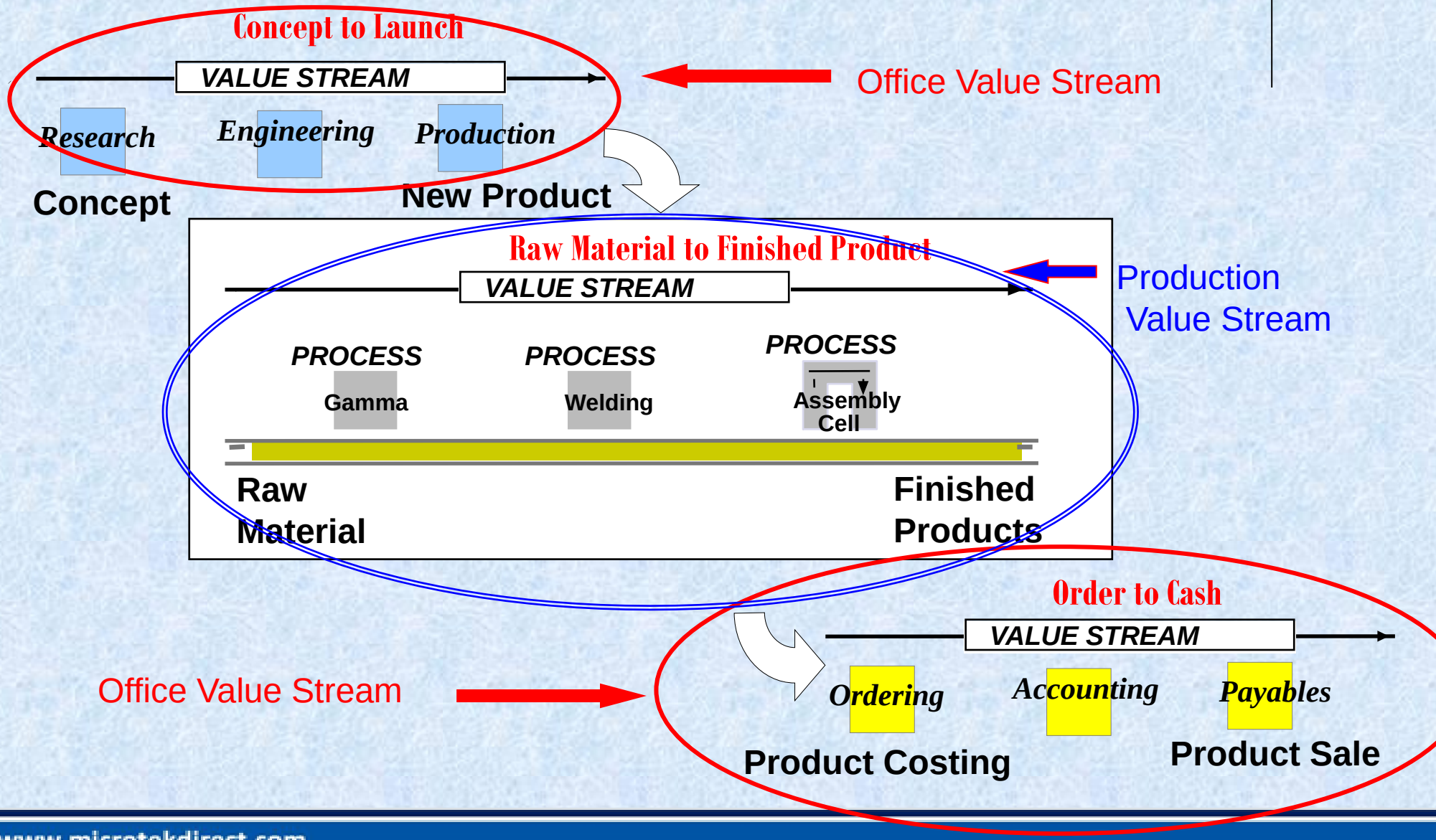
- Let customers get
  - exactly what they want &
  - exactly when they want.

Understanding Value Streams

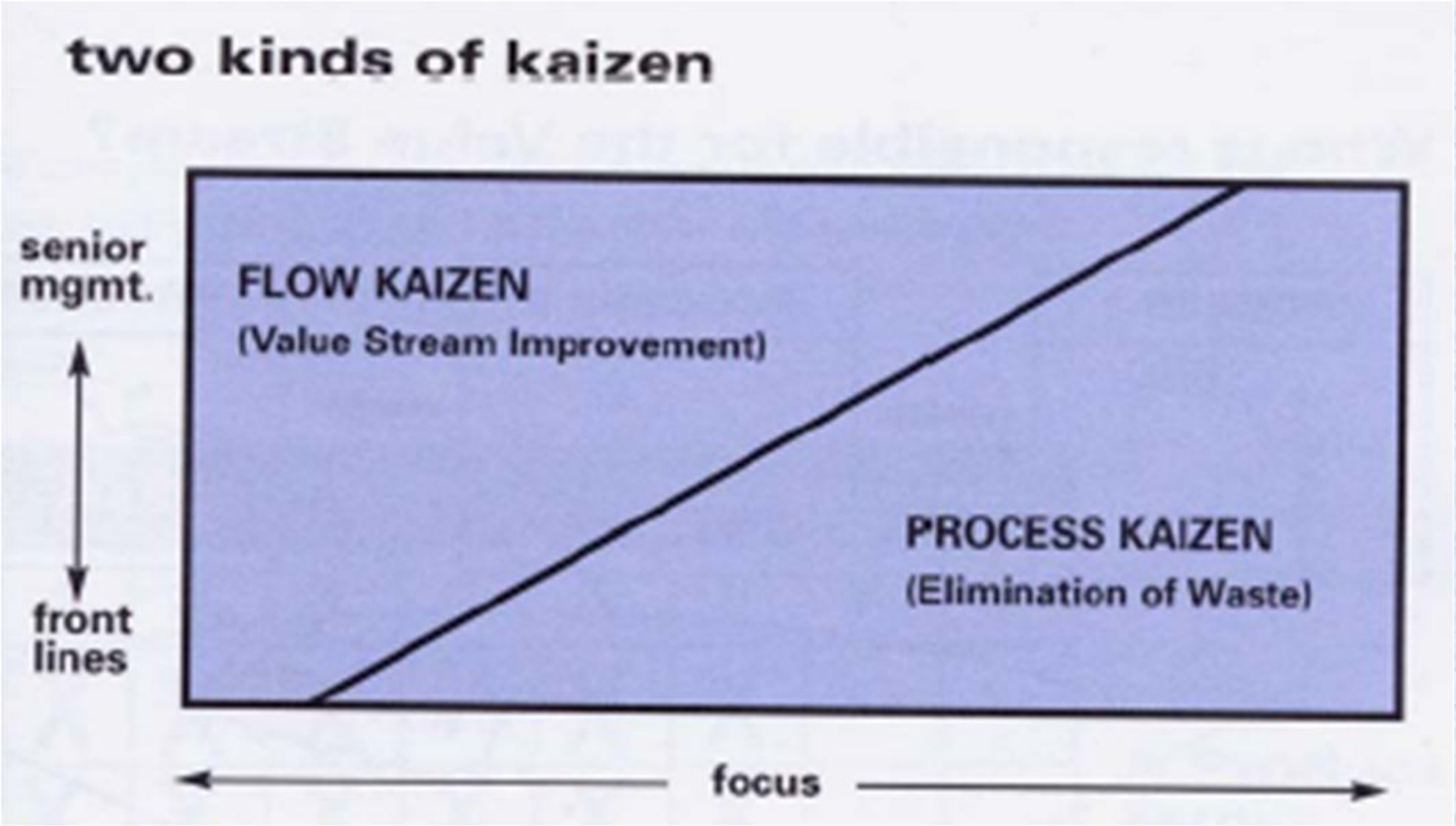
The set of all specific actions required to bring a specific product through the three critical management tasks of any business.

1. **Problem Solving** (e.g. Product and process Design & Development)
2. **Information Management** (e.g. order processing and other non production activities.)
3. **Physical Transformation** (e.g. converting raw material to finished goods)

Understanding Value Streams



Understanding Value Streams

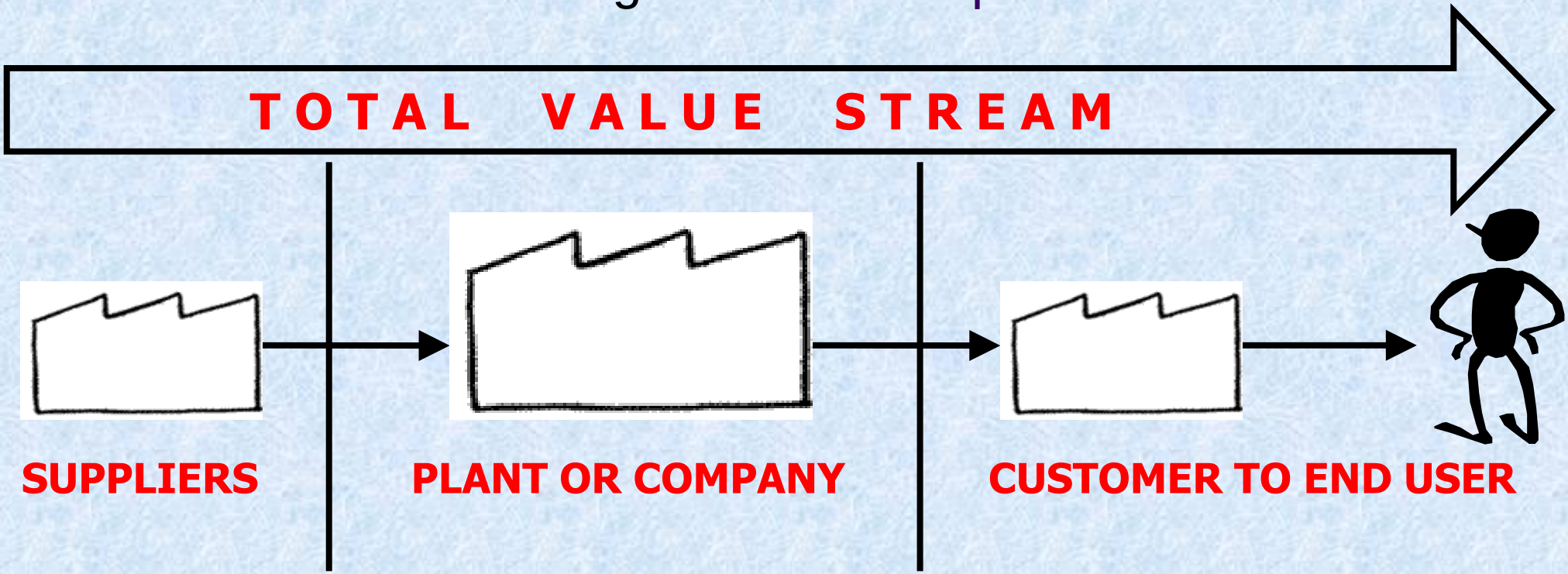


Understanding Value Streams

- A Value Stream perspective implies a big picture and not just individual processes and involves improving the entire working of the organization
- This requires to follow the Value Stream across many firms and even more facility
- This is very complex and to avoid this, we follow Door--To-Door Production Flow in the manufacturing plant consisting of raw material to finish stage activities

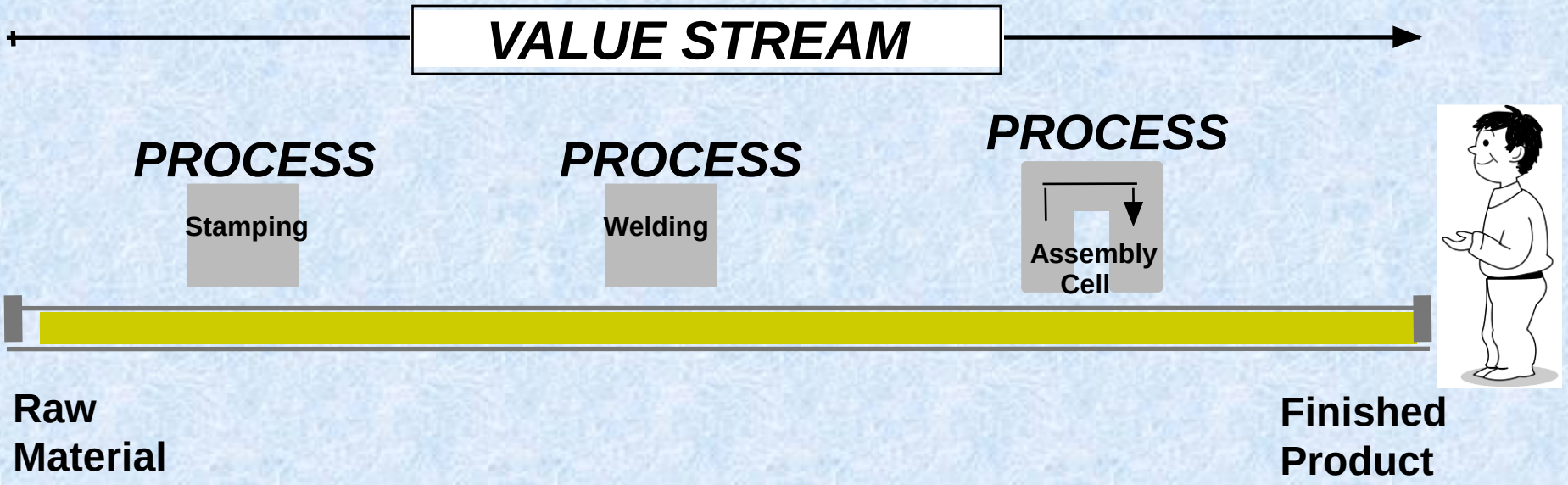
Door-To-Door Production Flow

Typically we examine the value stream from raw materials to finished goods within a plant.



Door-To-Door Production Flow

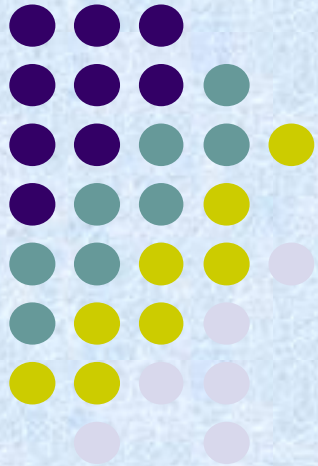
Typically we examine the value stream from raw materials to finished goods within a plant.



Why do Value Stream Mapping?

- It provides the means to see the material and information flows together.
- It helps you see more than waste. Mapping helps you see the sources of waste in your value stream.
- It provides a common language for talking about manufacturing system.
- It forms the basis of an implementation plan.
- Support the prioritization of continuous improvement (Kaizen) activities at both the value stream and plant levels.

