Agile Toolbox:
Value-Stream Mapping

Class will begin at 11am Eastern Time

Value Stream Mapping

Value-stream mapping is a lean-management method for assessing the current state and designing a future state for the series of events that take a product or service from the beginning of the specific process until it reaches the customer.

Value Stream Mapping

- Also known as "material flow” or “information flow” mapping
- The term comes from Lean
- Analyze the series of events involved in delivering a product or service to the customer, from start to finish; this is known as the “current state”
- Design a “future state”, that improves efficiency and the flow of value from start to finish

Value Stream Mapping

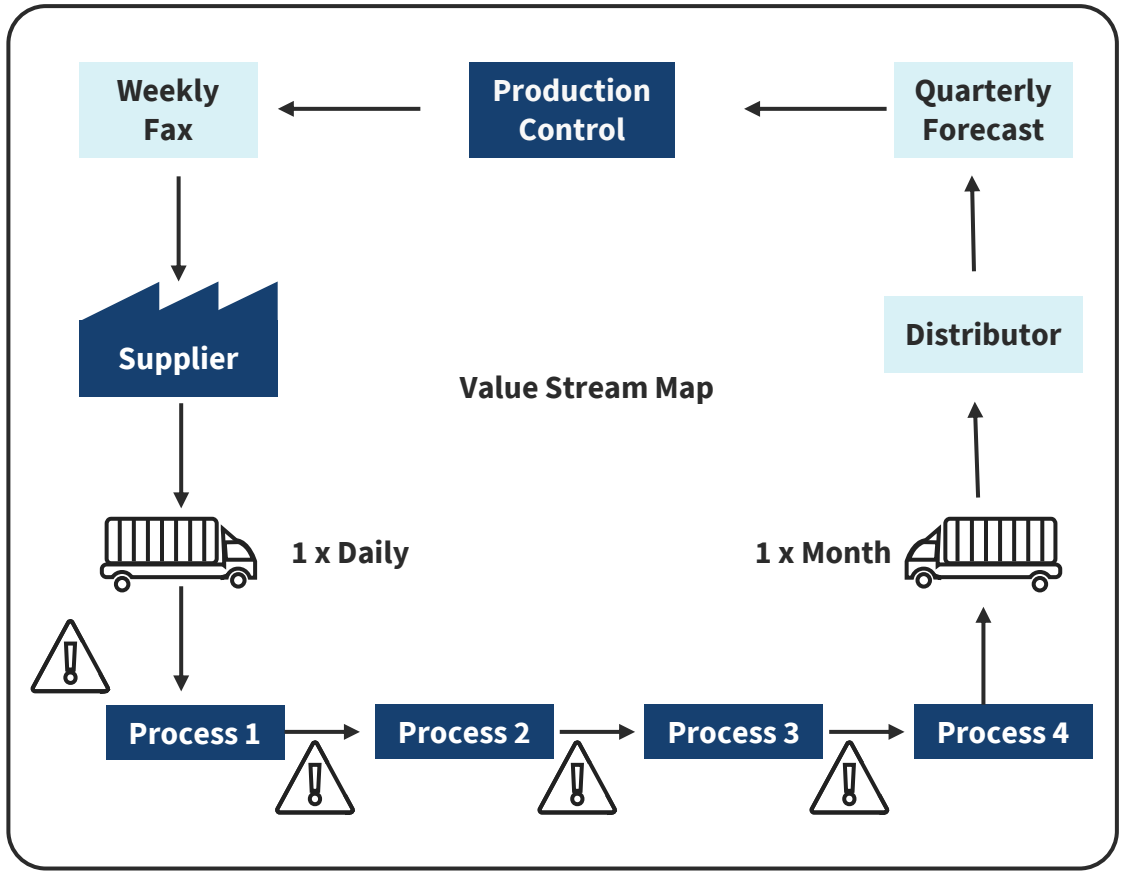
How does it work?

- Observe it
- Note how it fits into a larger picture or pattern

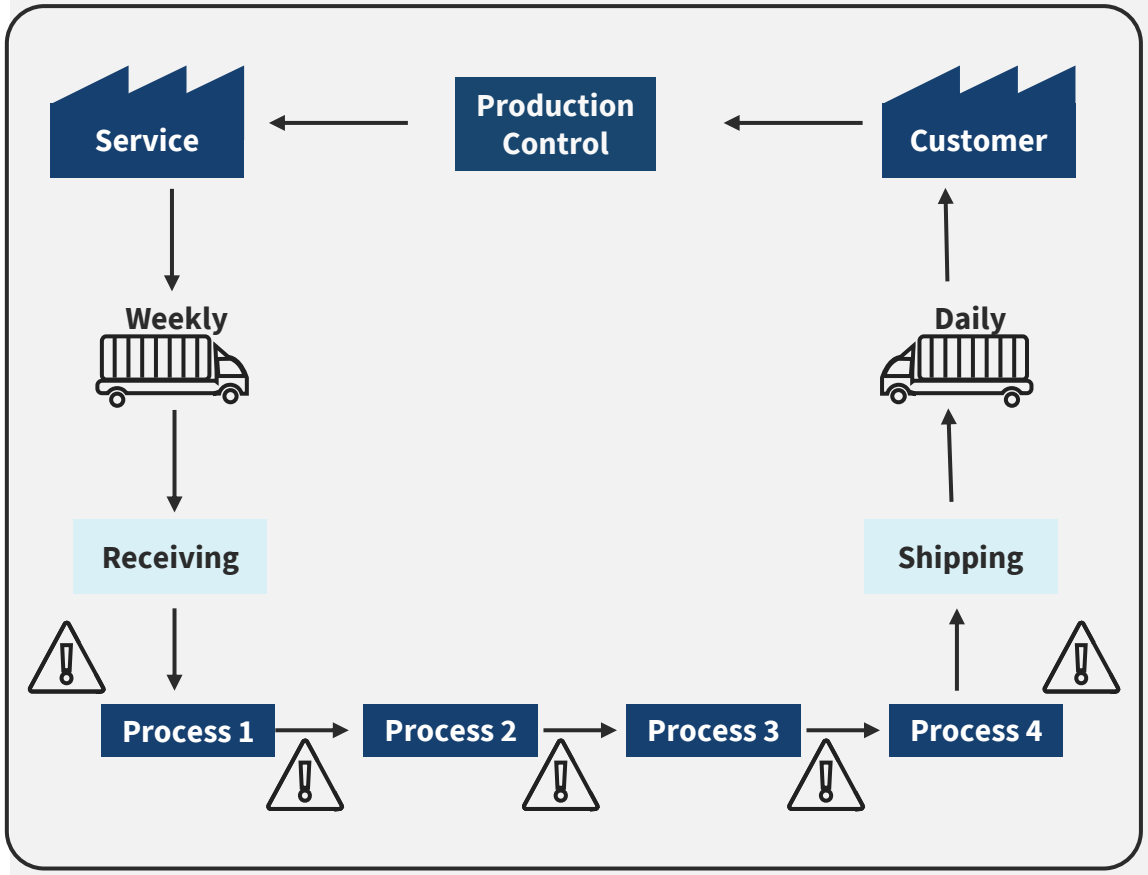
Value Stream Maps

- Visual representations of material and information flow
- Lead to a product or service being created
- Identify inefficiencies and their causes
- Eliminate sources of waste and process blocks