Material and Information Flow



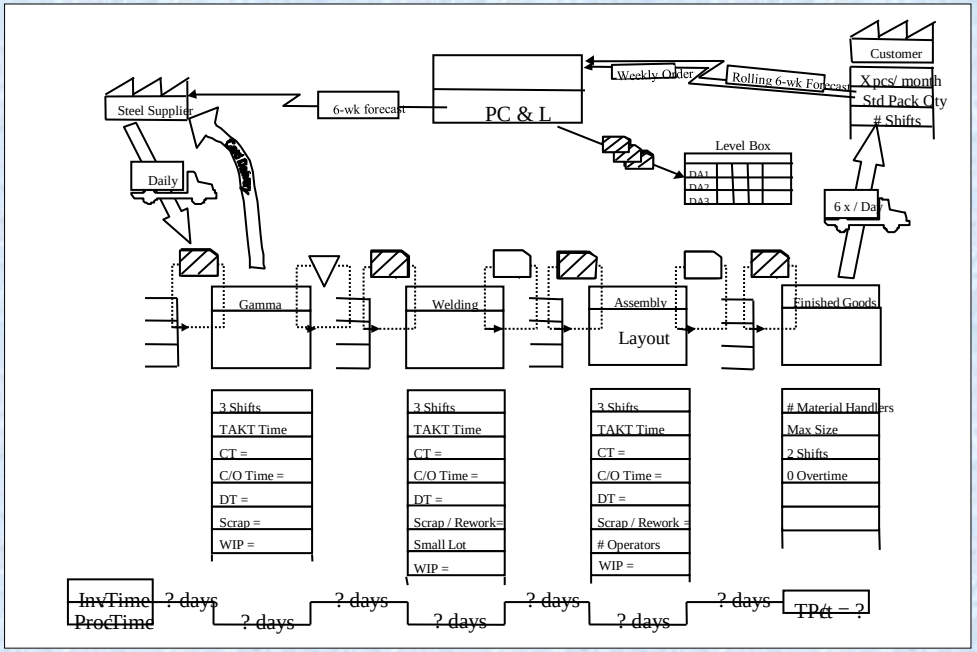
Types of Flow in Manufacturing

3 types of flow are identified in manufacturing - the flows of Material & Information

- Material Flow is the movement of material through the factory.
- Information Flow tells each process what to make or do next.
- Operations Flow is flow of equipment and people in time and space

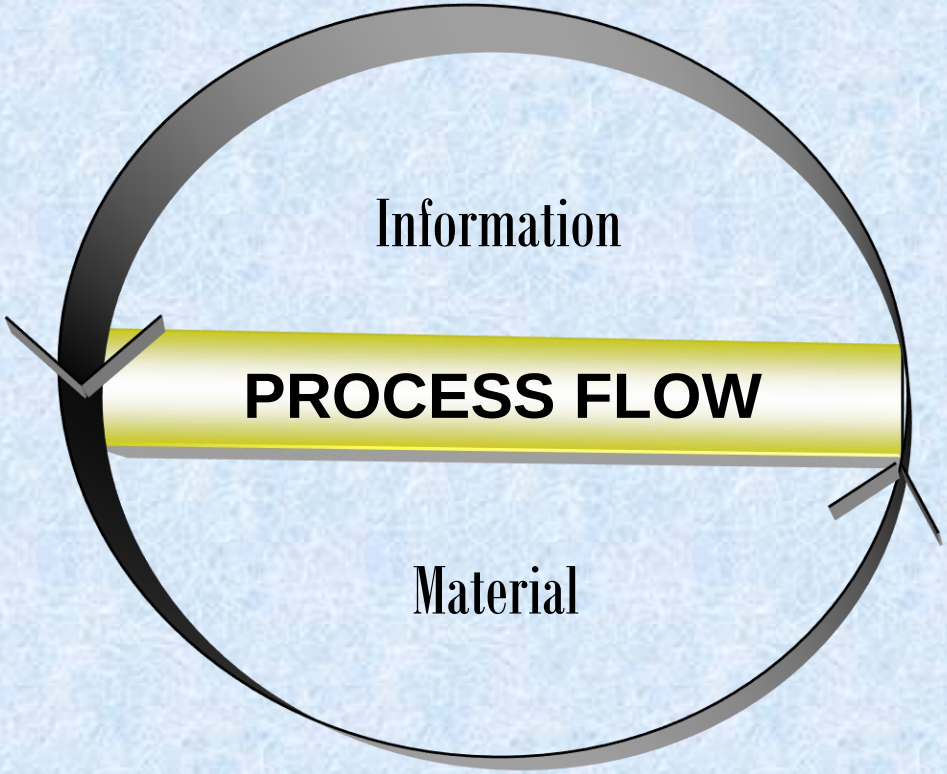
Value Stream Mapping

Value Stream Mapping (VSM) is a pencil and paper tool that helps you to see and understand the flow of material and information as a product makes its way through the value stream.

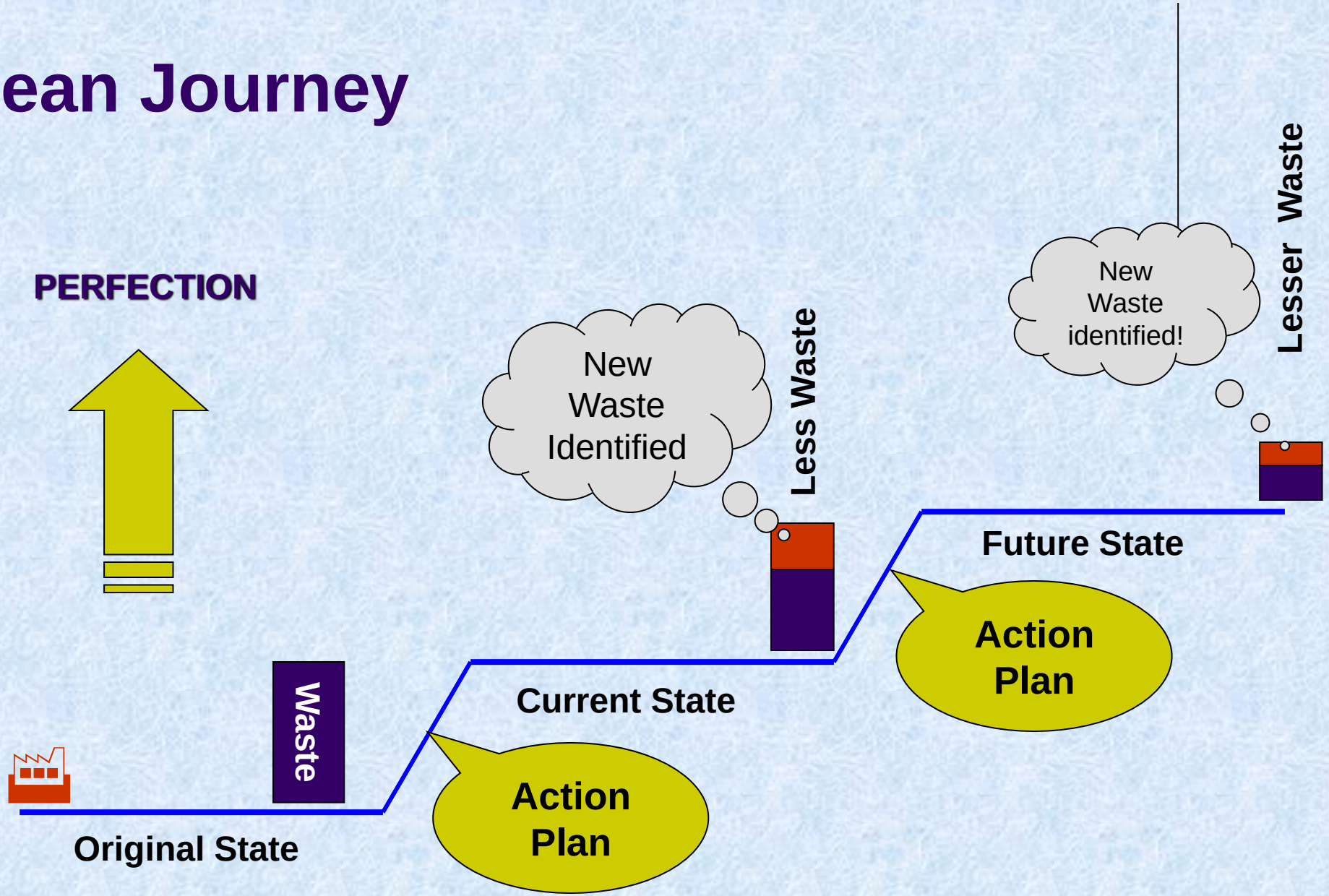


Future State Material, Information and Process Flows with total Product Cycle Time

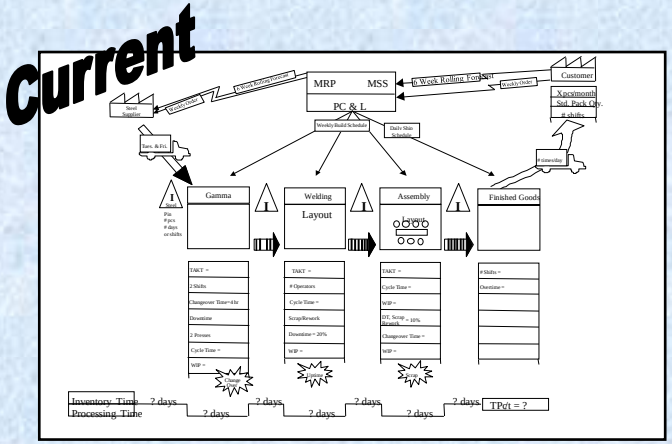
Value Stream Mapping



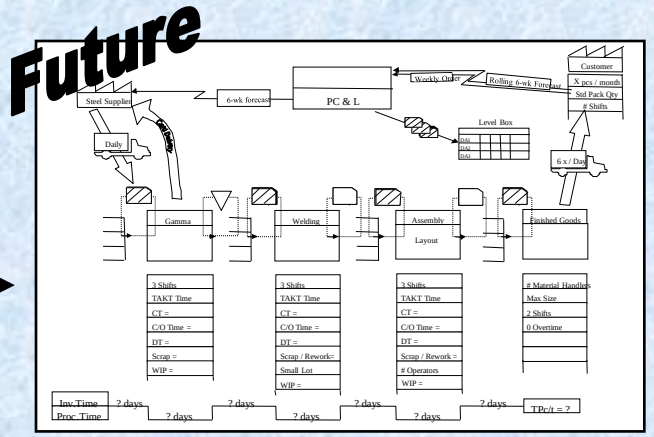
Lean Journey



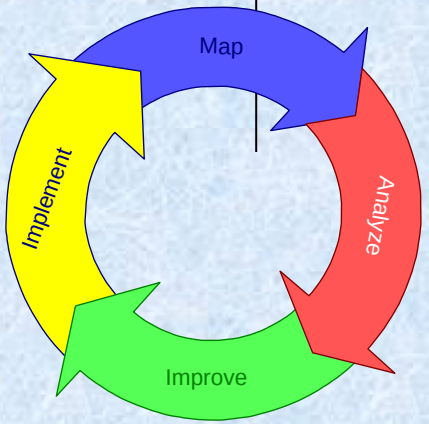
The Process



Map the Current State



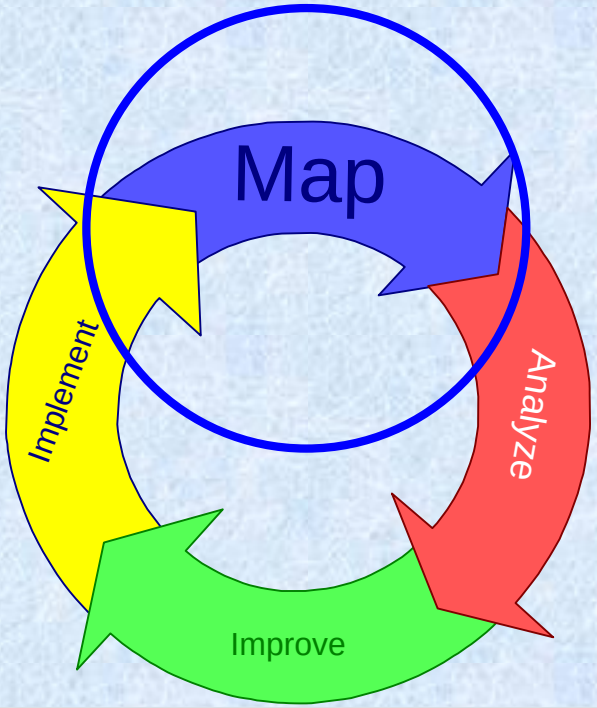
Analyze the Current State and Design the Future State



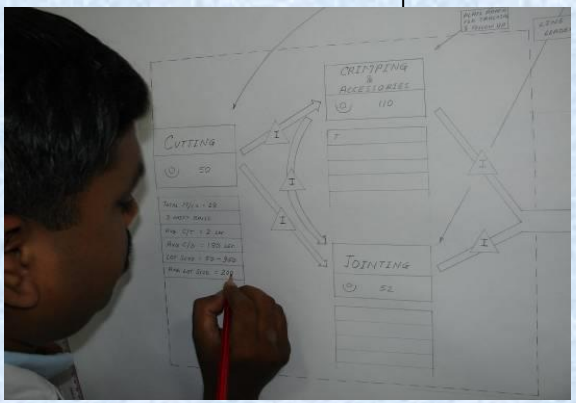
Create an implementation plan and execute it !

Activity	1999				2000			
	1ST	2ND	3RD	4TH	1ST	2ND	3RD	4TH
Establish TAKT & Flow in Tank Ass'y								
Gamma Changeover Reduction								
Reduce Gamma Buffer								
Move Ass'y to Plant 10								
Establish TAKT & Flow in Sender Ass'y								
Pull To Sender Ass'y								
Training								

Map the Current State



A few Mapping Tips



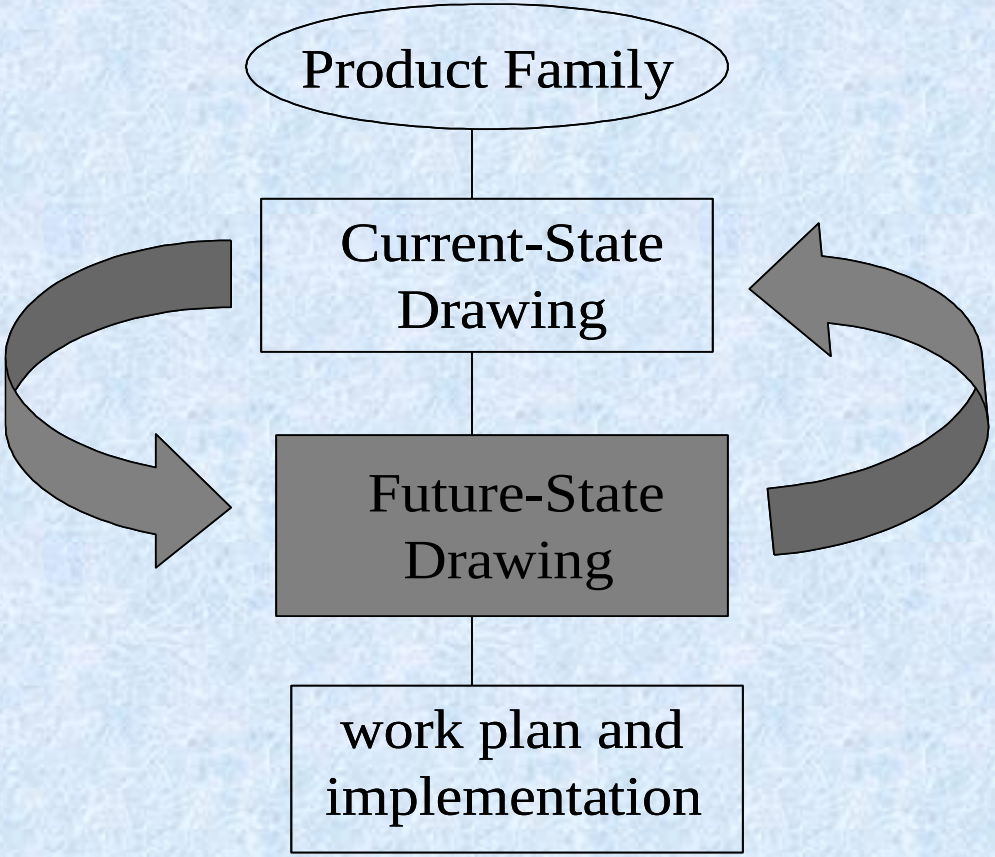
- Always collect current-state information while walking along the actual pathways of material and information flows yourself.
- Begin with a quick walk along the entire door-to-door value stream.
- Begin at the shipping end and work upstream.
- Bring your stopwatch and do not rely on standard times or information that you do not personally obtain.
- Map the whole value stream yourself.
- Always draw by hand in pencil.

Mapping Method

- Follow a product's production path from customer to supplier.
- Carefully draw a visual representation of every process in the material and information flow – Current State Map.
- Then ask a set of key questions and draw a Future State Map of how value should flow.

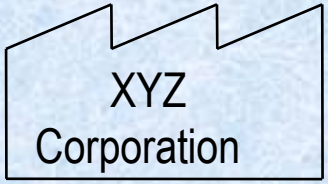
Using the Mapping Tool

Initial Value Stream Mapping Steps

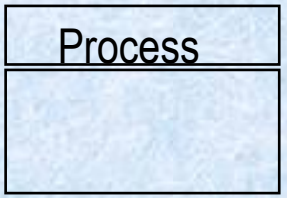


VSM Common Icons

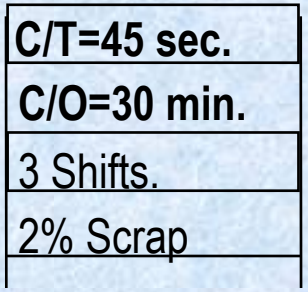
(Shall be discussed in subsequent slides)



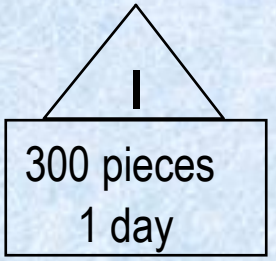
Supplier/
Customer



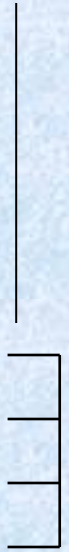
Process
Box



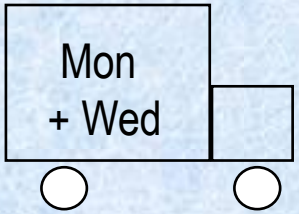
Data Box



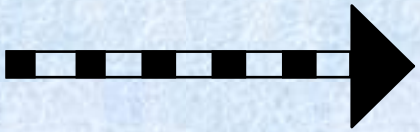
Inventory



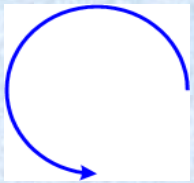
Supermarket



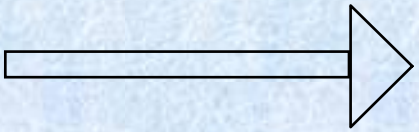
Shipment



Push



Physical
Pull



Finished Goods
to Customer

First-In-First-Out

Current State Map

Step 1: Select a Product Family

Step 2: Form a Team

Step 3: Understand Customer Demand

Step 4: Map the Process Flow

Step 5: Map the Material Flow

Step 6: Map the Information Flow

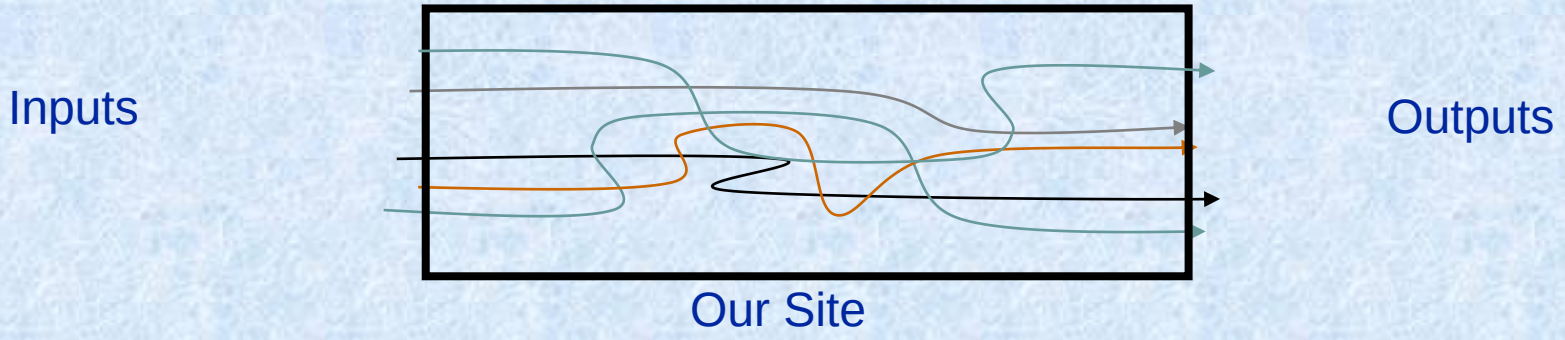
Step 7: Calculate Total Product Cycle Time

Step 1: Select a Product Family

What is a Product Family?

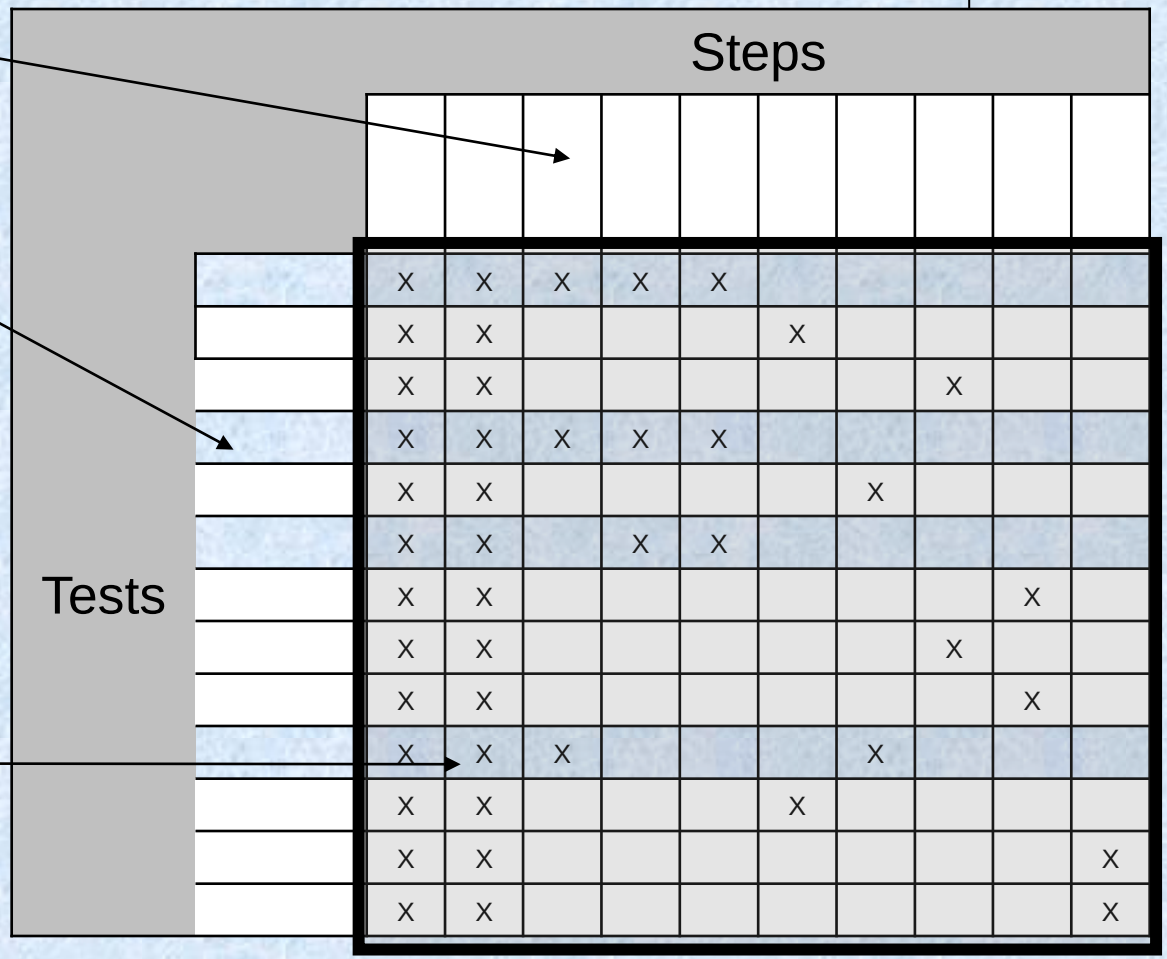
- **Family:** a group of products/ services that use the same or similar processing steps and equipment within the selected process
- **Product Family Matrix:** the tool for analyzing product flow and identifying product families

Product Families are the most efficient way of organizing your Value Stream Maps

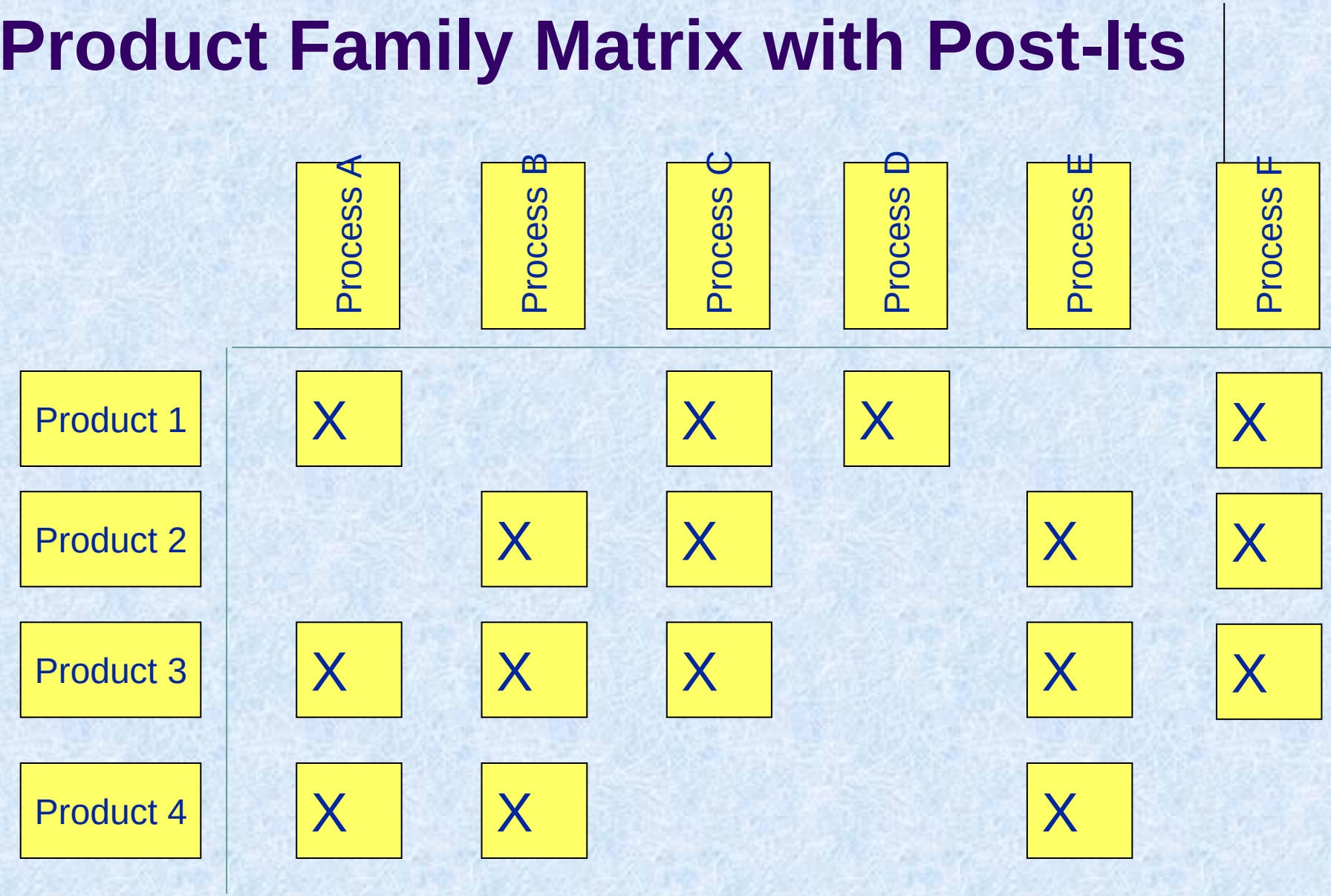


Creating a Product Family Matrix

- List process steps on top
- List products on left
- Identify steps required for each product by placing an X in the box



Product Family Matrix with Post-Its



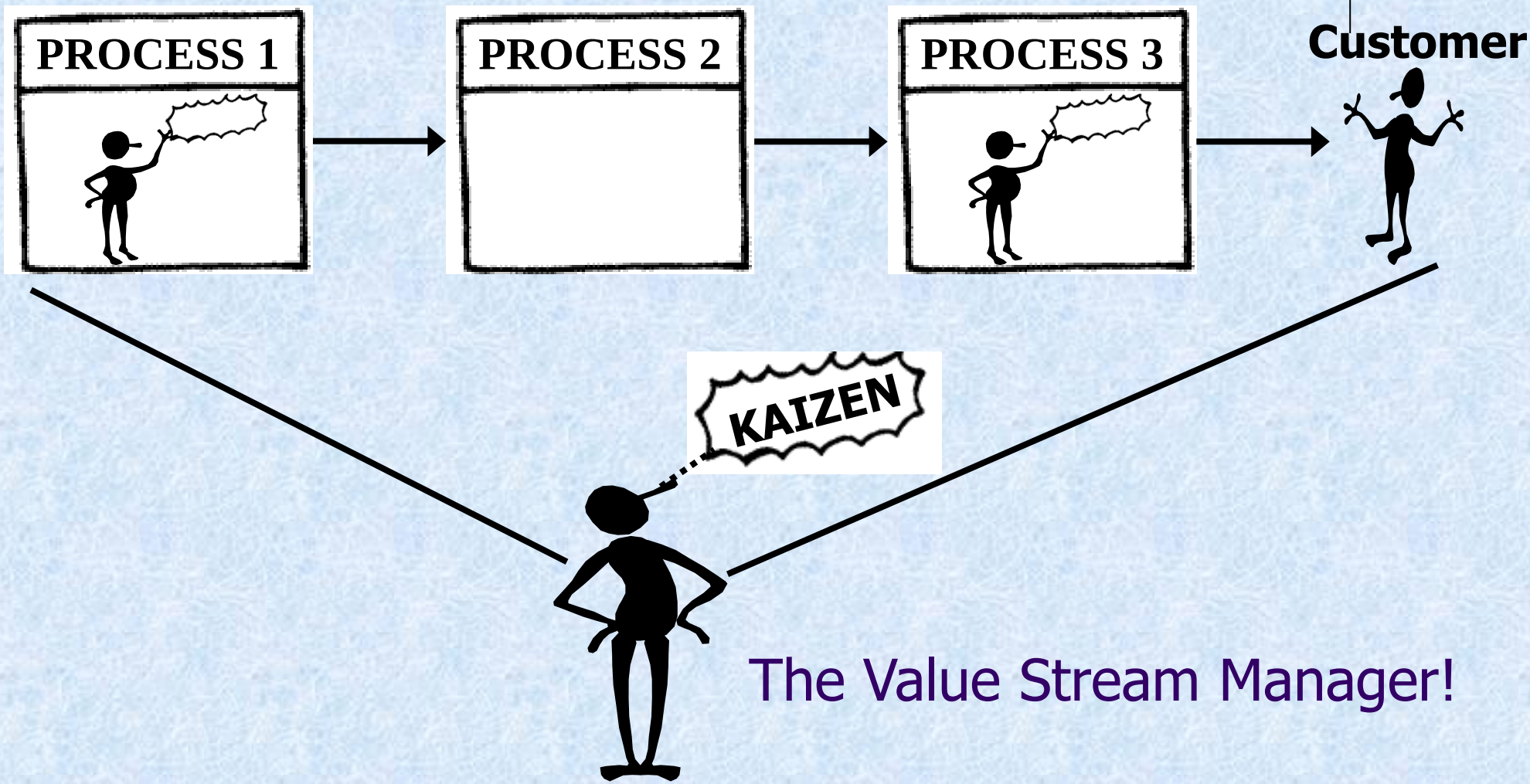
Current State Map

Step 2: Form a Team

- Select a cross-functional team
- Select team members who are familiar with the product
- Ensure that team members are trained in the use of VSM
- Designate a Value Stream Manager

THIS IS CRITICAL

Who is responsible for the Value Stream?

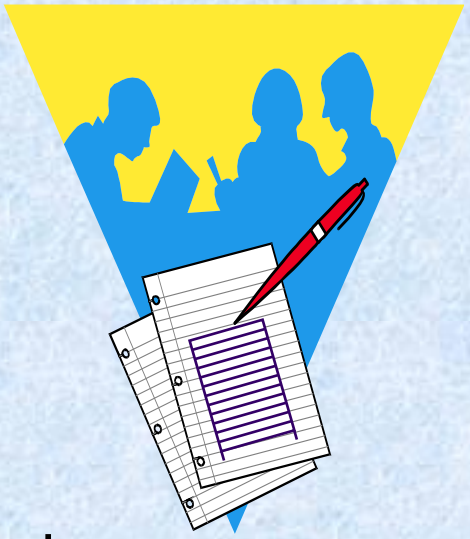


The Value Stream Manager!

Data Collection

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



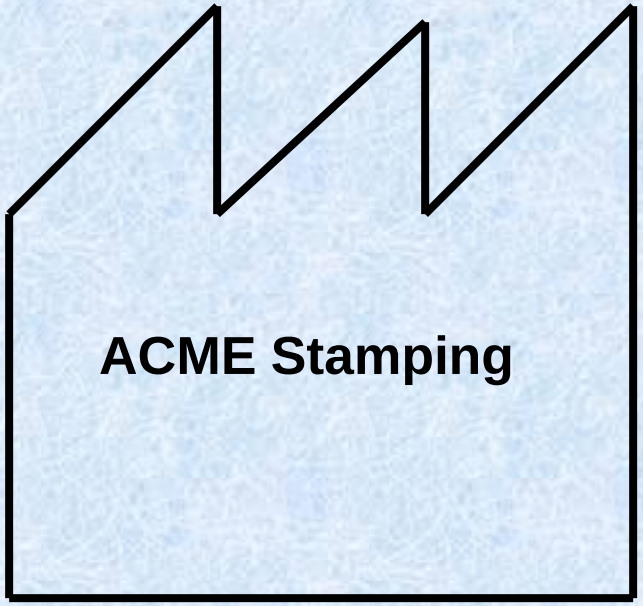
- Scrap
- Rework
- Downtime

- Work-in-process inventory
- Overtime per week
- Process cycle times
- Number of product variations at each step
- Batch (lot) sizes
- Changeover times
- Changeover frequencies

Step 3: Understand Customer Demand

- Mapping starts with the customer requirements.
- Represent the customer's assembly plant with a factory icon, placed in the upper right-hand portion of the map.
- Underneath this icon, draw a data box recording the requirements of the customer.