Value Stream Map



Example 1

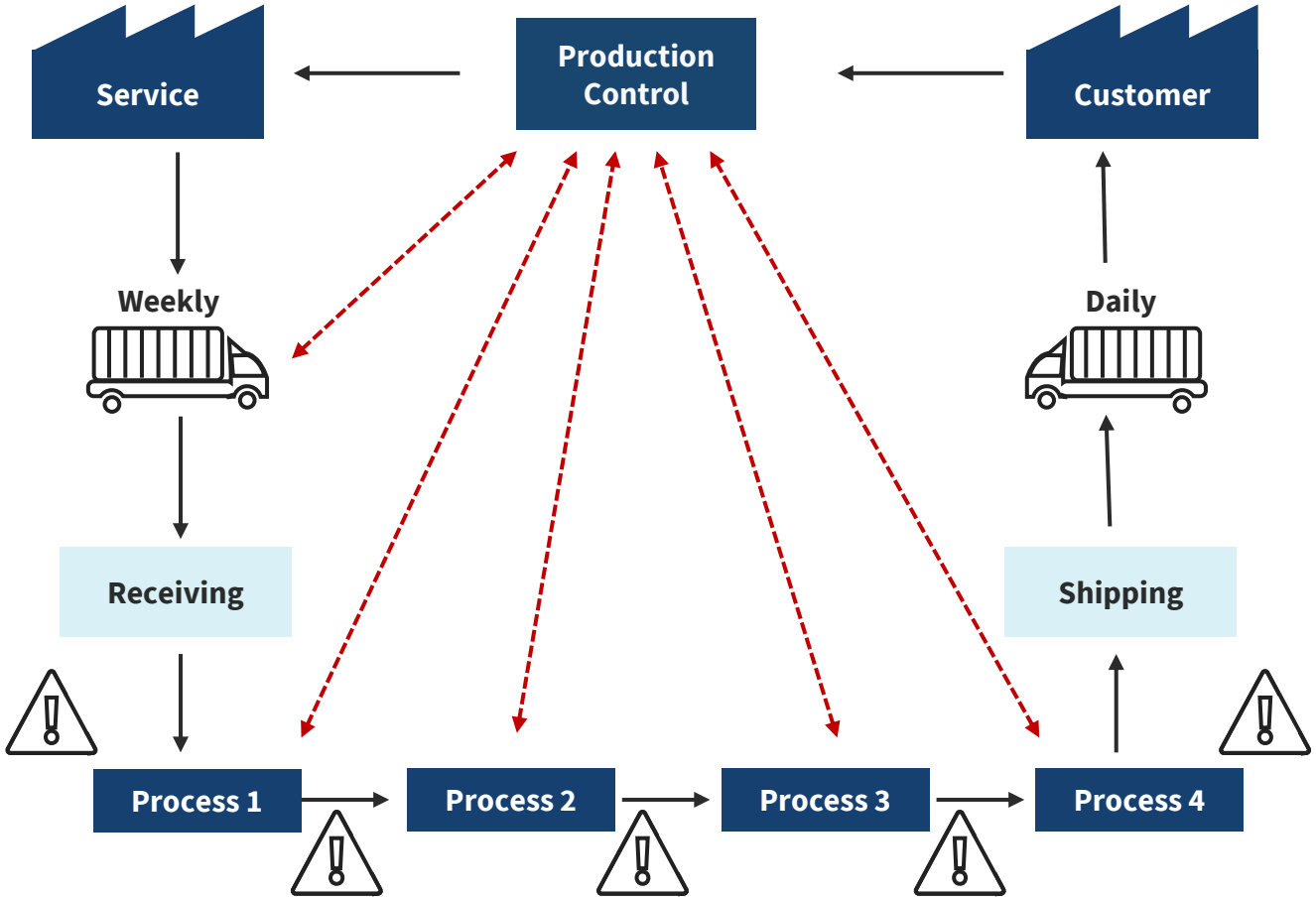


Example 2

Material and Information Flows

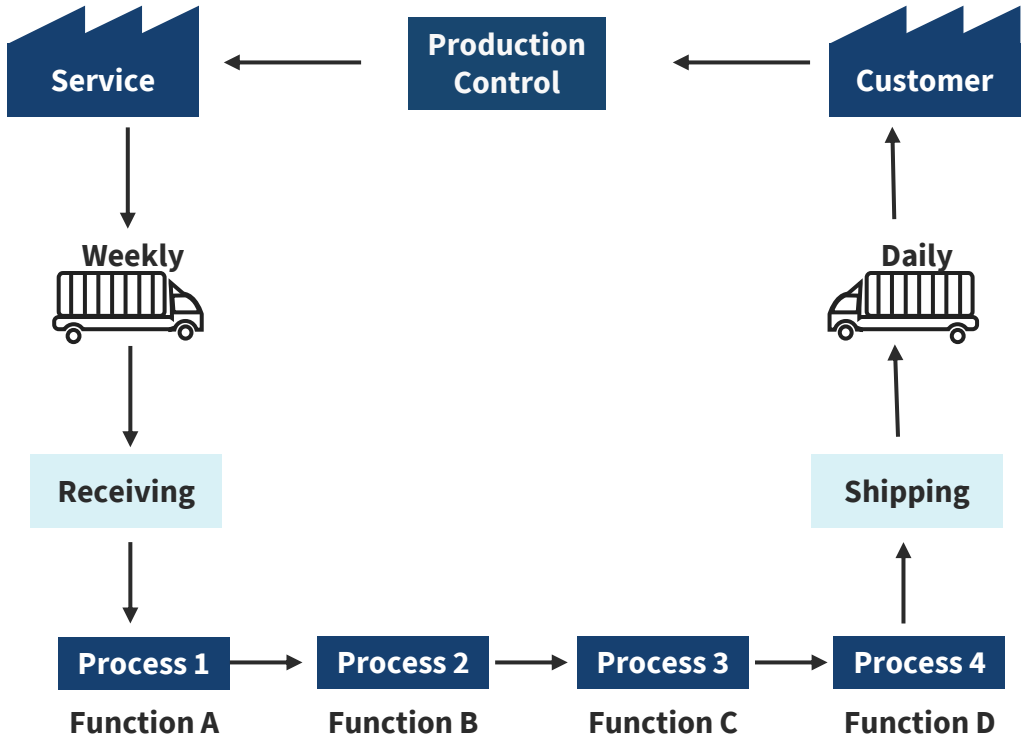
Red arrows represent Information Flows

Black arrows represent Material Flows

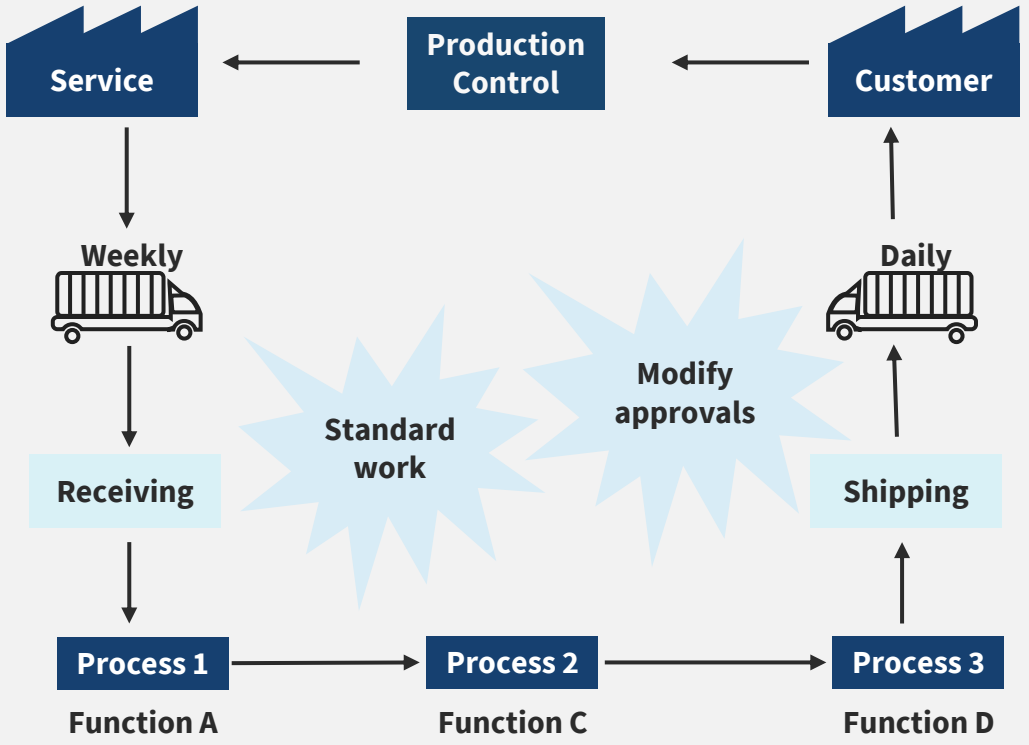


Current State and Future State

Current-state value stream map



Future-state value stream map



The Value Stream Mapping Process

Identify the product or service you want to analyze

- Which will benefit the most from process improvements?
  - Highest number of defects
  - Highest product volume
  - Customer or destination factors

The Value Stream Mapping Process

Manufacturing

- Static activities or tasks
- Low labor content and few alternative flows
- Example: attaching keypads

Service Industry

- Four basic flows
  - People
  - Processes
  - Technology
  - Time
- Flow can be more complex
- Changes to one of the flows can affect the others

The Value Stream Mapping Process

1. Identify product or service to map
2. Create current state map
   - Work processes as they are
   - Identify improvement opportunities
   - Acts as a baseline
3. Assess the current state
   - Identify sources of waste
4. Create future state map
   - Eliminate sources of waste
   - Balance production to meet demand
5. Develop and implement a plan to achieve future state
   - Determine how to make the improvements
   - Reward efficient work and suggestions

Gathering Data for Value Stream Mapping

Data Gathering Steps

1. Gather the data
2. Draw the shell of the map
3. Expand on the details it contains

Data Gathering Tools

1. Clipboard
2. Stopwatch
3. List of questions
4. Video camera (optional)

Specific Data

1. Cycle times
2. Changeover times
3. Uptime
4. Number of operators at each station
5. Inventory amounts,
6. Batch sizes
7. Working time
8. Defect rate

Key Production Metrics

Cycle Time

The time a team spends actually working on producing an item, up until the product is ready for shipment

Includes waiting stages

Lead Time

The elapsed time from the moment a customer places an order to when they receive the product