VSM Icon : Factory Icon



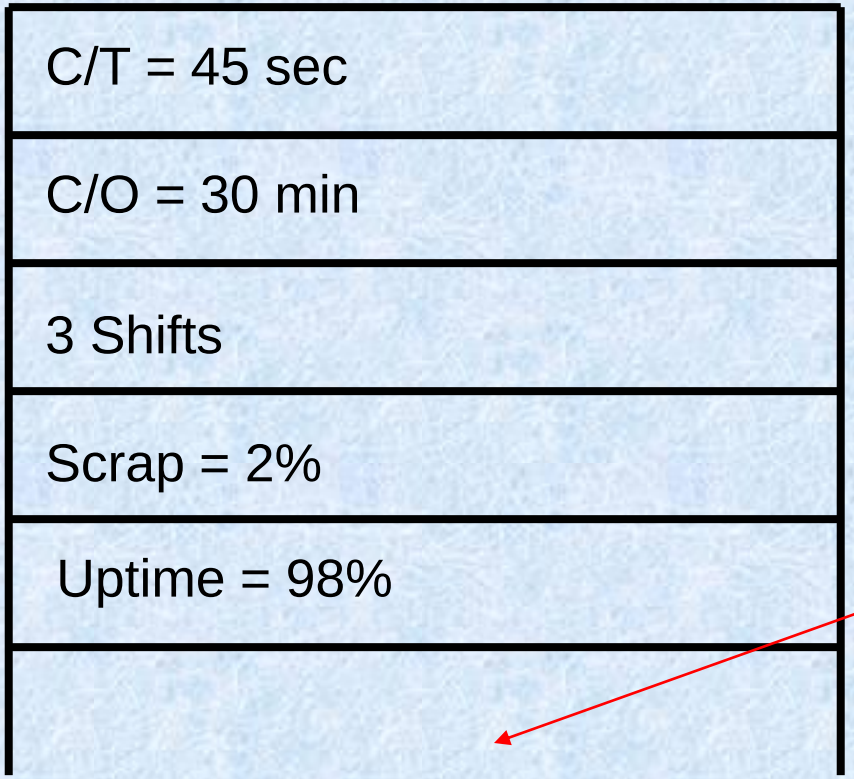
Factory Icon

Suppliers

Customers

Ext. Job Shops

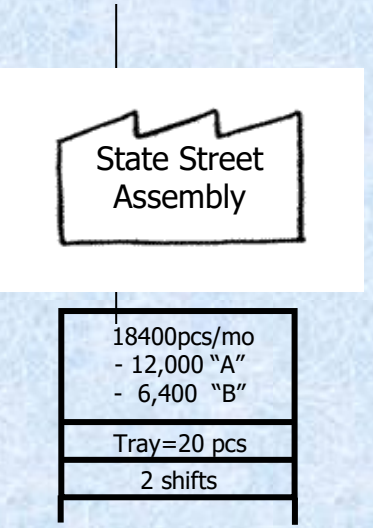
VSM Icon: Data Box

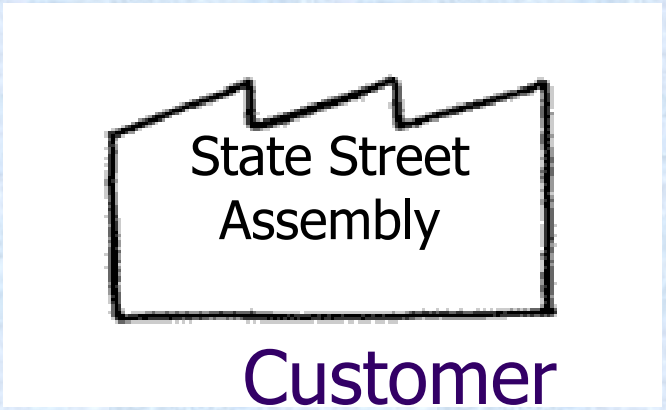


Used to record information concerning
A manufacturing process, department, customer, etc.

Open at Bottom
For Additional
Data

Step 3: Understand Customer Demand

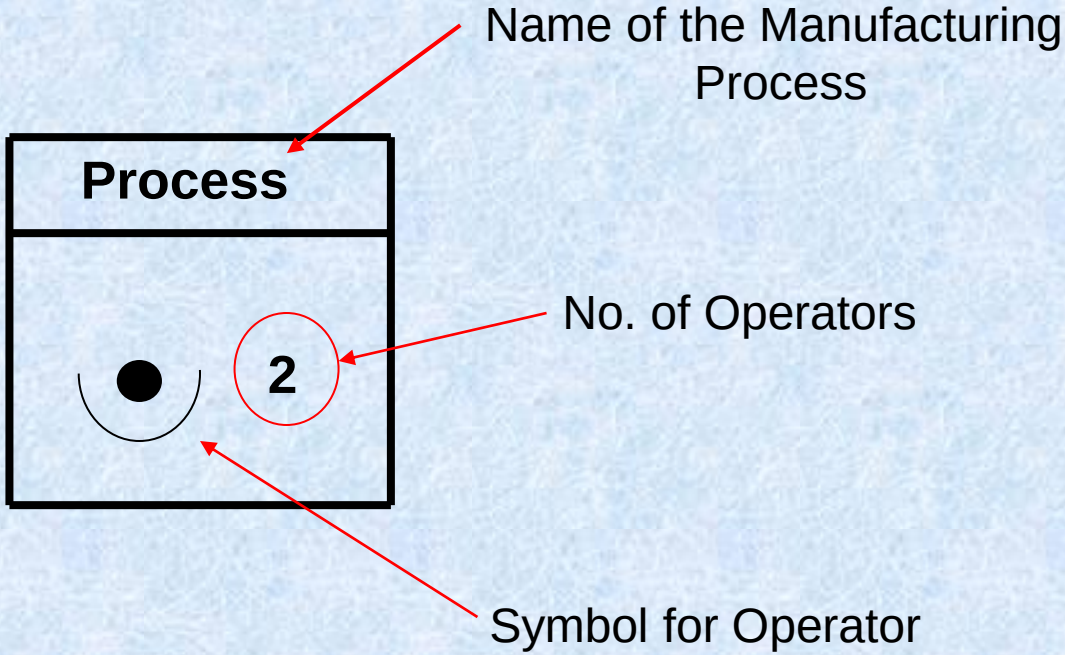




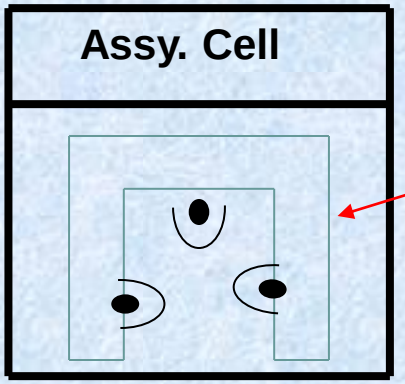
State Street Assembly operates two shifts using 18400 steering brackets per month (12000 LH and 6000 RH

First View of Current State Map

Step 4: Map the Process Flow



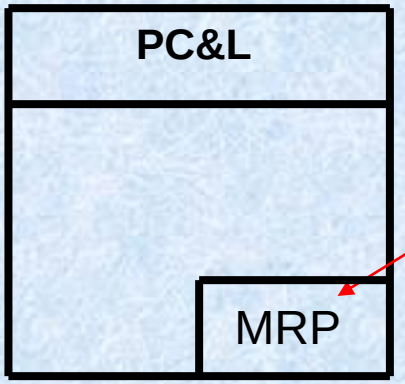
Step 4: Map the Process Flow



"U-Cell" with
Three Operators

One process box equals an area of flow. All processes should be Labeled.

Step 4: Map the Process Flow



Department runs
MRP Software
For Material Planning

Also used for departments such as Production Control, sales & marketing etc.

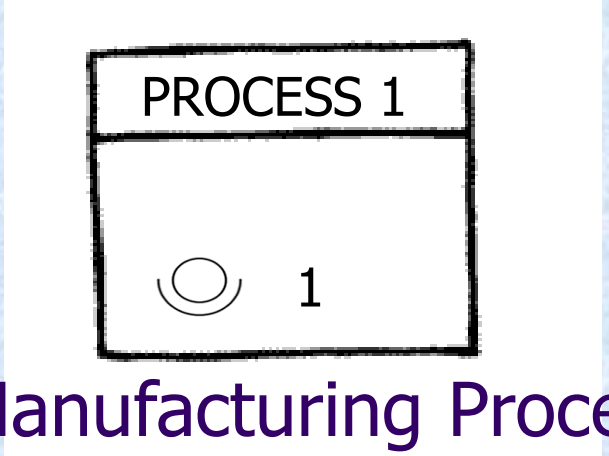
Step 4: Map the Process Flow

- Draw the basic production processes by using a process box.
- The process boxes must be arranged in the sequence of their occurrence.
- Draw the data box for each production process recording the cycle time, changeover time, reliability, available work time, etc. for each individual process.
- Use one process box icon to indicate one area of material flow

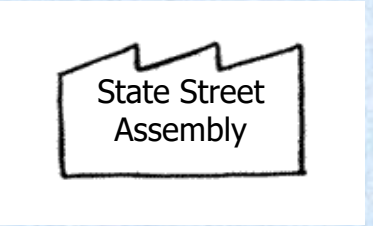
Step 4: Map the Process Flow

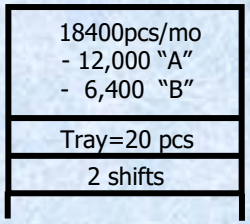
- Draw material flow from left to right on the bottom half of the Map in the order of processing steps
- Draw data box under each process box and record the following:
  - Cycle Time (C/T)
  - Changeover Time (C/O)
  - Number of People required to operate the process
  - Available working time
  - Machine Up Time
  - Amount of Inventory at each location

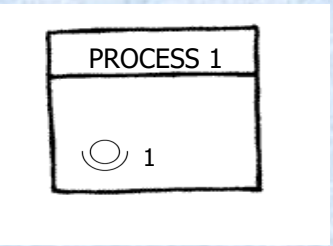
Step 4: Map the Process Flow

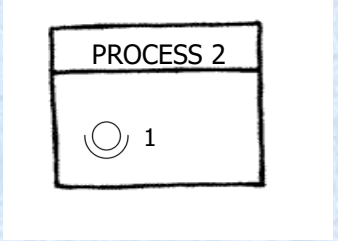


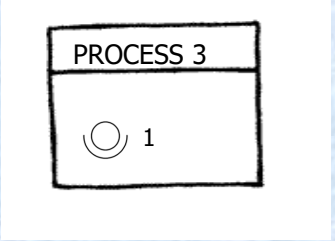
Manufacturing Process

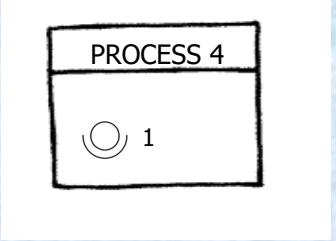


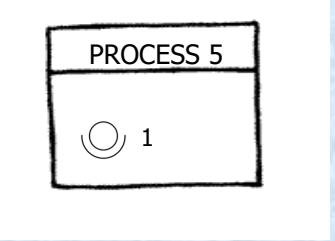


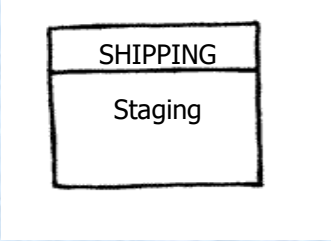




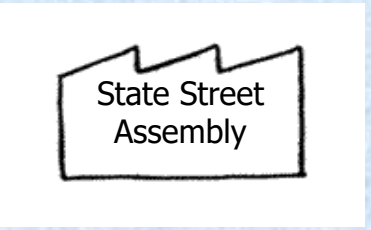


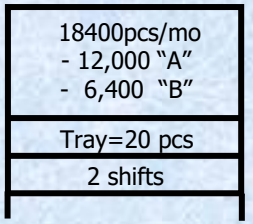


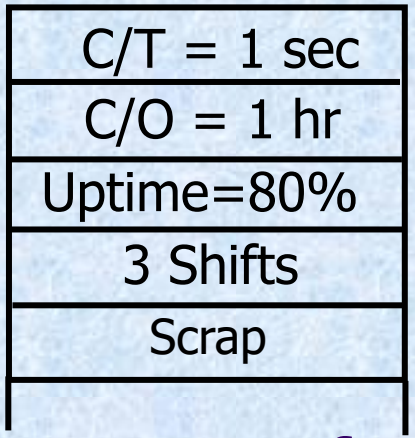




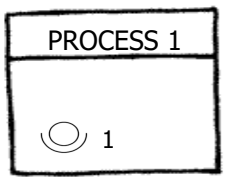
Step 4: Map the Process Flow

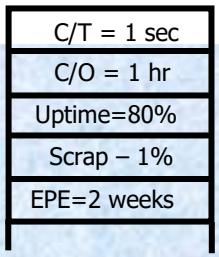


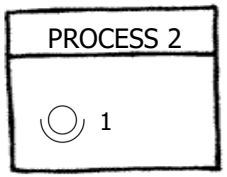


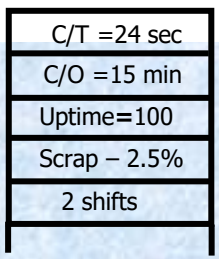


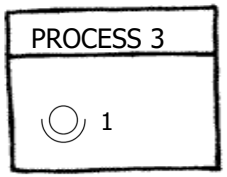
Data Box for the Process

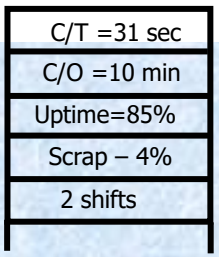


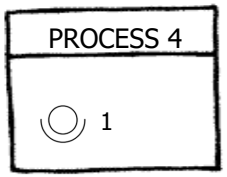


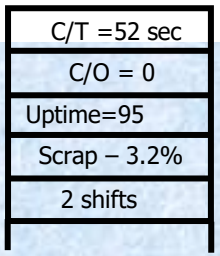


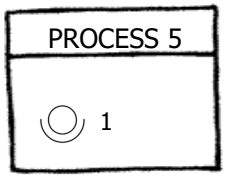


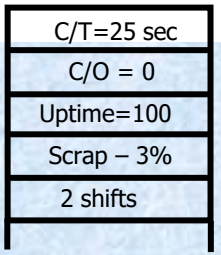


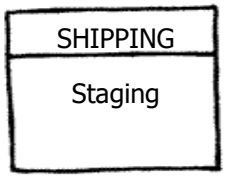








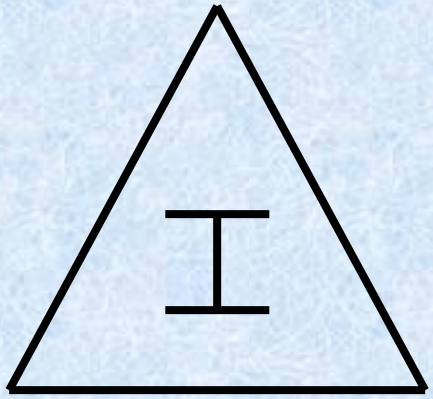




Step 5: Map the Material Flow

- Material Flow is drawn from left to right on the bottom half of the map in the order of processing steps, not according to the physical layout of the plant.

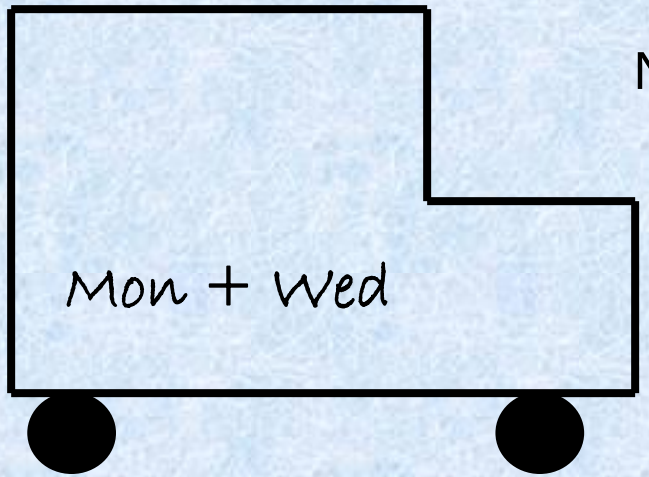
Inventory



330 pieces
1 Day

Count and time should be Noted.

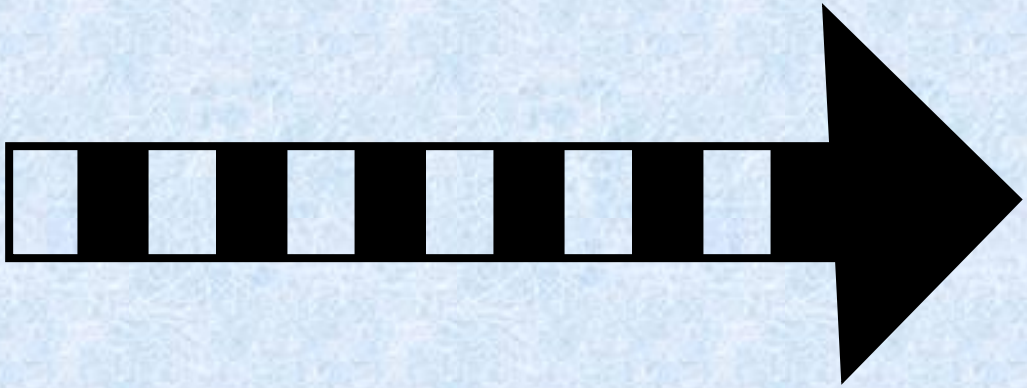
Truck Shipment



Note frequency of shipments.

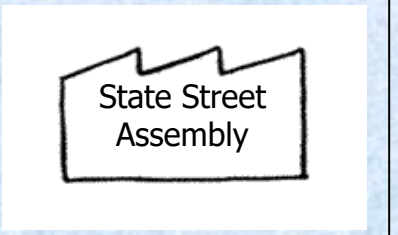
Movement of production Material by PUSH

Material that is produced and moved forward before the next process needs it; usually based on a schedule.



Movement of finished
Goods to the customer

Step 5: Map the Material Flow



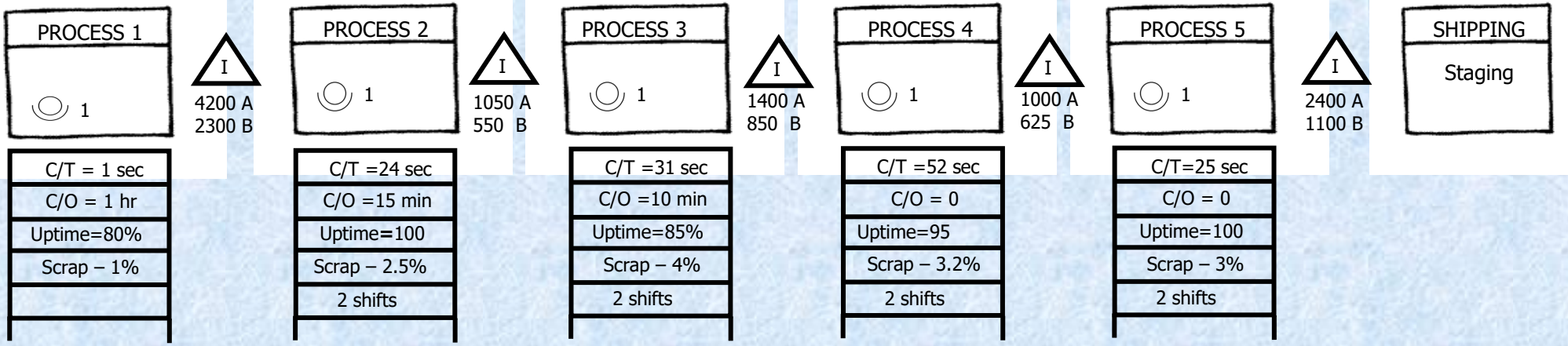
4200 A
2300 B

18400pcs/mo
- 12,000 "A"
- 6,400 "B"

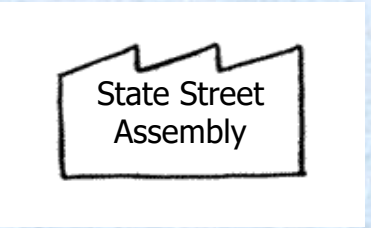
Tray=20 pcs

2 shifts

Inventory Triangle showing the amount of inventory



Step 5: Map the Material Flow

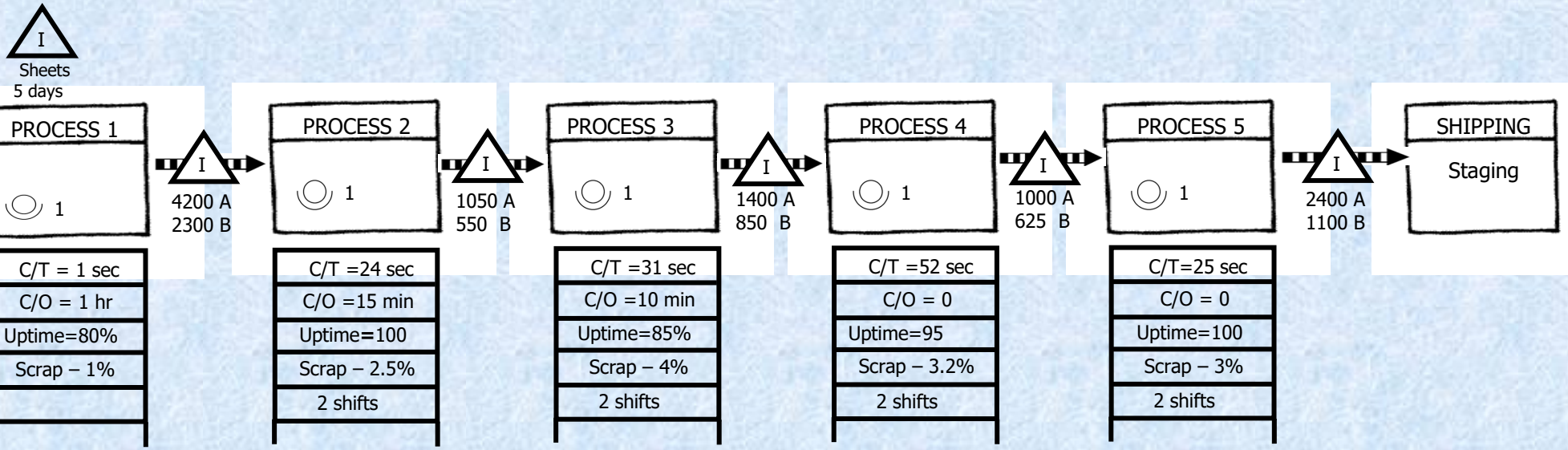


18400pcs/mo
- 12,000 "A"
- 6,400 "B"

Tray=20 pcs

2 shifts

PUSH
Arrow



Craig Steels Company

Step 5: Map the Material Flow

State Street Assembly

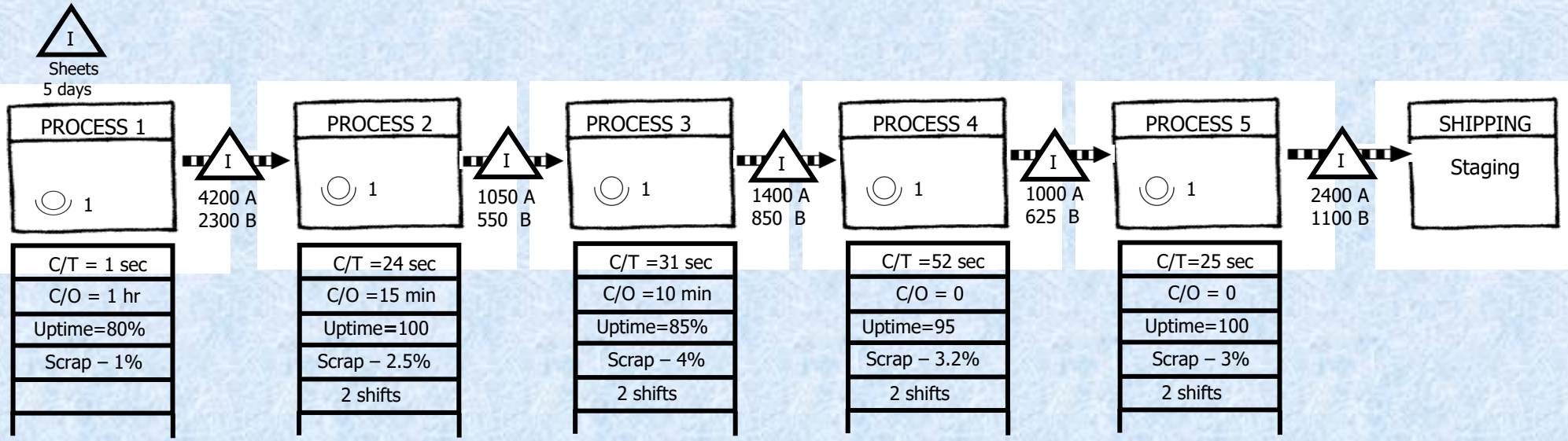
18400pcs/mo
- 12,000 "A"
- 6,400 "B"