Represents the complete production process

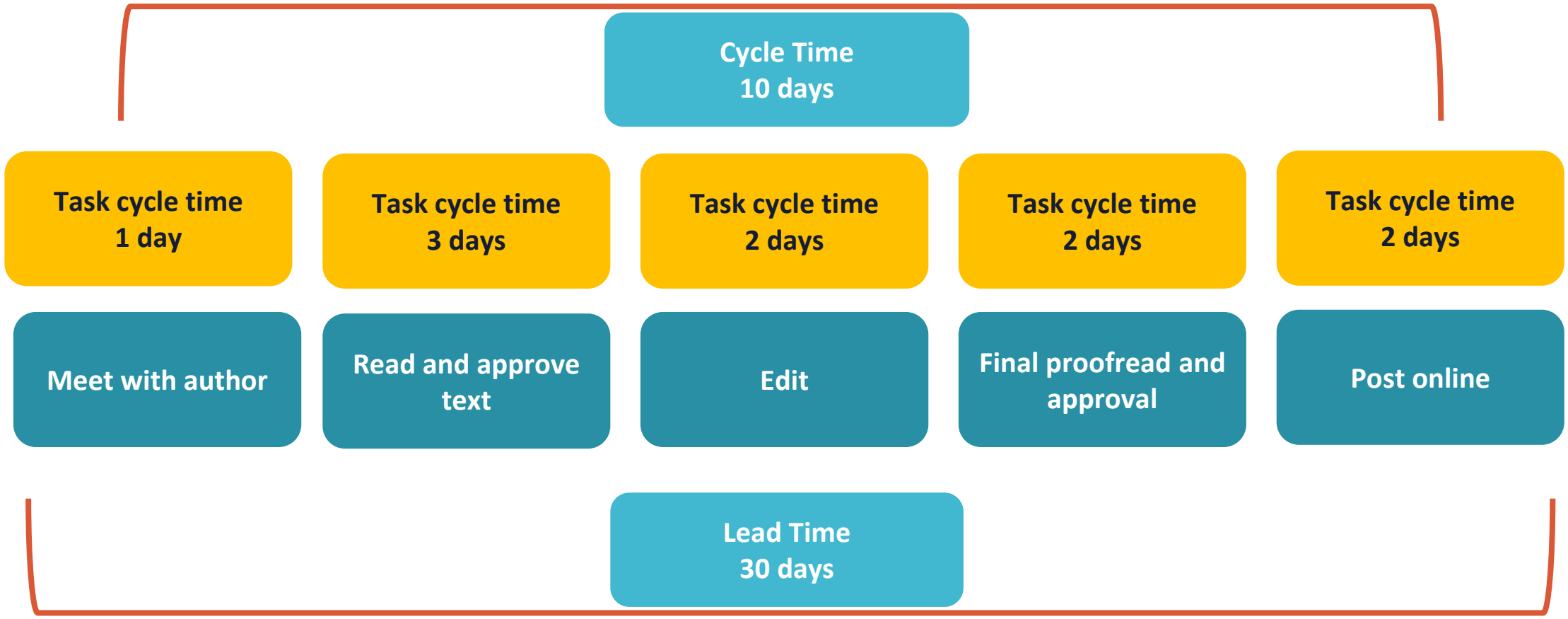
Takt Time

The time between starting to work on one item and starting the next

Means “rhythm” in German

Rate of production needed to me customer demand

Lead Time and Cycle Time

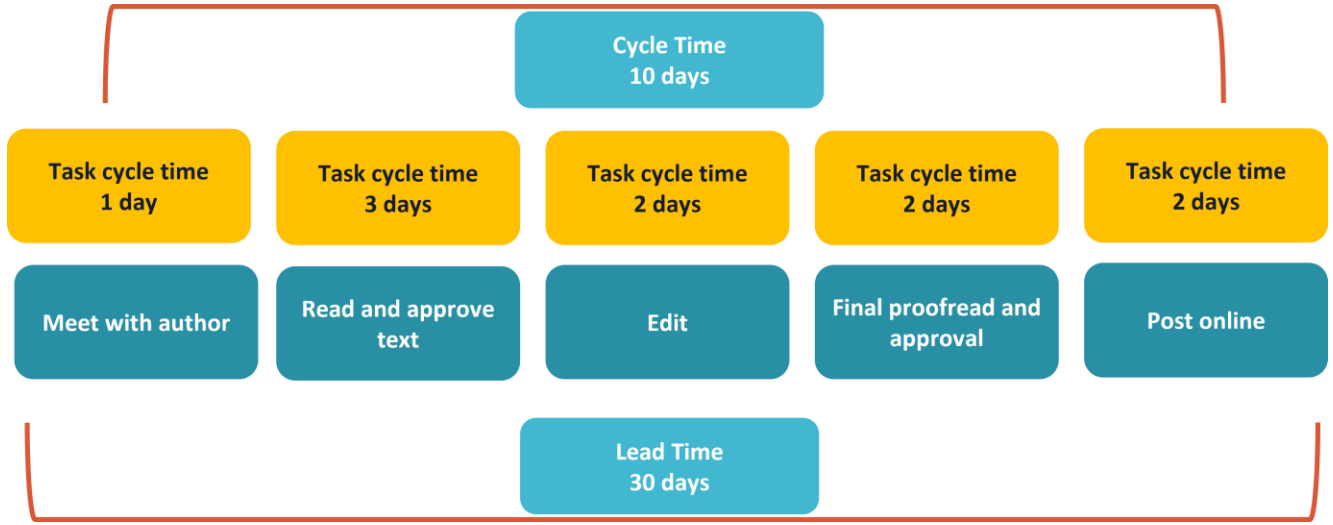


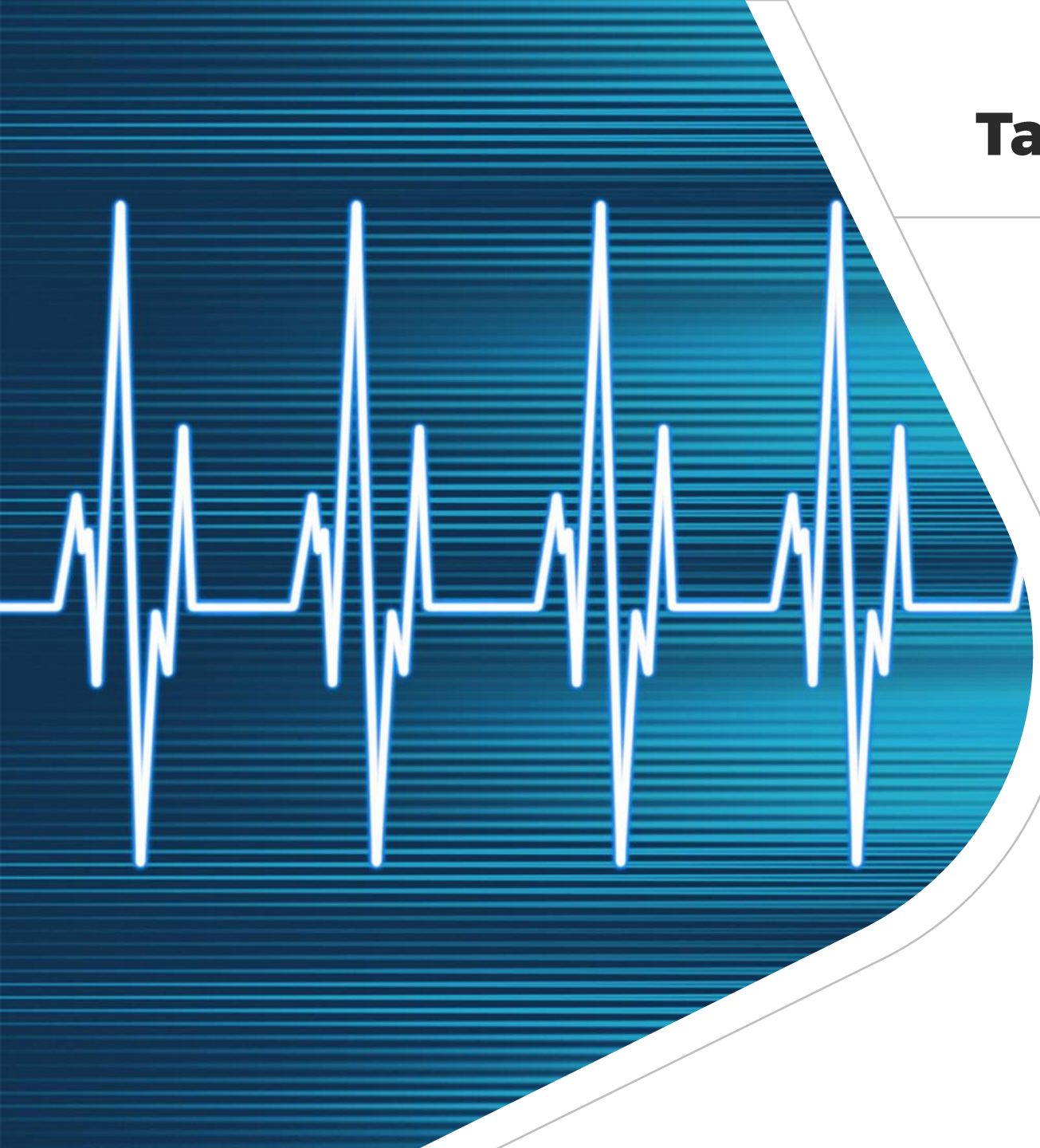
Process Cycle Efficiency (PCE)

PCE = Process cycle efficiency

PCE = $\frac{\text{Value added time}}{\text{Lead time}}$

PCE =





Takt Time

Takt means “rhythm” in German

- Like a regular heartbeat
- Production must maintain a cadence
- Measures the pace at which work must be performed
- Helps ensure customer demand is met

Video

How to Determine Cycle Time, Takt Time and Lead Time

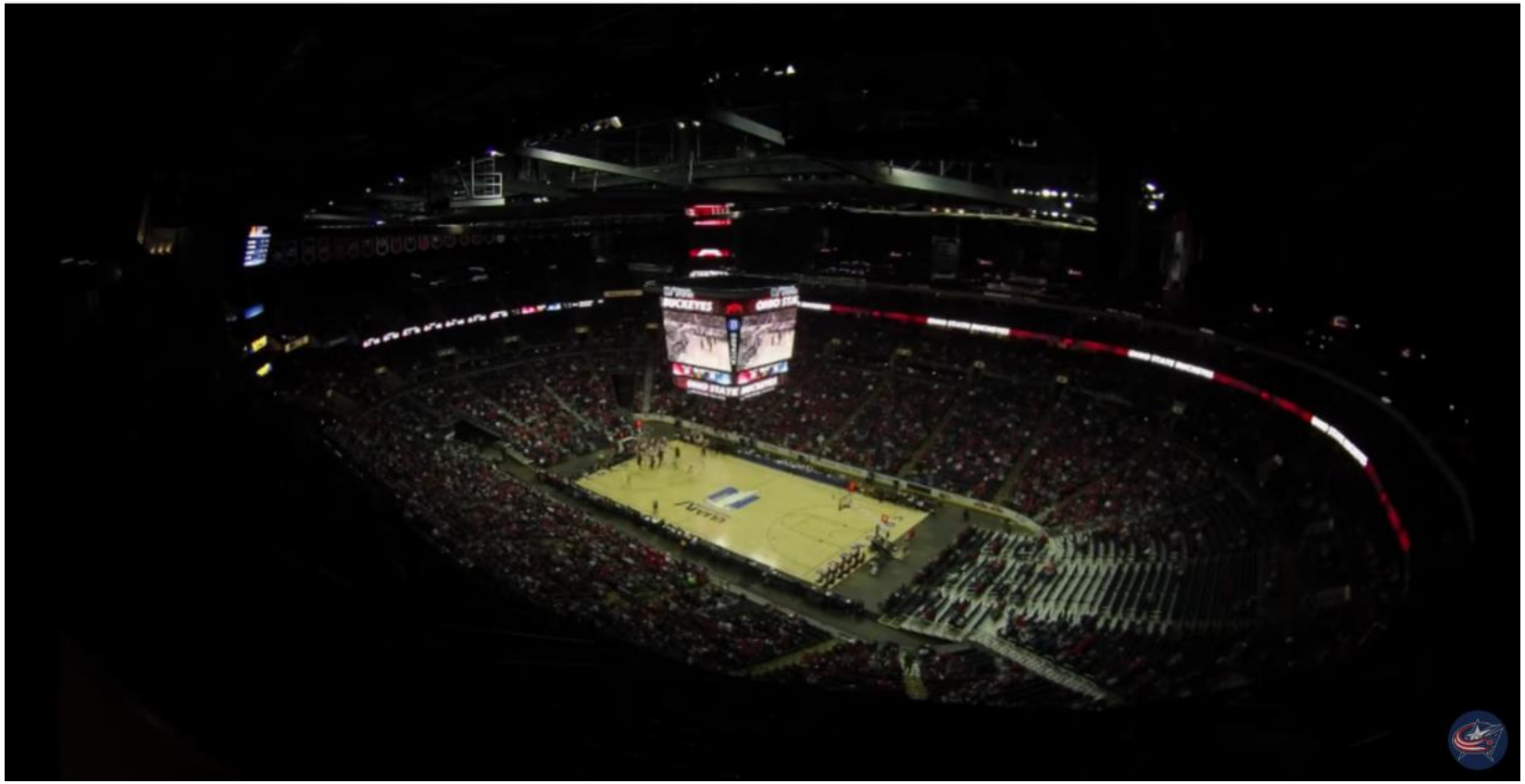
https://youtu.be/ziPcYyCdXLI

Changeover Time

Changeover time is a measurement of how long it takes to transition a machine, production line, or person from working on one product or task to another. It is the elapsed time between the completion of the last piece (part, transaction, action) of the prior run/task and the first good piece/completed action of the next run.