Tray=20 pcs

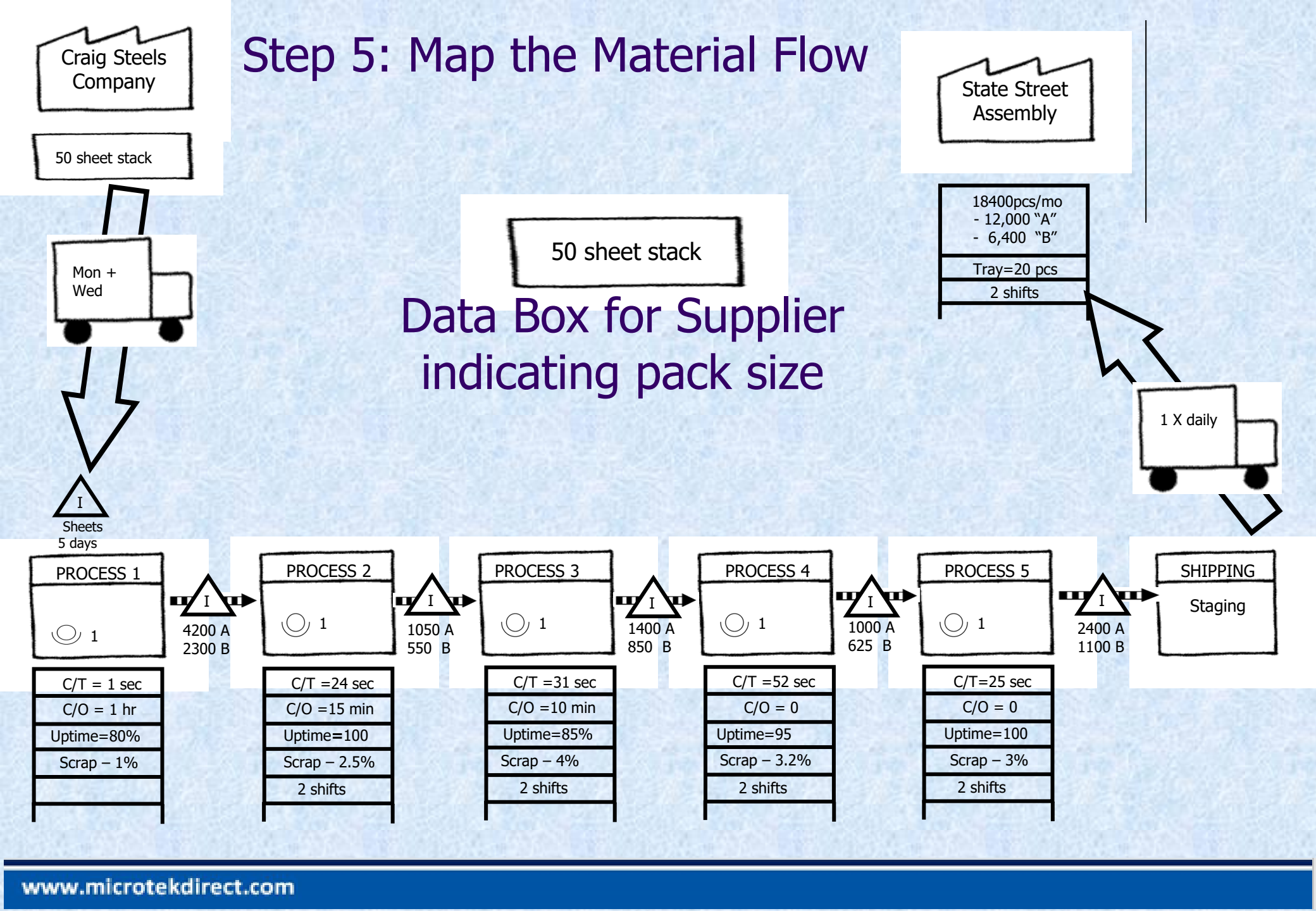
2 shifts

Craig Steels Company

Outside Source - Supplier



Step 5: Map the Material Flow

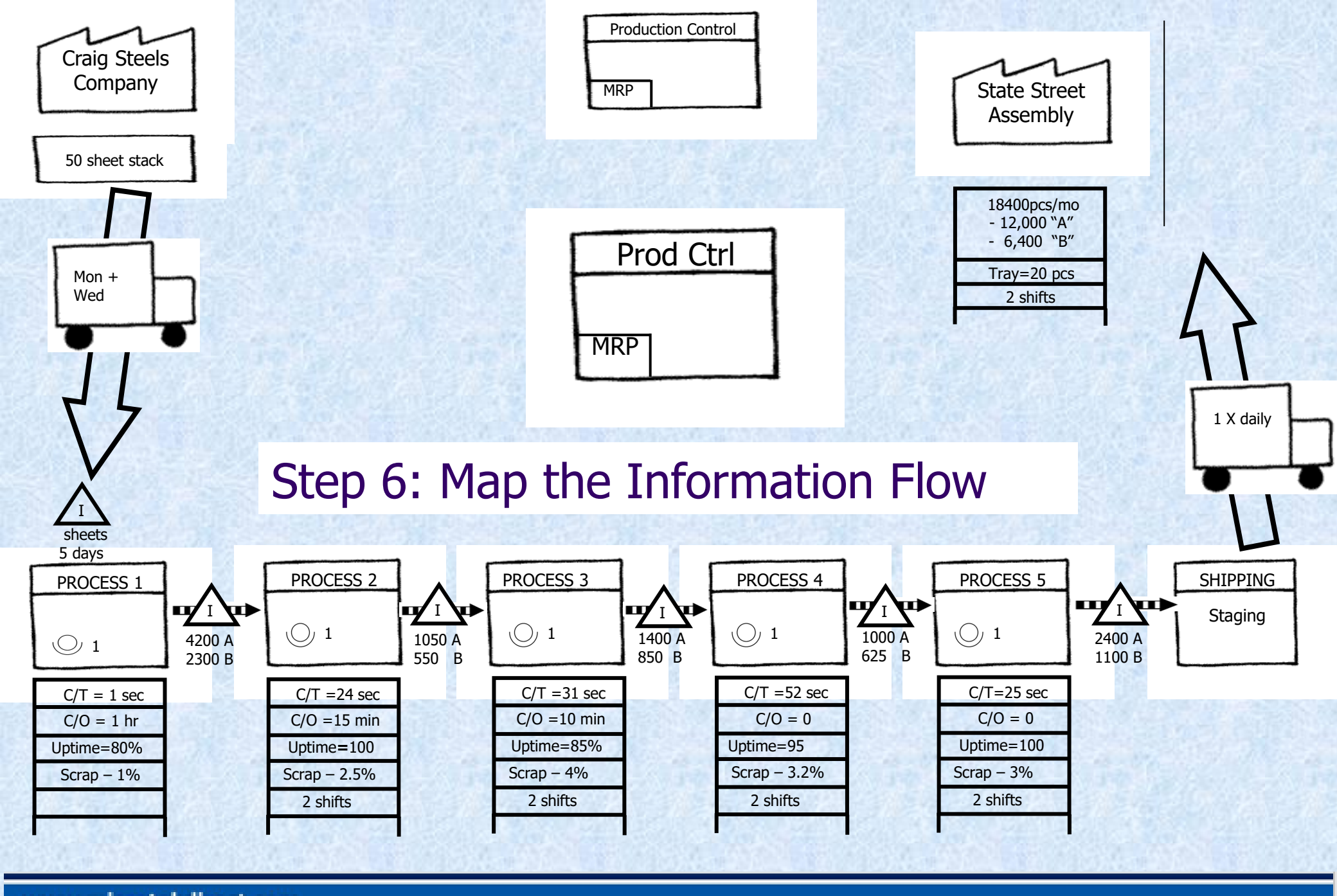


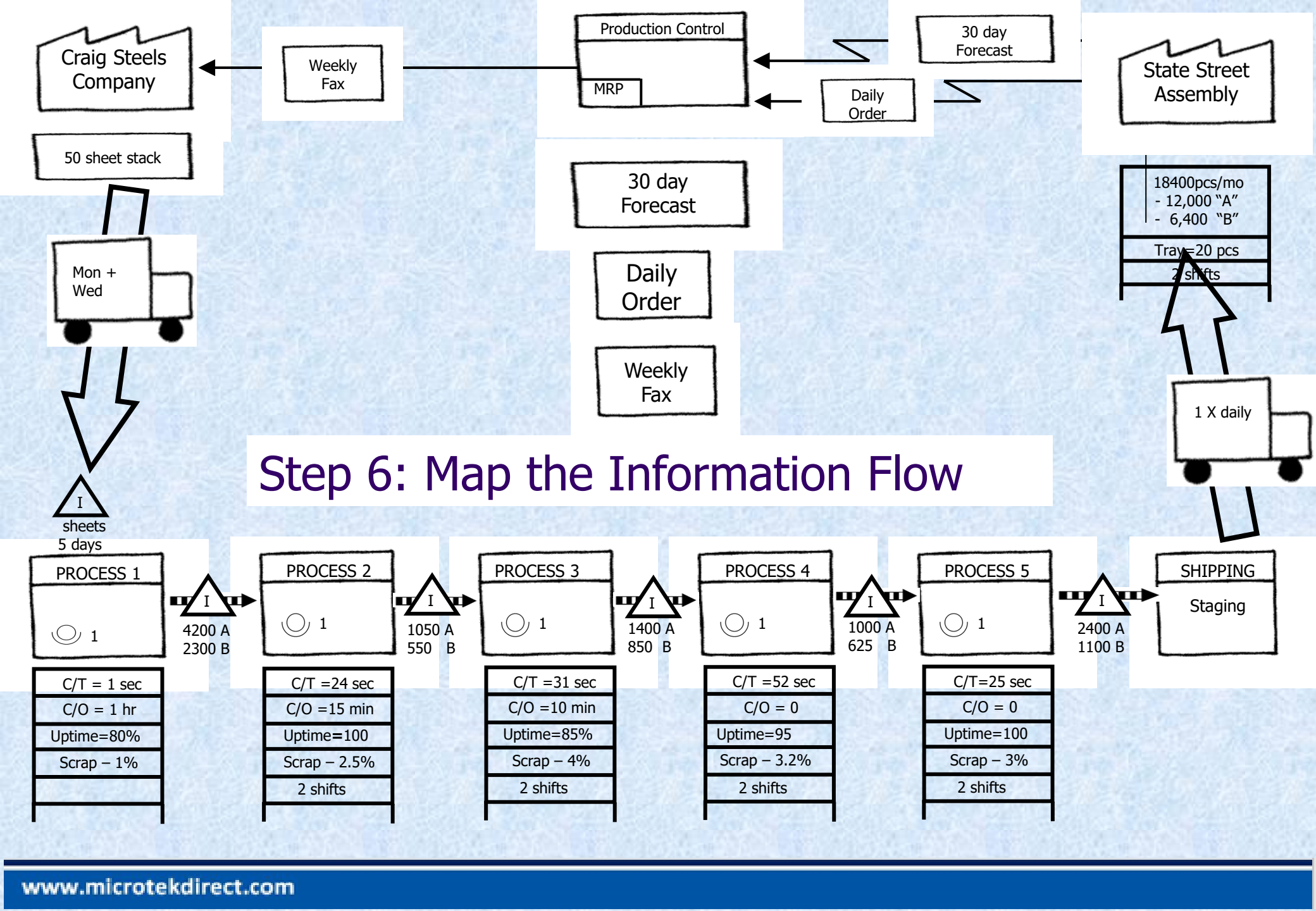
Data Box for Supplier indicating pack size

Step 6: Map the Information Flow

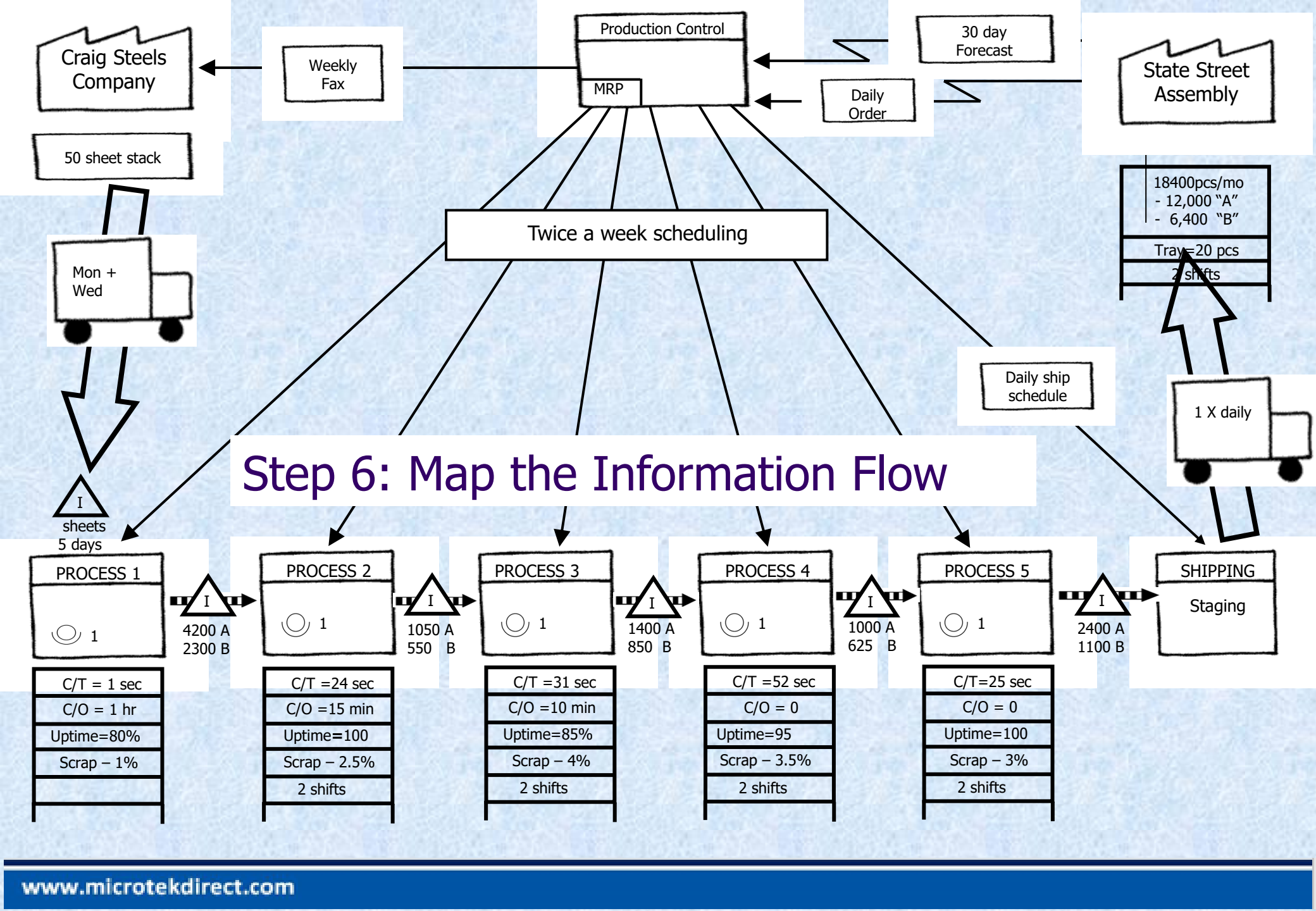
- The information flow is drawn from right to left in the top half of the map.

Step 6: Map the Information Flow





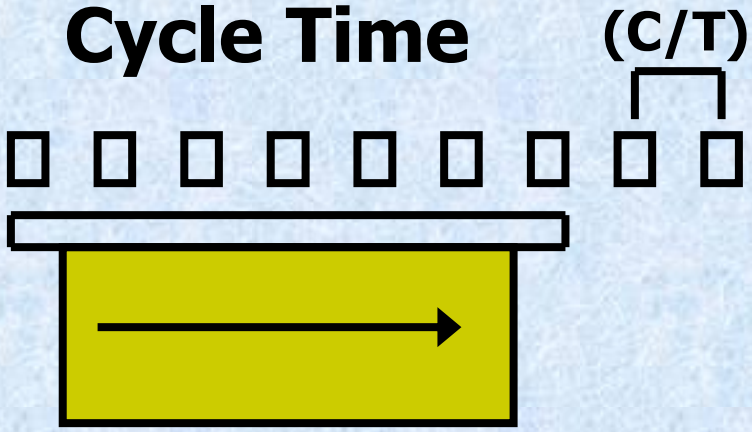
Step 6: Map the Information Flow


Craig Steels Company
Weekly Fax
Production Control
MRP
30 day Forecast
Daily Order
State Street Assembly
50 sheet stack
Mon + Wed
Twice a week scheduling
18400pcs/mo
- 12,000 "A"
- 6,400 "B"
Tray=20 pcs
2 shifts
Daily ship schedule
1 X daily
Step 6: Map the Information Flow
I
sheets
5 days
PROCESS 1
1
C/T = 1 sec
C/O = 1 hr
Uptime=80%
Scrap – 1%
I
4200 A
2300 B
PROCESS 2
1
C/T =24 sec
C/O =15 min
Uptime=100
Scrap – 2.5%
2 shifts
I
1050 A
550 B
PROCESS 3
1
C/T =31 sec
C/O =10 min
Uptime=85%
Scrap – 4%
2 shifts
I
1400 A
850 B
PROCESS 4
1
C/T =52 sec
C/O = 0
Uptime=95
Scrap – 3.5%
2 shifts
I
1000 A
625 B
PROCESS 5
1
C/T=25 sec
C/O = 0
Uptime=100
Scrap – 3%
2 shifts
I
2400 A
1100 B
SHIPPING
Staging

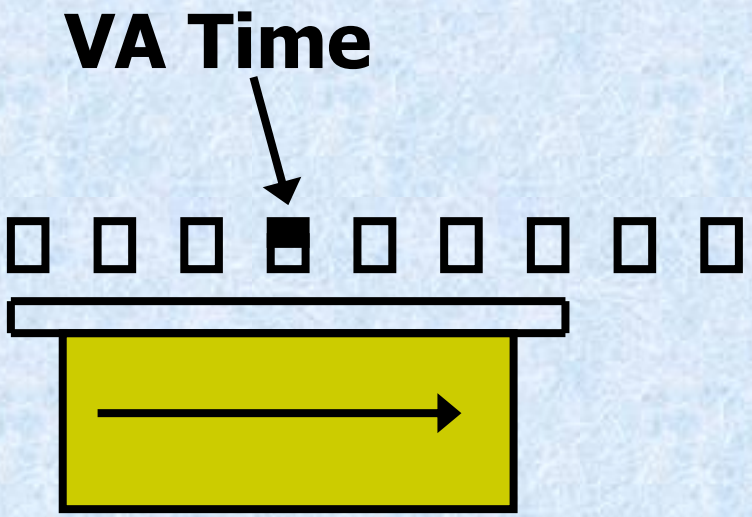
Step 7: Calculate Total Product Cycle Time

- Draw a timeline under the process boxes and inventory triangles to compile the production lead time.
- Production lead time is the time it takes one part to make its way through the shop floor, beginning with arrival as raw material through to shipment to the customer.
- Next, add up only the value-adding (processing) times for each process.
- Compare the value added to total lead time.

Cycle Time and Value Added Time

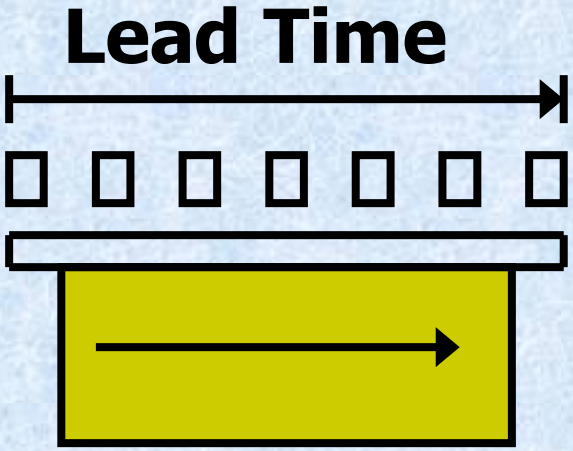


Cycle Time (C/T)
Time it takes an operator to go through all of their work elements before repeating them.

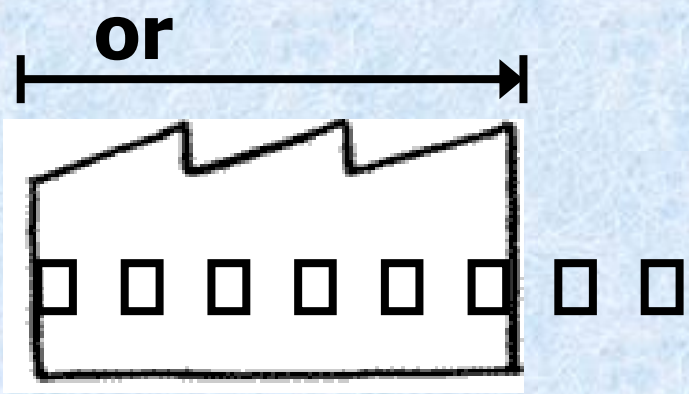


Value Added Time (VA)
Time of those work elements that actually transform the product in a way that the customer is willing to pay for.

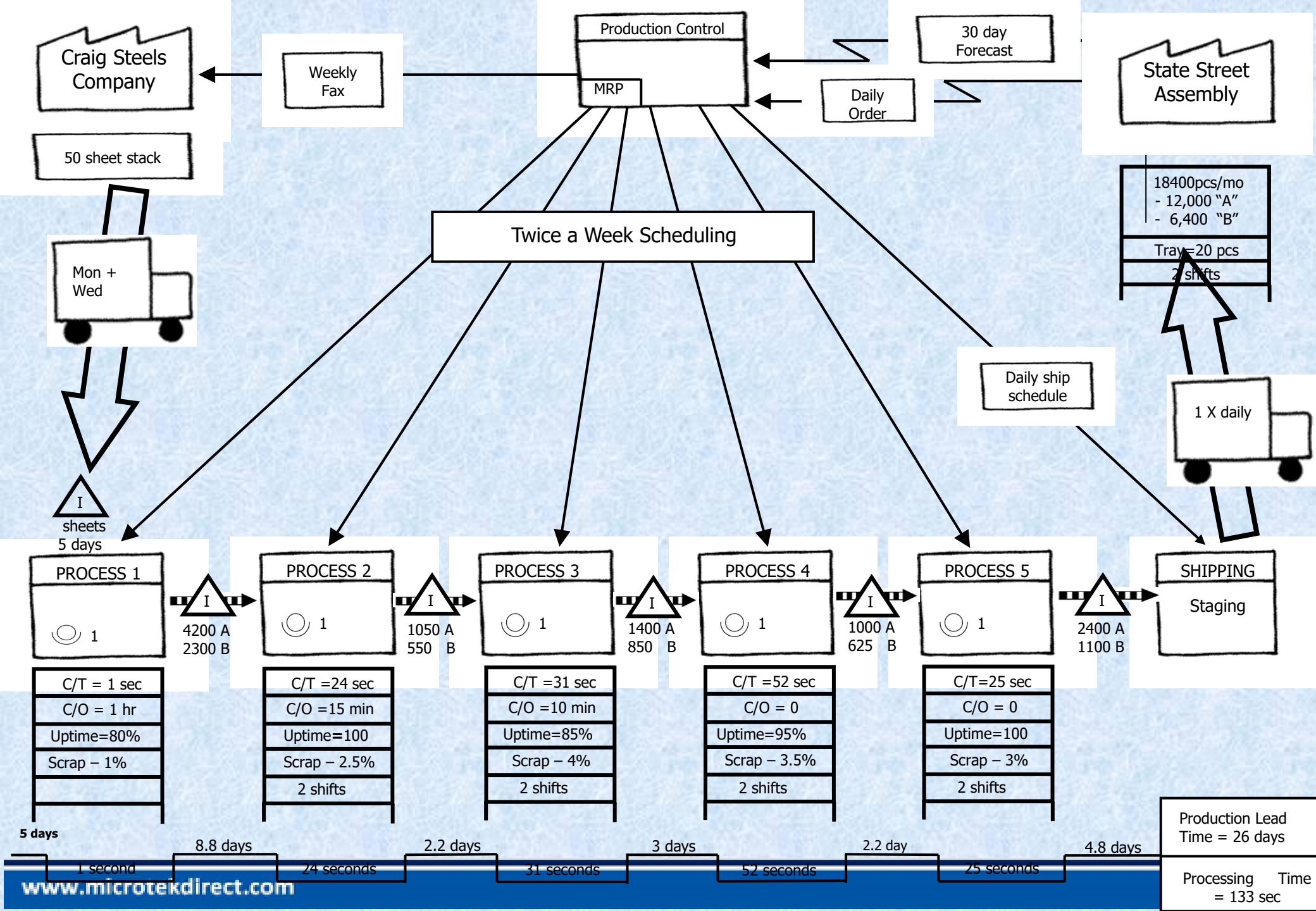
Total Product Lead Time



Lead Time (L/T) The time it takes one piece to move all the way through a process or a value stream, from start to finish.