Video

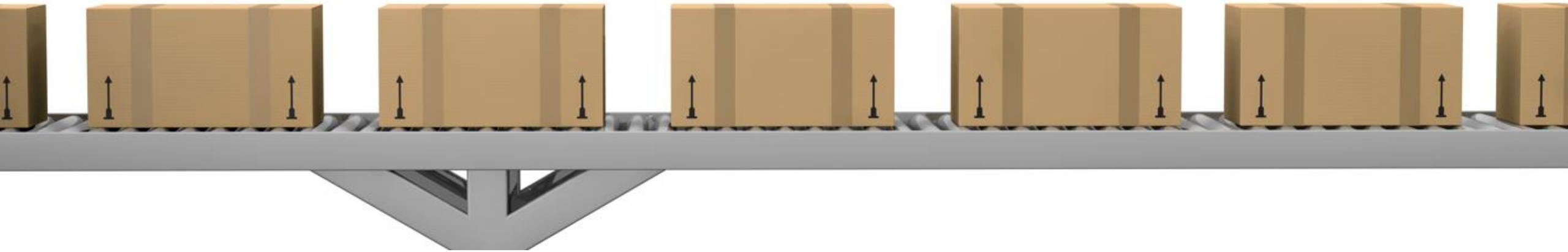
Changeover Time



https://youtu.be/IQMaOweF5M0

Uptime

Uptime, also known as run time, is a Key Performance Indicator (KPI) used to evaluate Lean processes and prevent downtime. Uptime considers all possible stoppages, both planned and unplanned, for a tally of the amount of time a production line is running. Helps with early detection of breakdowns.



Defect Rate

The total number of noncompliant units that occur over a known number of units. A unit is considered defective when a process or characteristic doesn't perform within specifications. Can be expressed as Defects per Opportunity (DPO) or Defects per Million Opportunities (DPMO).

Example: Battery Manufacturing

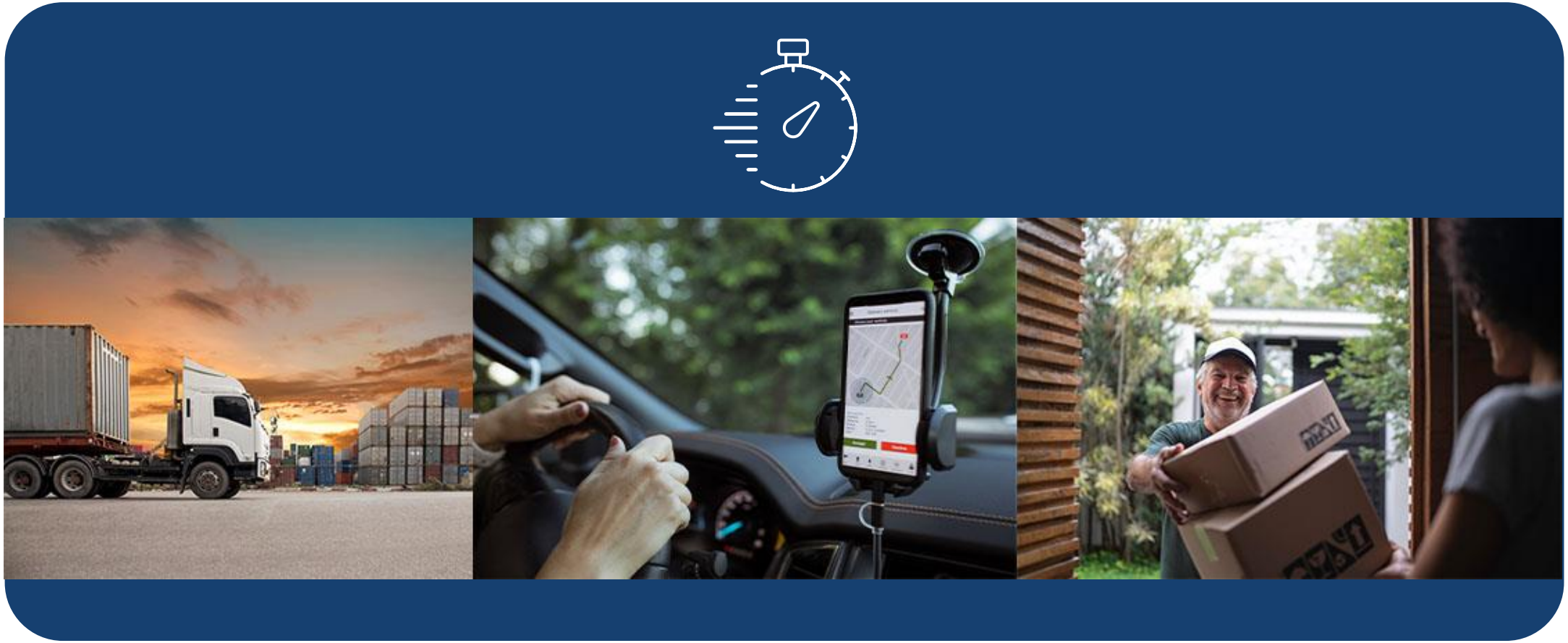
Walk through the process

- Start to finish
- Step by step

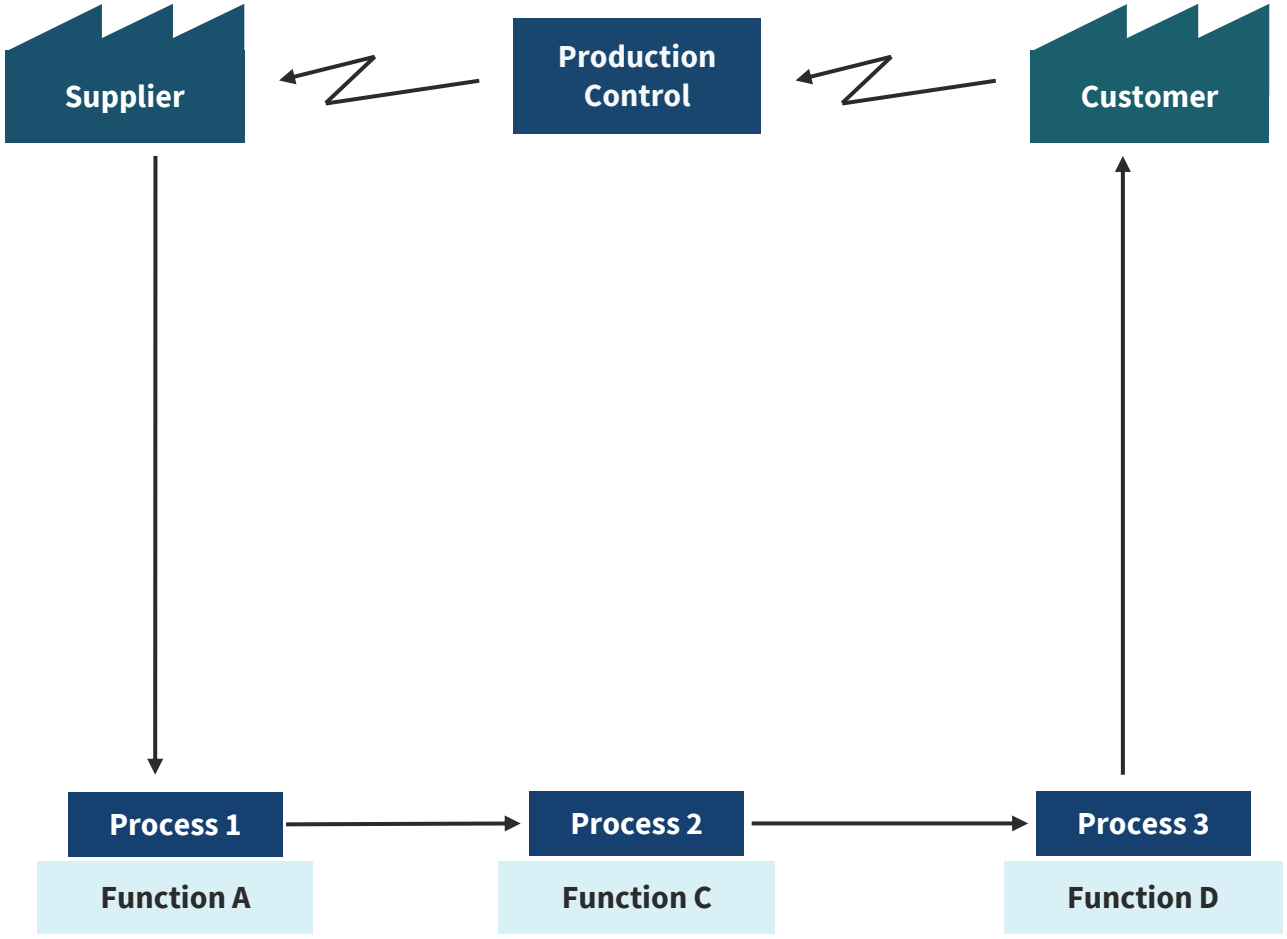
Document observations

- Number of operators
- Cycle times
- Inventory numbers
- Changeover times
- Uptime for equipment