Usually : VA < C/T < L/T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2 shifts
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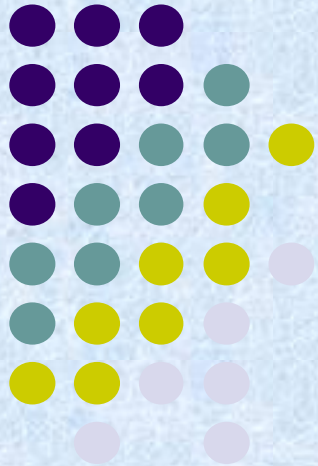
1 X daily
I
sheets
5 days
PROCESS 1
1
C/T = 1 sec
C/O = 1 hr
Uptime=80%
Scrap – 1%
I
4200 A
2300 B
PROCESS 2
1
C/T =24 sec
C/O =15 min
Uptime=100
Scrap – 2.5%
2 shifts
I
1050 A
550 B
PROCESS 3
1
C/T =31 sec
C/O =10 min
Uptime=85%
Scrap – 4%
2 shifts
I
1400 A
850 B
PROCESS 4
1
C/T =52 sec
C/O = 0
Uptime=95%
Scrap – 3.5%
2 shifts
I
1000 A
625 B
PROCESS 5
1
C/T=25 sec
C/O = 0
Uptime=100
Scrap – 3%
2 shifts
I
2400 A
1100 B
SHIPPING
Staging
5 days
1 second
8.8 days
24 seconds
2.2 days
31 seconds
3 days
52 seconds
2.2 day
25 seconds
4.8 days
Production Lead Time = 26 days
Processing Time = 133 sec
www.microtekdirect.com

Step 7: Calculate Total Product Cycle Time

- As seen, the total production lead time is 21 days.
- The actual processing time is only 133 seconds.

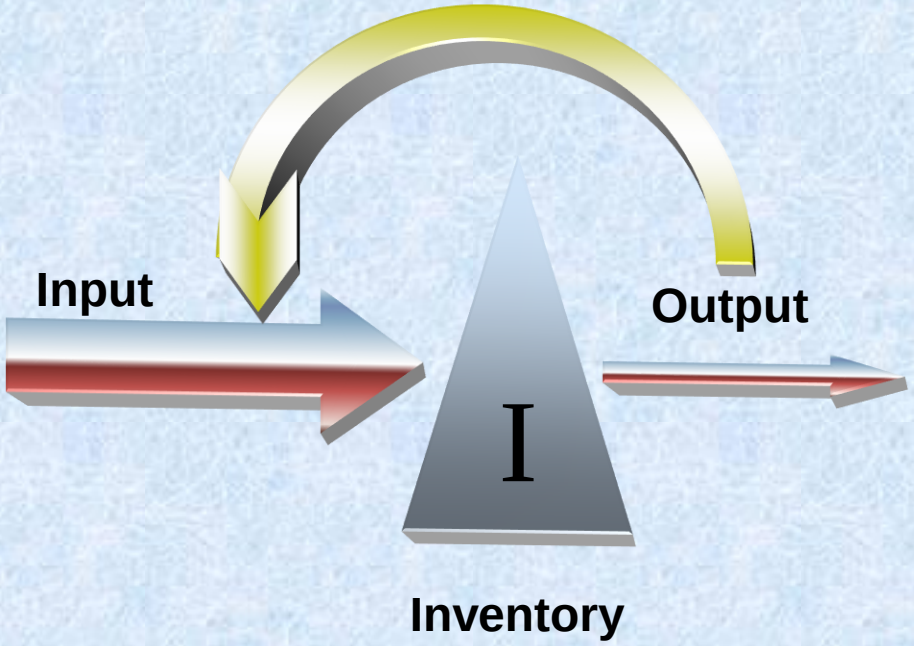
Eliminating MUDA



Eliminating MUDA & Guidelines for Improvement

- Reducing Overproduction
  - This is the fundamental problem of mass production and each process operate as an isolated island
  - Producing and pushing products forward against schedule received from PPC
  - Defects remain hidden in the access inventory until the down stream process finally uses the parts and discovers the problem
  - A result of overproduction is that while the value added time for producing one part is very short, the total time that the product spends going through the plant is very long (Long Lead Time)

Overproduction



To Make

Input = Output

Stop Overproduction

By Linking Input to Output

Overproduction

Eliminating MUDA & Guidelines for Improvement

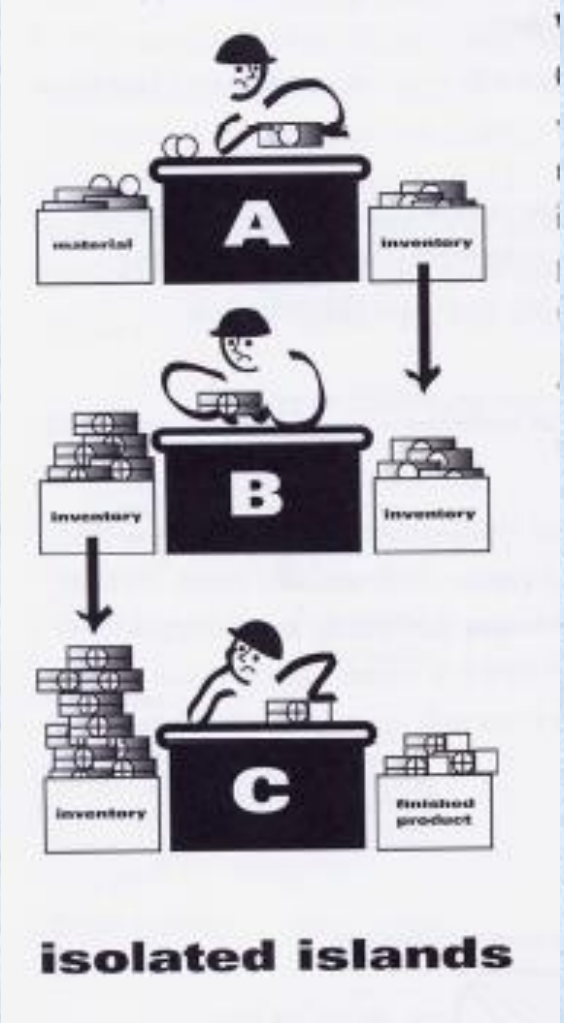
- Produce to your Takt Time
  - Takt Time is how often you should produce one part or product to meet customer requirements (based on sale)
  - Synchronize your pace of production with takt time specially at pacemaker process.
  - This requires
    - Elimination of causes of downtime
    - Provide past response to problem
    - Eliminate changeover in down stream processes

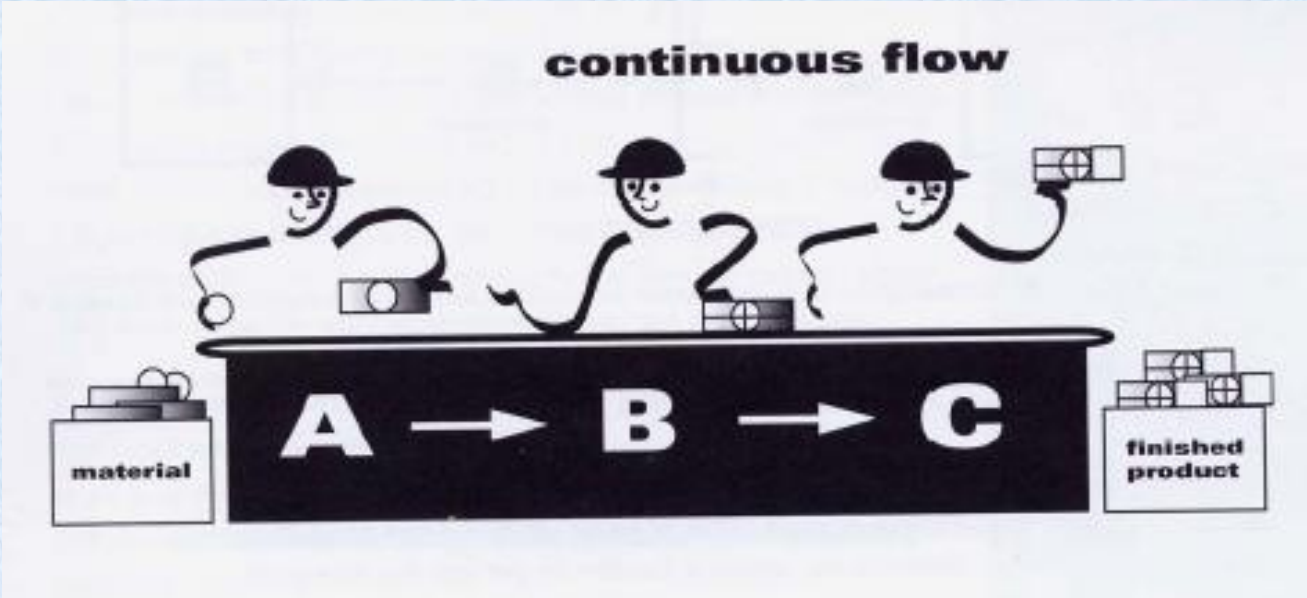
Eliminating MUDA & Guidelines for Improvement

- Develop Continuous Flow wherever possible
  - Continuous flow refers to producing one piece at a time with each item passed immediately from one process step to next without any inventory buildup. This is the most efficient way to produce. When introducing continuous flow in the Future State Map combine two or more boxes into one

Eliminating MUDA & Guidelines for Improvement

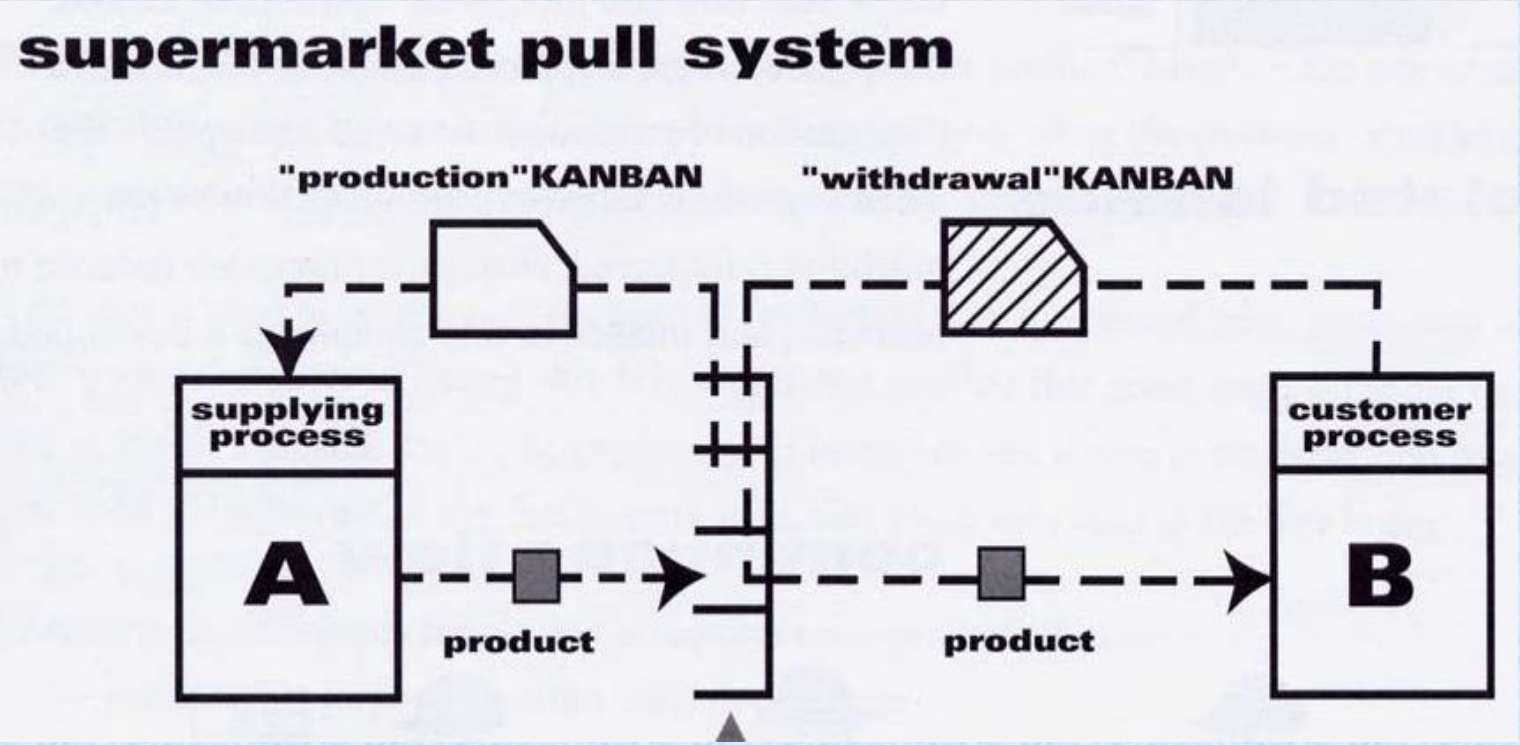
Develop Continuous Flow



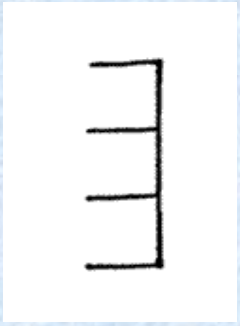


Eliminating MUDA & Guidelines for Improvement

- Use Supermarket to Control Production
  - Wherever required

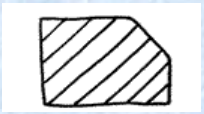


Additional Mapping Icons

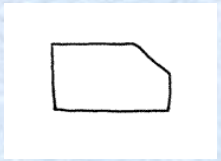


Supermarket

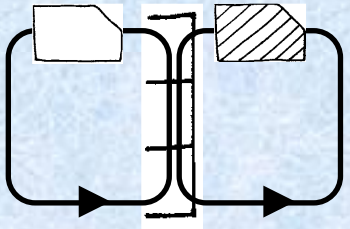
Signal Kanban



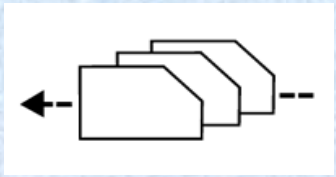
Withdrawal Kanban



Production Kanban

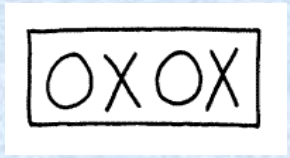


Kanban Path

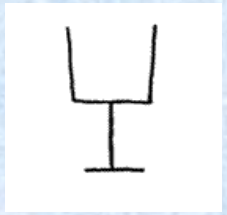


Kanban arriving in batches

Physical Pull



Leveling



Kanban Post

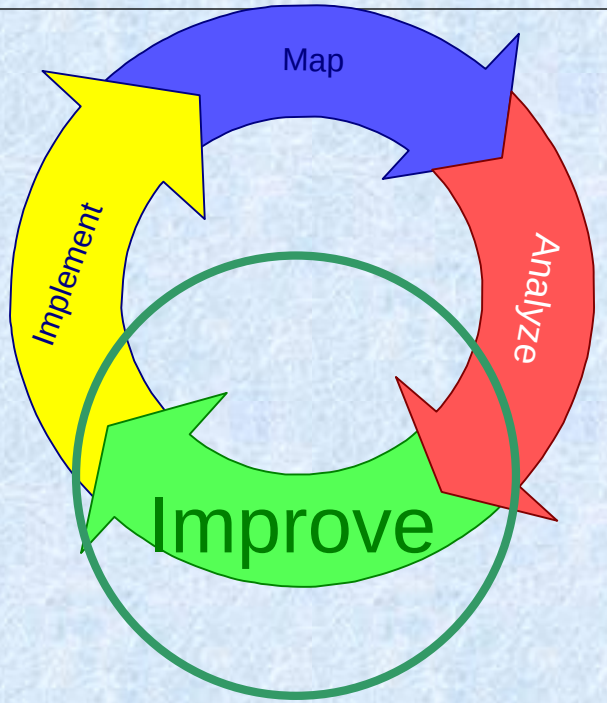
First-In First-Out Flow

Process Kaizen

Eliminating MUDA & Guidelines for Improvement

- Send the Customer Schedule to only one Production Process
  - By using Supermarket Pull System, the production schedule will have to be provided only at one point in door-to-door operation because controlling production at one point sets the pace for all the upstream processes.
  - This point is pacemaker process.
  - Materials transferred from the pacemaker process down stream to finish goods needs to occur as flow (no supermarket or pulls down stream of pacemaker process)

Future State Map



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 !

Future State Map

A simple way to approach the Future State Map is to begin by modifying the Current State Map.

Key Questions for the Future State

1. What is your Takt Time?
2. Will you build to a finished goods supermarket from which the customer pulls, or directly to shipping?
3. Where can you use continuous flow processing?
4. Where will you need to use supermarket pull systems in order to control production of upstream processes?
5. At what single point in the production chain (pacemaker process) will you schedule the production?
6. How will you level the production mix at the pacemaker process?
7. How will you level the production volume at the pacemaker process?
8. What process improvements will be necessary?

The Future State Questions

1. What does the customer really need?

$$\text{Takt Time} = \frac{\text{Effective working time}}{\text{Customer Requirement}}$$

Example:

In a single shift the organization can receive 46 orders.
Order entry personnel work an 8-hour shift, with 30 min for lunch and two 10 min breaks. Therefore, effective working time per shift is 460 min

$$\text{Takt Time} = \frac{460 \text{ mins per shift}}{46 \text{ orders per shift}} = 10 \text{ mins}$$

Drawing The Future State Map

Q1:What is Takt Time for the chosen product family?