Process Improvement and Flows

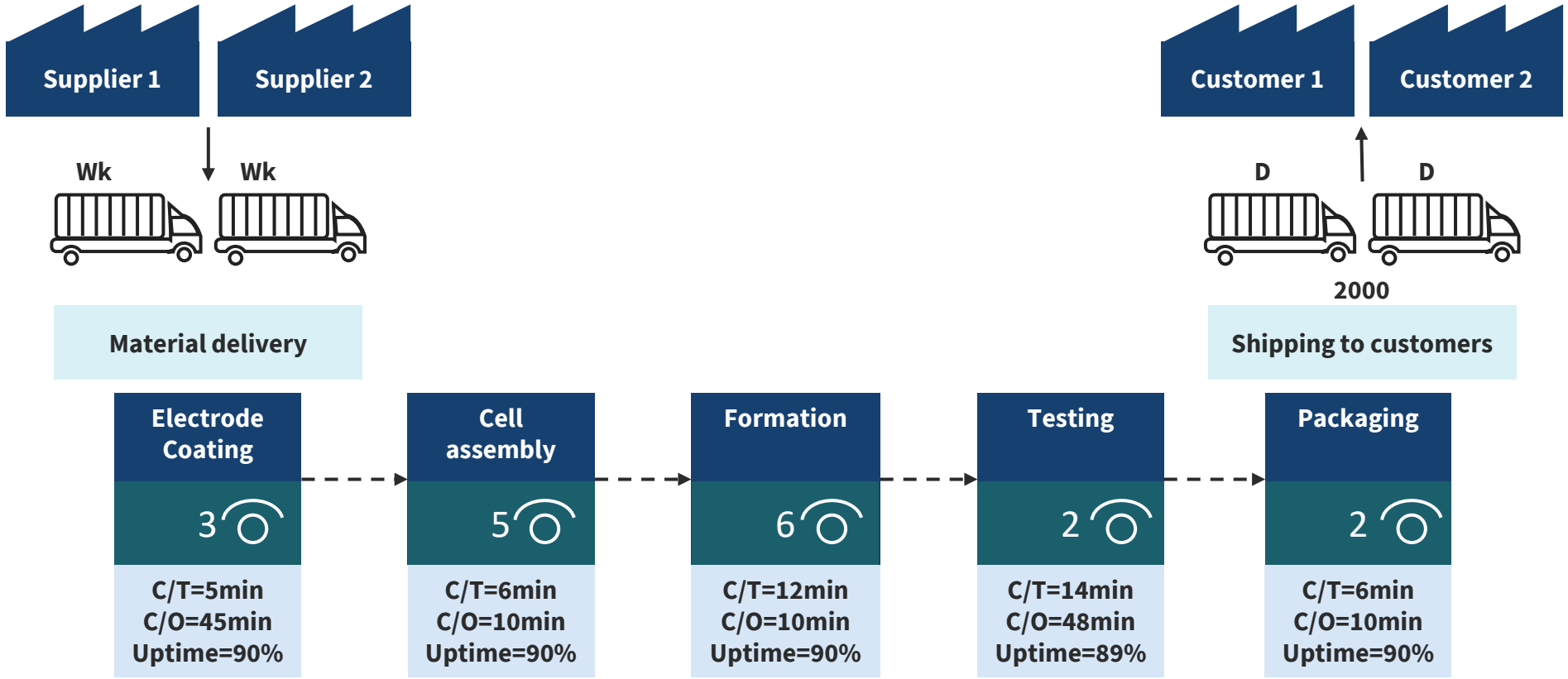


Creating a Value Stream Map

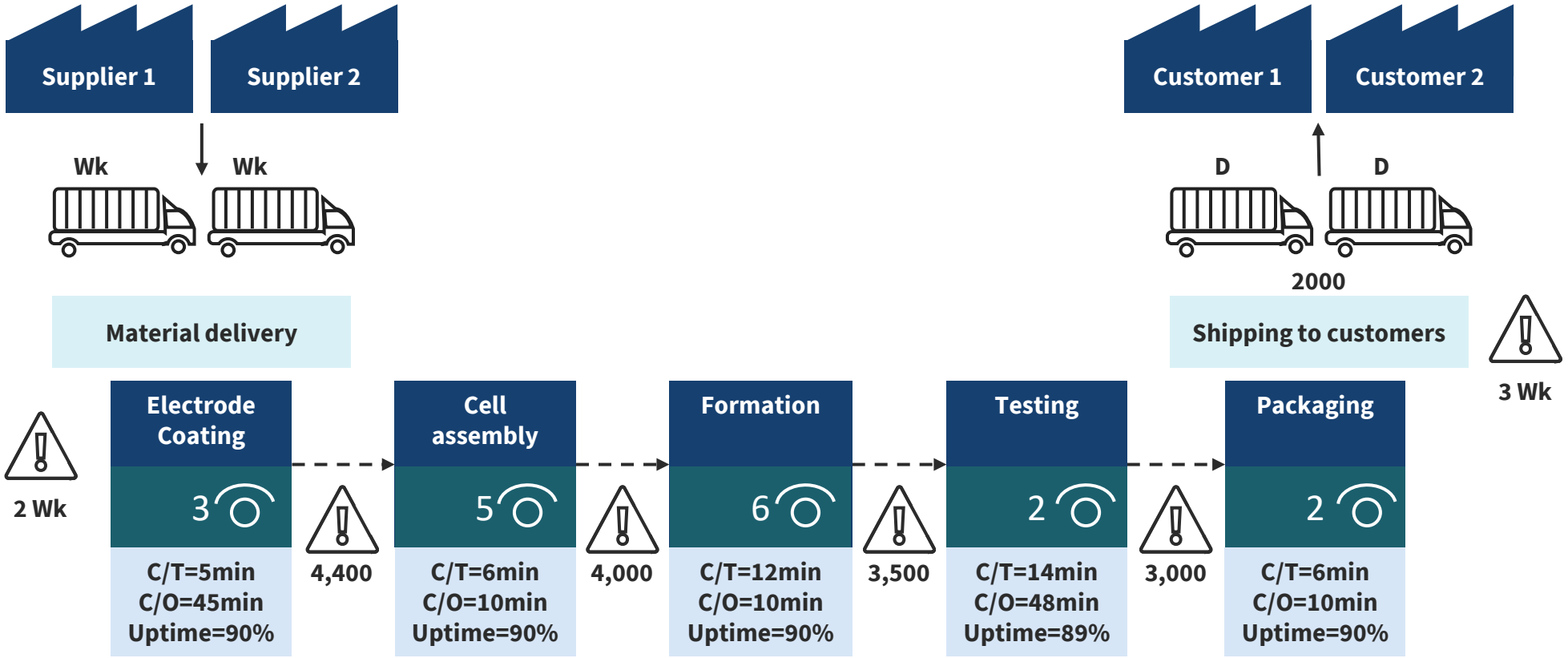


Creating a Value Stream Map

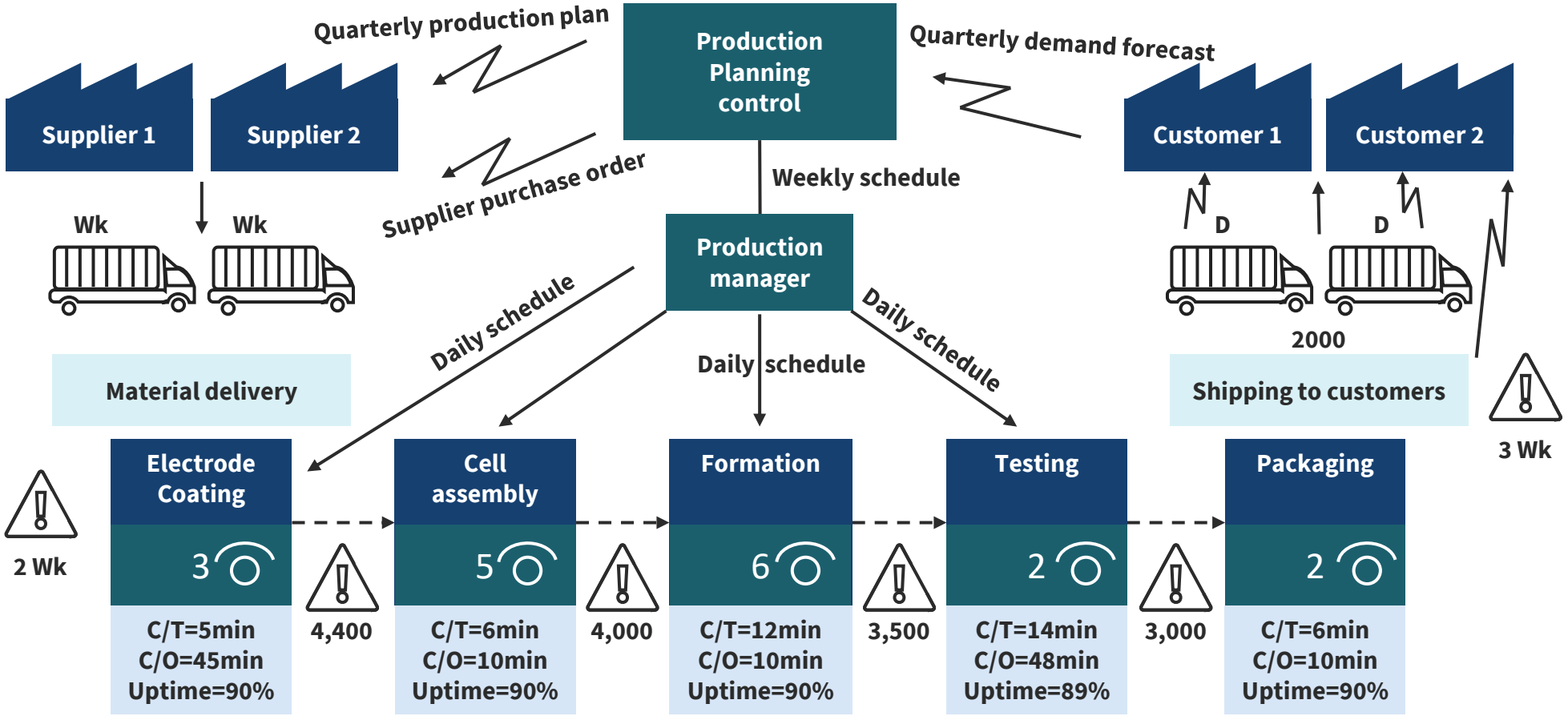
Creating a Value Stream Map



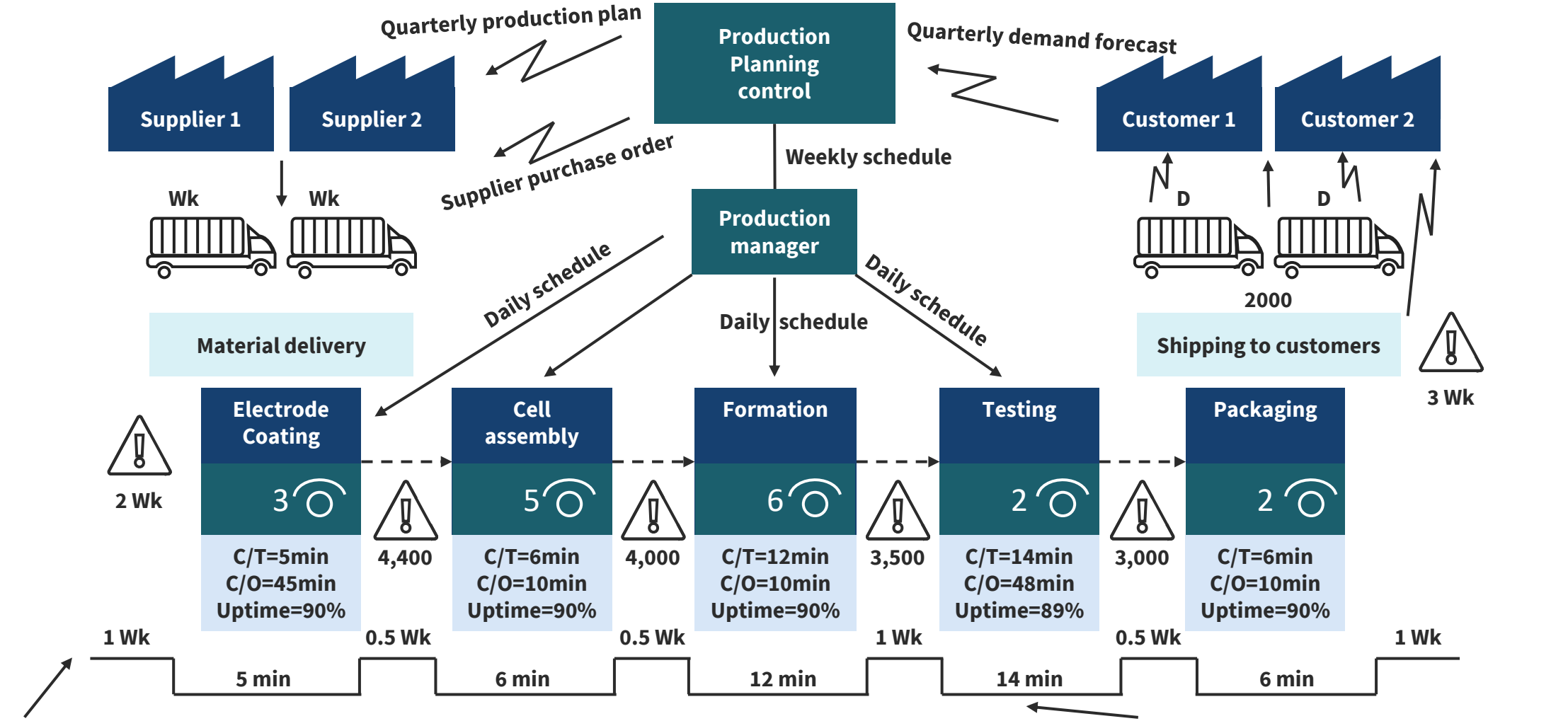
Creating a Value Stream Map



Creating a Value Stream Map



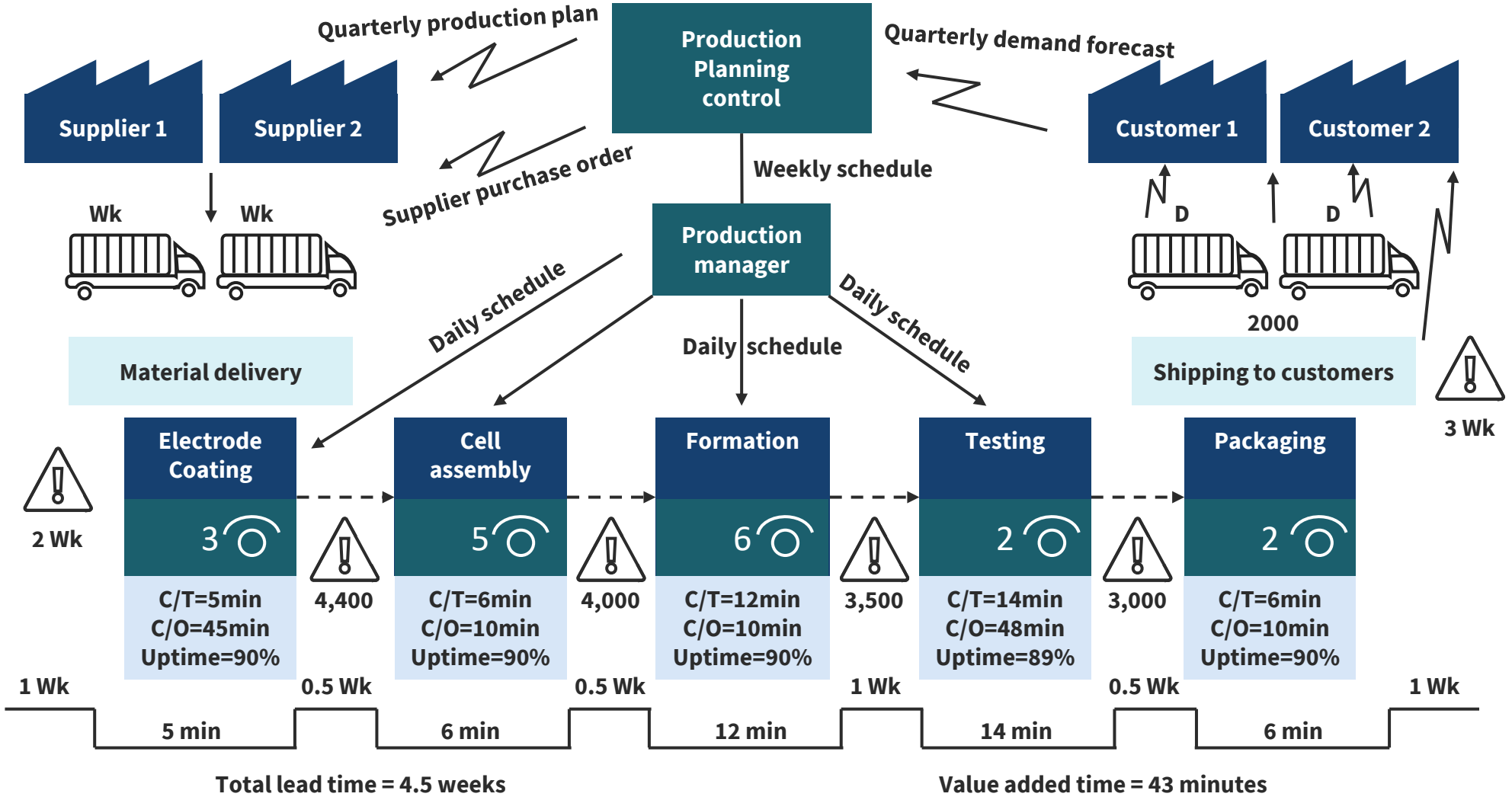
Creating a Value Stream Map



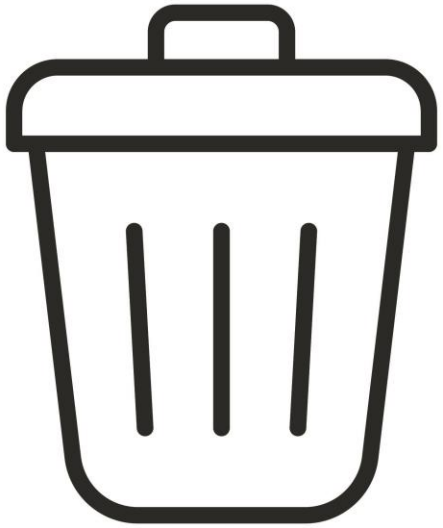
Peaks represent lead time between each process.

Troughs represent value-added time associated with each process.

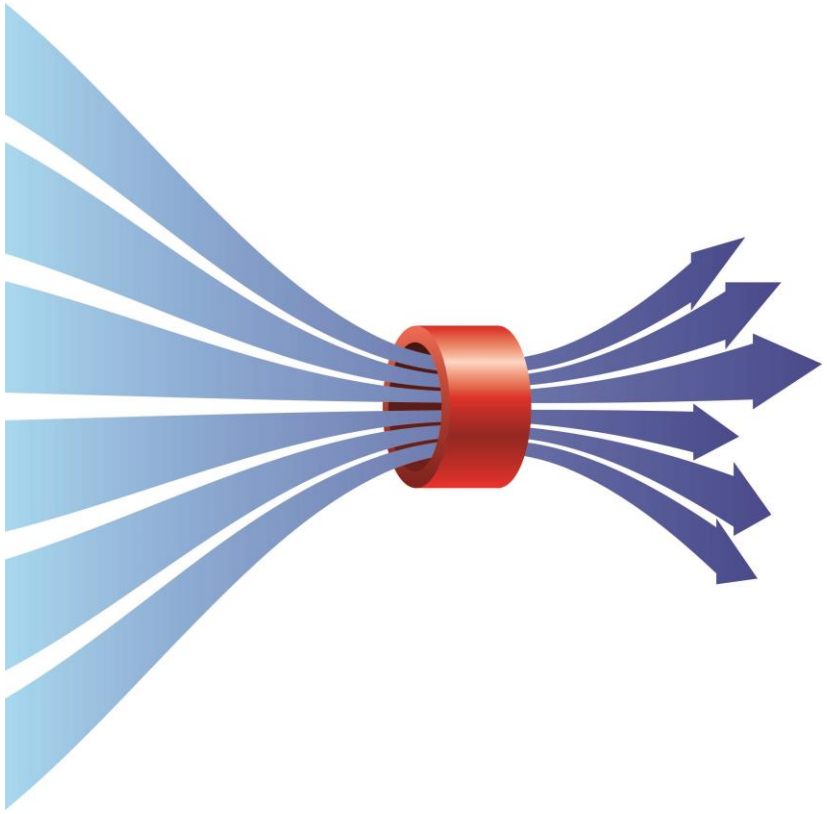
Creating a Value Stream Map



Identifying Waste in a Value Stream Map



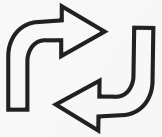
Waste



Process Blocks and Bottlenecks

Lean Wastes

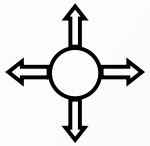
Waiting



Task-switching

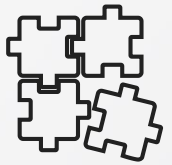
Extra processes

Motion



Extra features

Defects



Partially done work

5 Whys Exercise

Why does it take so long to gather the components?

Because the stock is kept in a separate room, in five different boxes.

Why is the stock kept in a separate room, in five different boxes?

Because we have always kept our inventory organized that way……

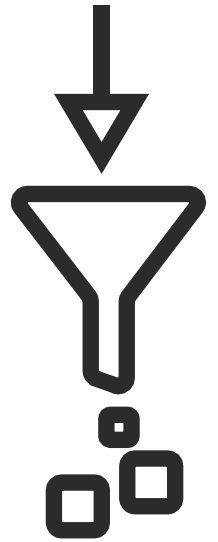
Continue asking “Why” to arrive at the root cause

Identifying Process Blocks in a Value Stream Map

Cycle Time > Takt Time = Blocked Process!

Cycle time: the time it takes to complete a cycle, or task, excluding any waiting or queuing time

Takt time: the time a task must be completed in for production to continue at a rate that matches customer demand



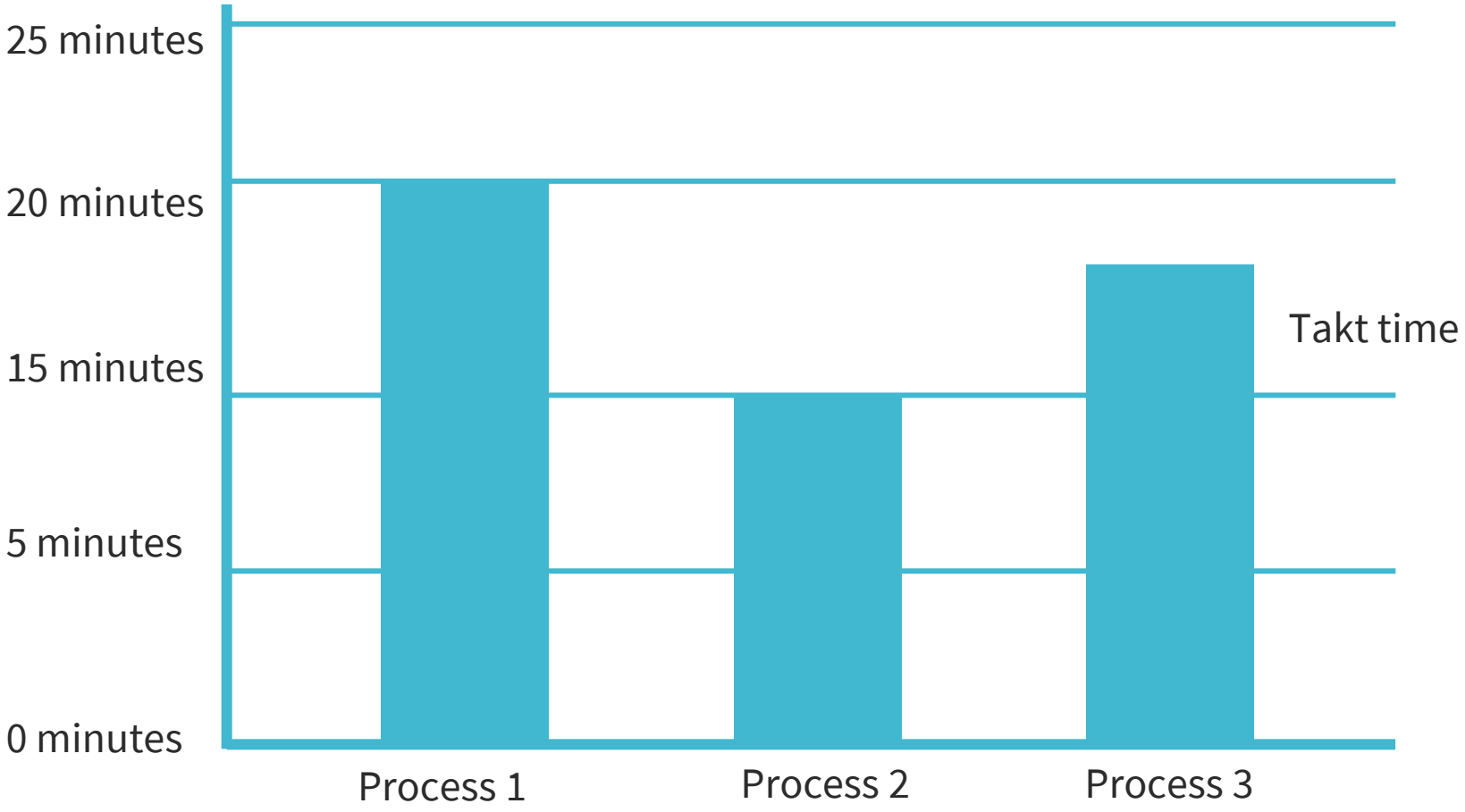
Identifying Process Blocks in a Value Stream Map

$$\text{Takt time} = \frac{\text{Net operating time}}{\text{Customer requirements}}$$

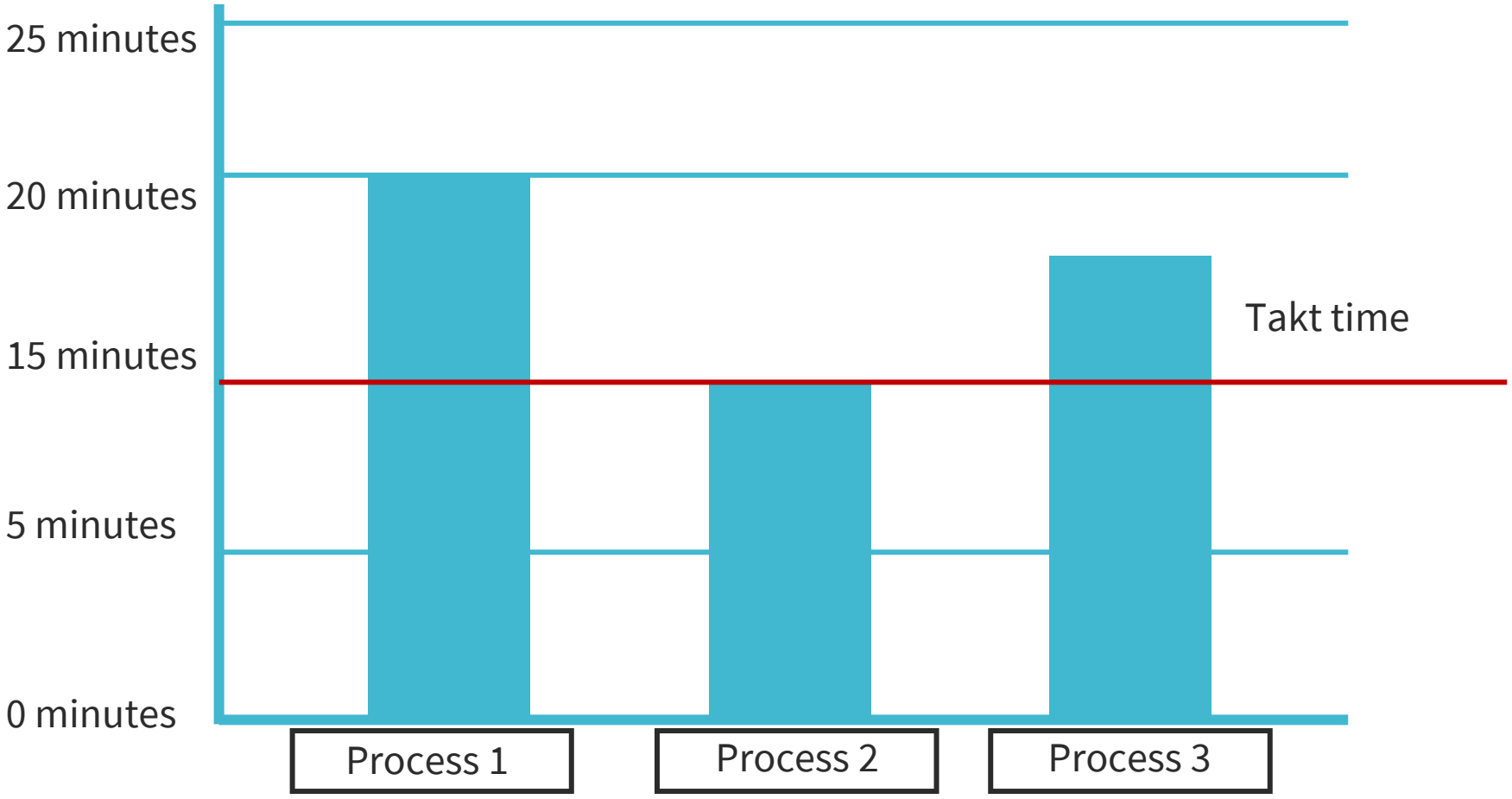
$$\text{Takt time} = \frac{420}{35}$$

$$\text{Takt time} = 12 \text{ min}$$

Identifying Process Blocks in a Value Stream Map

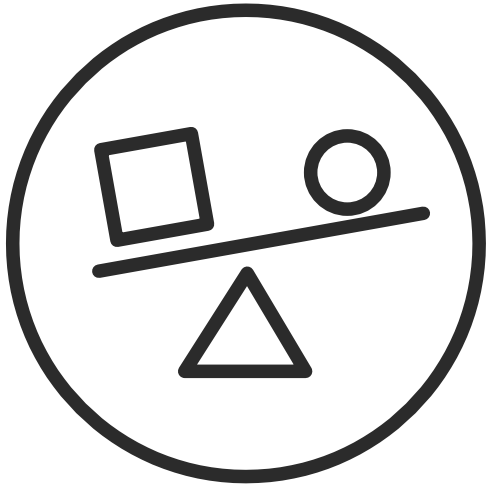


Identifying Process Blocks in a Value Stream Map

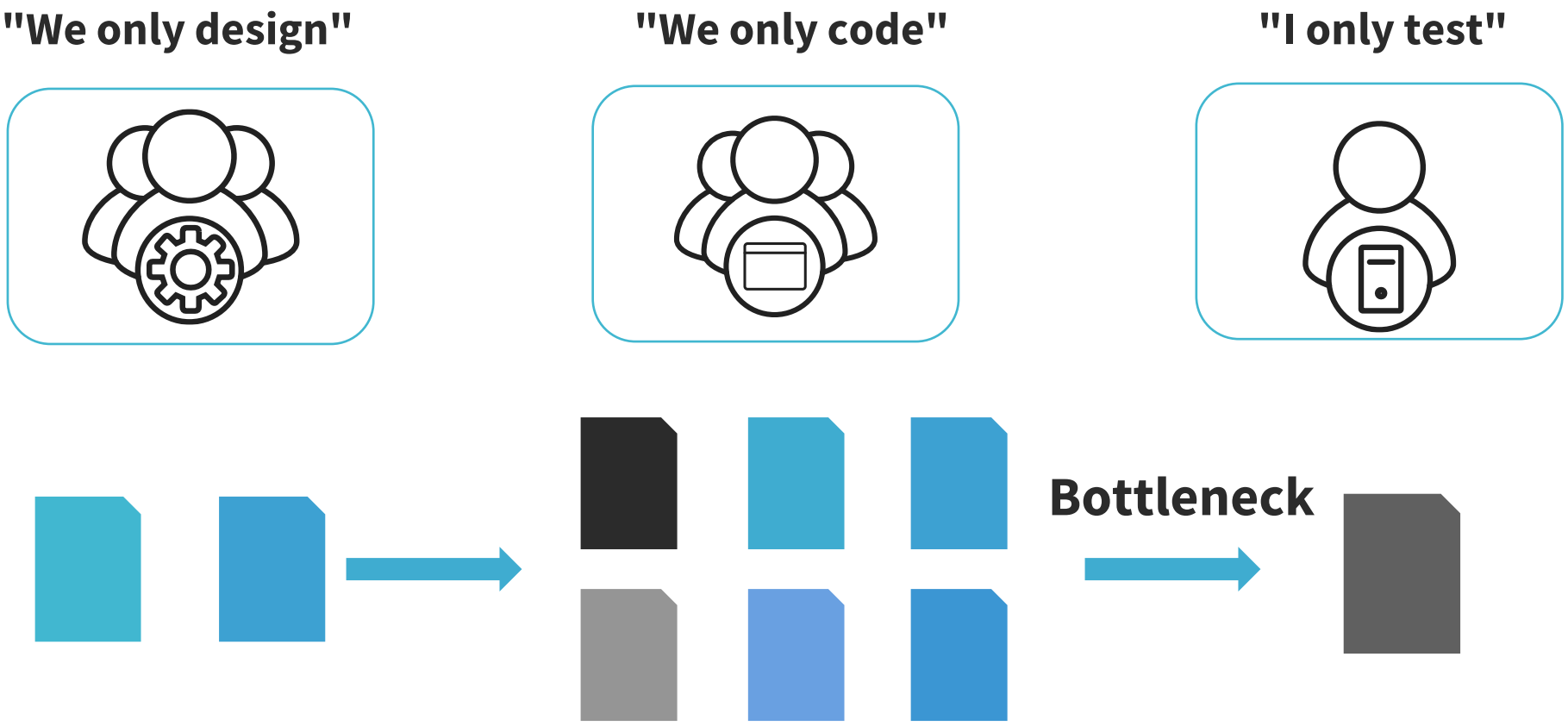


Line Balancing

- Ensure work is divided evenly among all operators
- Cycle times match Takt time
- Track operators cycle time
- Redistribute work or even workers
- Ensure all tasks finish at a similar time
- Bring in additional workers or alter processes