Available Working Time:

= (8 X 60 X 60) sec – (2 X 10 X 60) sec

= 27,600 seconds per shift.

$$\text{Takt Time} = \frac{\text{Available Working Time}}{\text{Customer Demand}}$$

= (27,600)sec/504 units per shift

= 55 seconds

Drawing The Future State Map

2. Identify Bottleneck Process

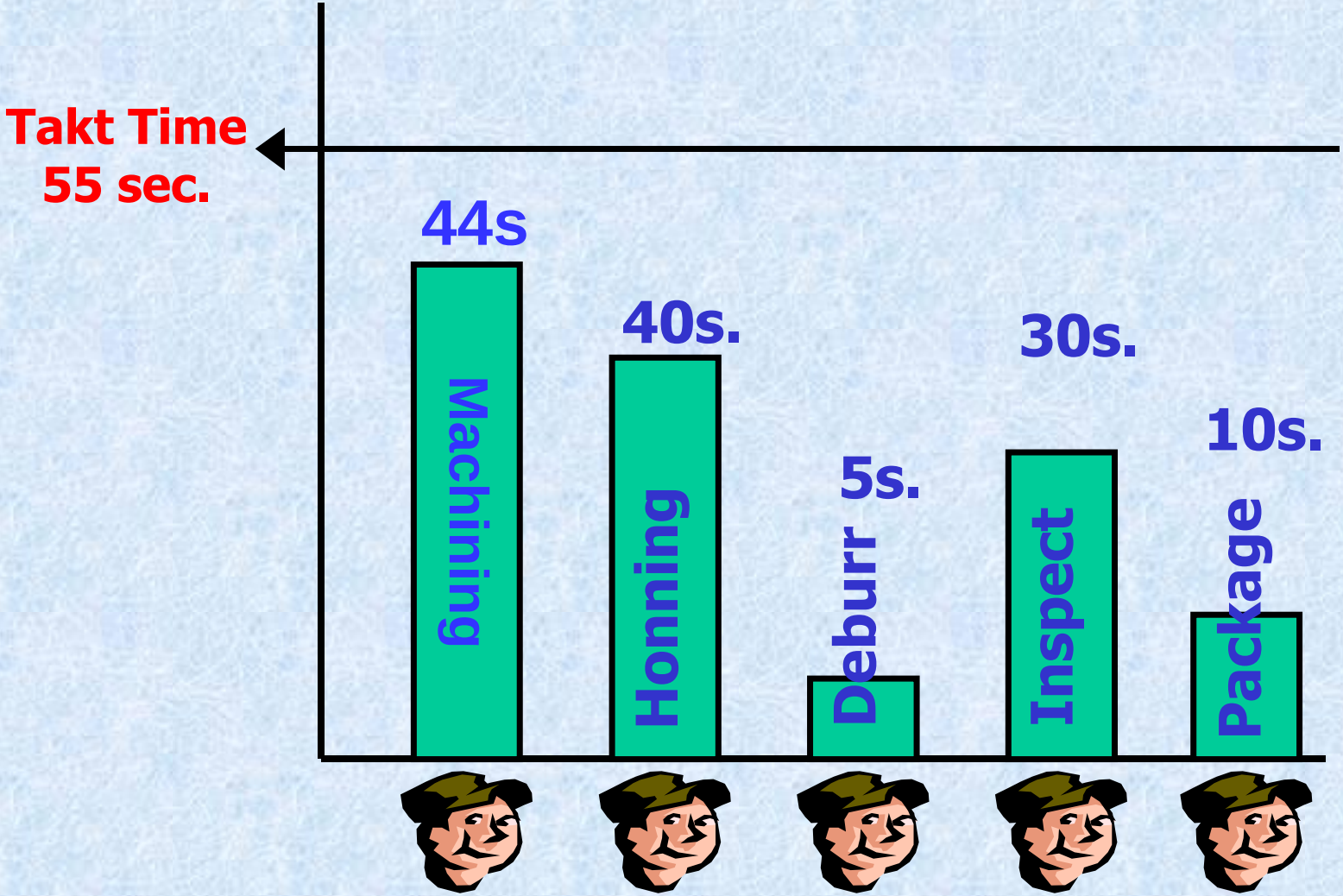
The **bottleneck process** is the operation with the longest cycle time.

In the example, this is machining at 44 seconds.

The bottleneck is important because it:

- **Determines total system output.**
- **Becomes the primary scheduling point**

ABC Gamma current cycle times

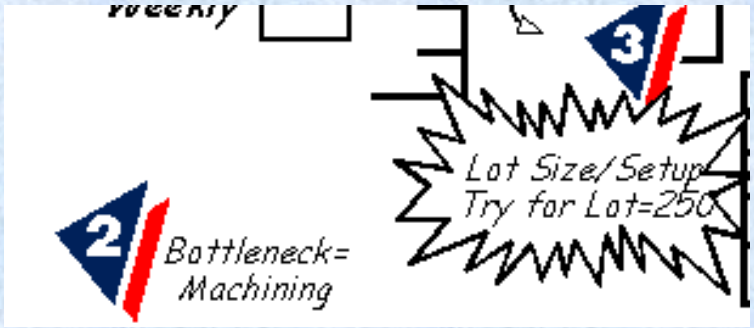


3. Identify Lot Sizing / Setup Opportunities

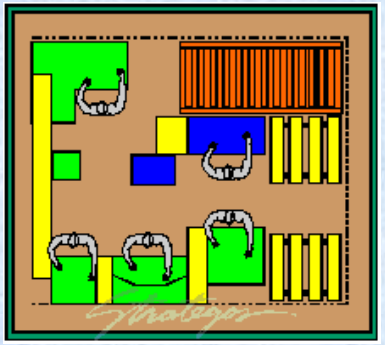
- Present lot size = 1000 pieces = 2 day's production.
- This requires at least 3-6 days finished goods

3. Identify Lot Sizing / Setup Opportunities

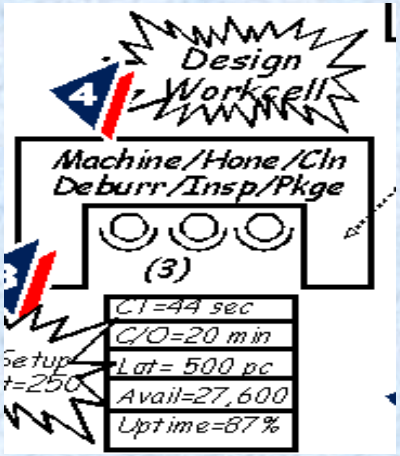
- Option 1: Simply Cut lot size.
  - Results faster response but additional setup time in machining would use available time. Machining could not meet the average customer requirements**.**
- Option 2: S**etup reduction** to 20-30 minutes
  - a batch size of 500, or even 250 is feasible.
- The mapping team established this as a goal, noted by a **Kaizen** Burst.



4. Identify Potential Workcells



- Machining and honing operations are closely balanced.
- cycle times for clean/deburr, inspection and packaging are quite short in comparison.
- It appears that **three operators can run the cell.** This is not a precise calculation. It only considers present cycle times and ignores setup.



5. Establish Scheduling Methods

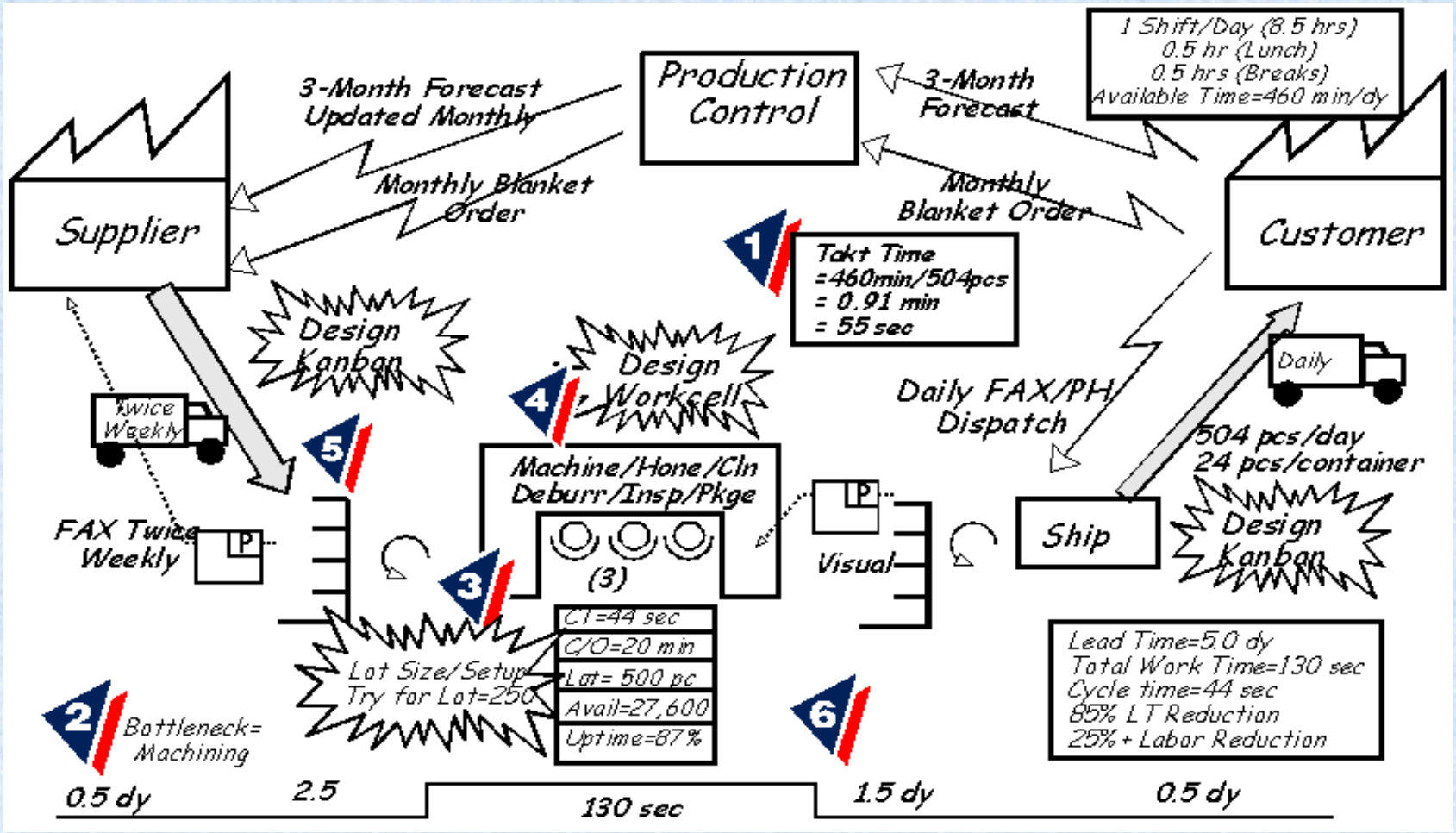
- Kanban and direct links now schedule all operations short term.
- Both the **workcell and the supplier, however, need forecasts** to plan staffing and possible changes in inventory levels.

6. Calculate Lead and Cycle Time

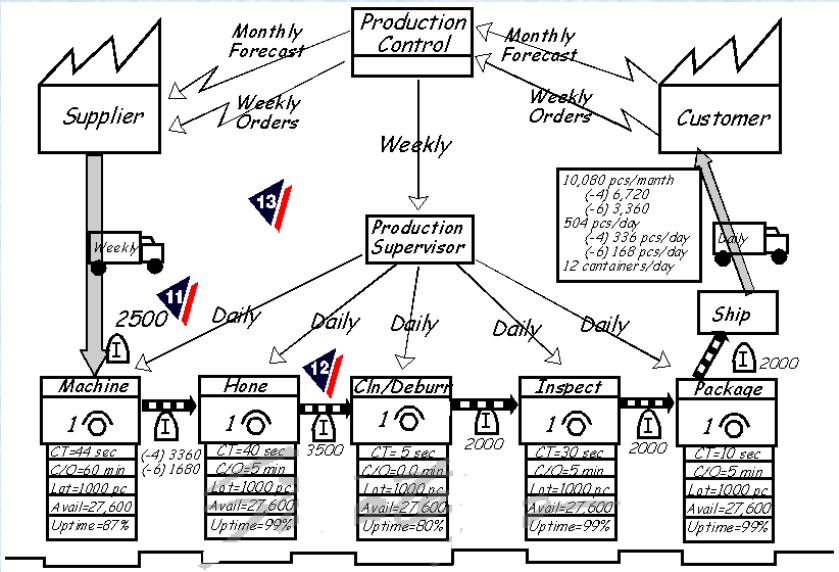
The final step in the Future State Map is to complete the **timeline** at bottom, and Calculate

Lead Time, Cycle Time and **Work Time**.

Drawing The Future State Map

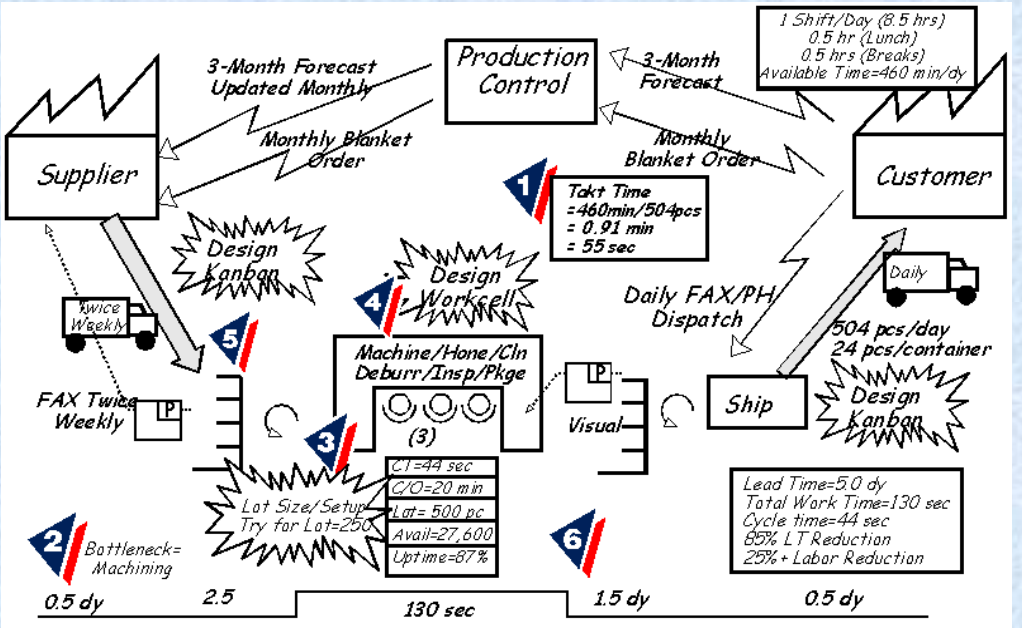


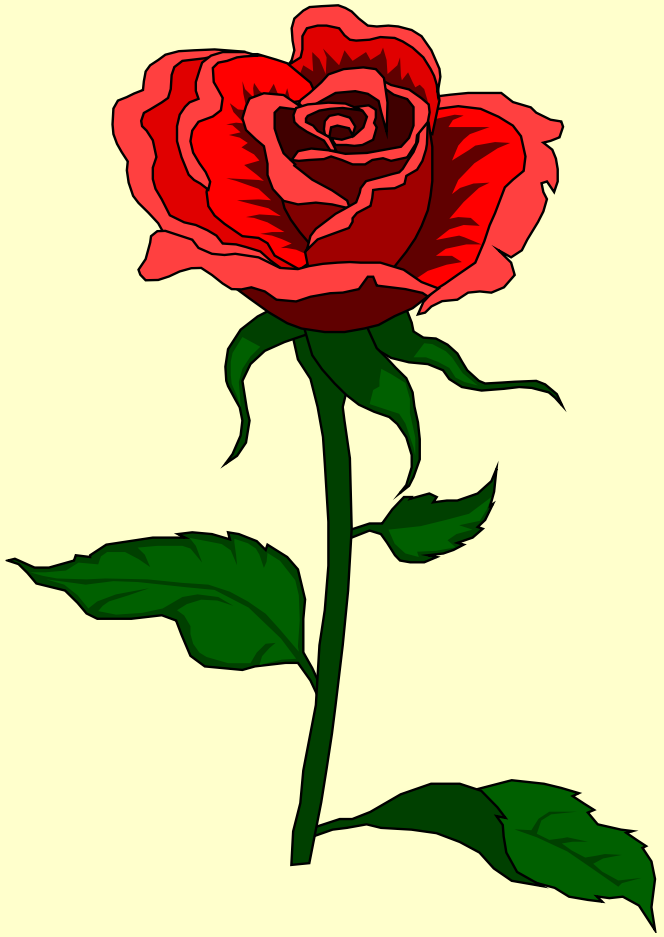
Drawing The Future State Map



CVSM

FVSM





THANK YOU FOR THE PATIENT LISTENING & WISHING YOU A RAPID “SUCCESS”