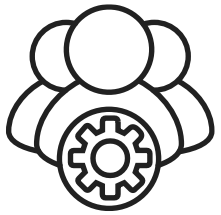


Specialists (I-shaped)

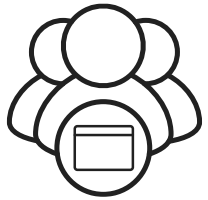


Generalized Specialists (T-shaped)

"We only design"



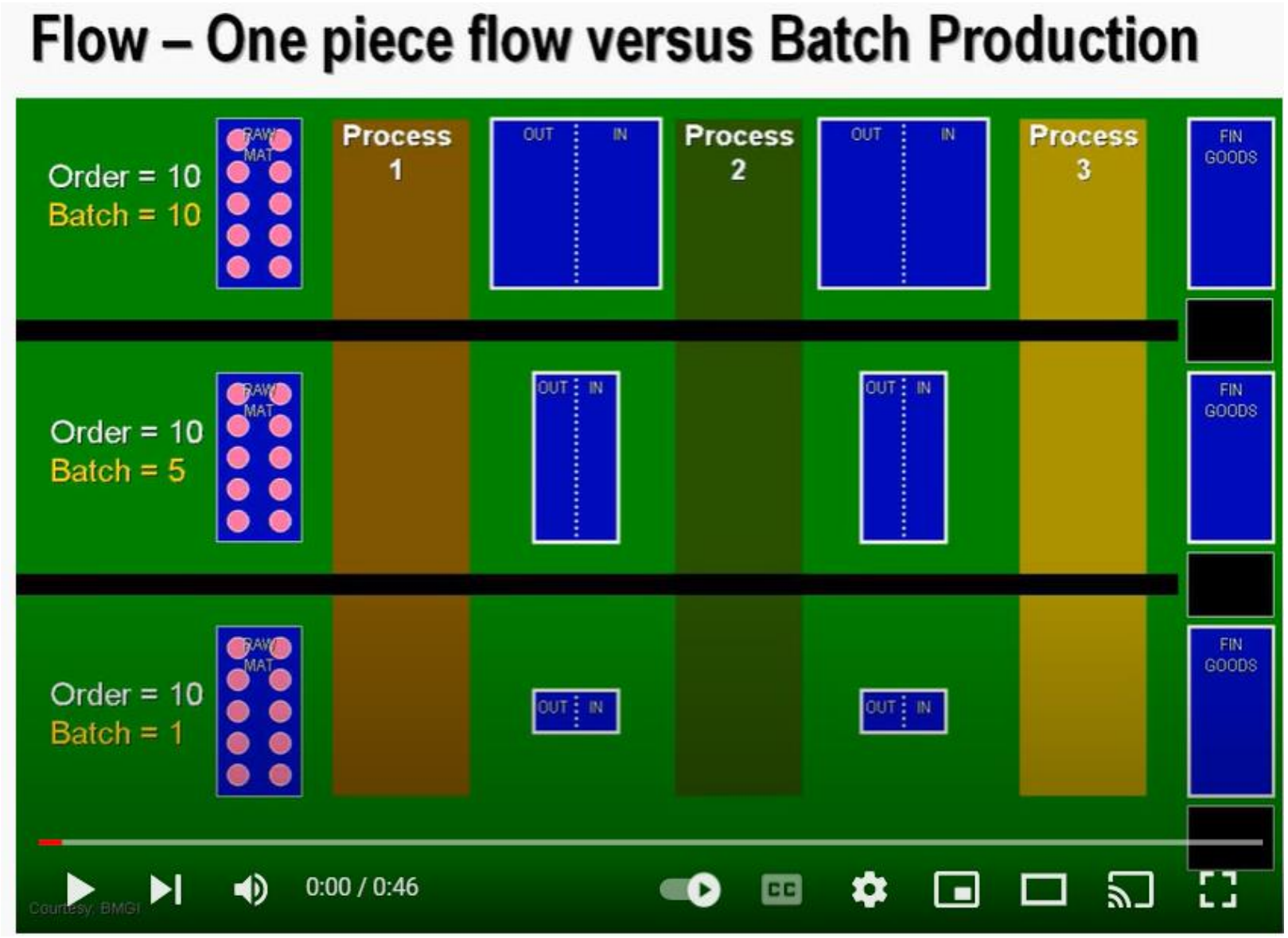
"We can code *and* test"



"I can code *and* test "

Ready for release

Video



https://www.youtube.com/watch?v=JoLHKSE8sfU

Little’s law

- Inventory (WIP)
- Throughput
- Lead time

By changing one,

we can change the others.

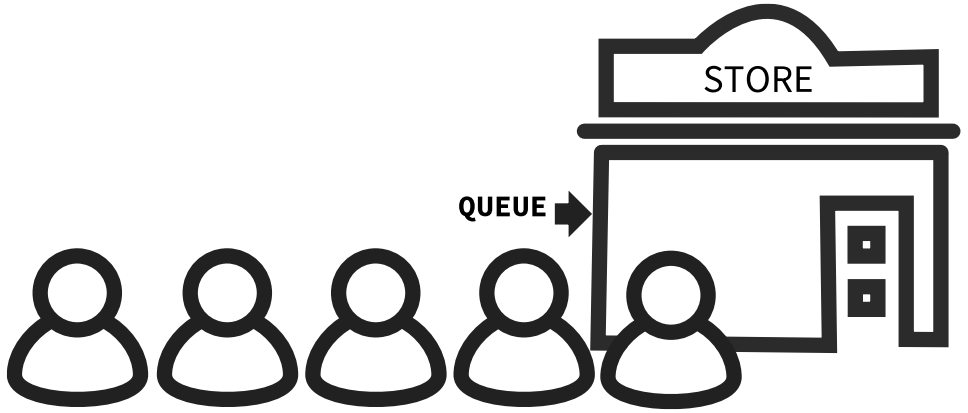
Little's law

$$\frac{\text{Inventory (WIP)}}{\text{Throughput (Speed)}} = \text{Wait Time}$$

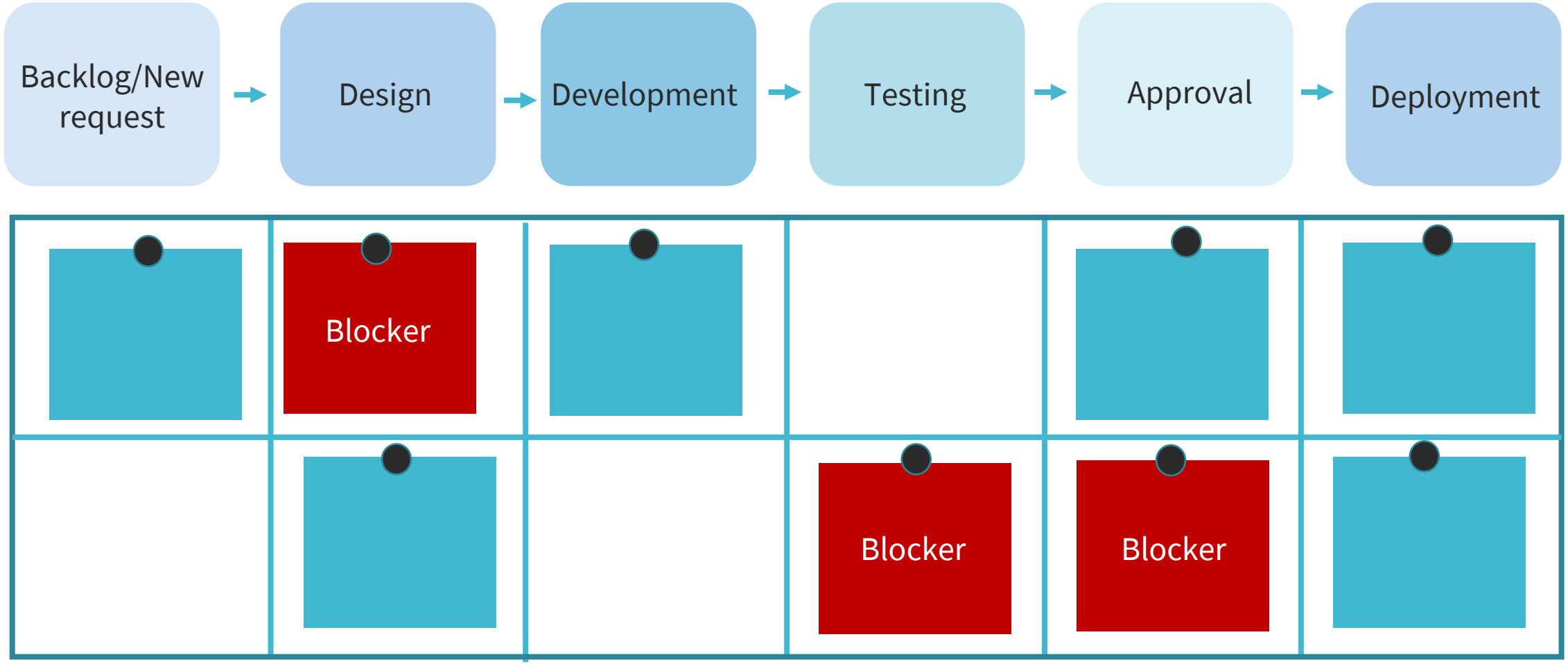
$$\frac{\text{10 customers in line}}{\text{2 customers per minute}} = \text{5-minute wait time}$$

Reduce the queue (WIP)
10 customers in line/2 customers per minute = 5 minutes
5 customers in line/2 customers per minute = 2.5 minutes

Increase the throughput (Speed)
10 customers in line/2 customers per minute = 5 minutes
10 customers in line/5 customers per minute = 2 minutes



Kanban Blockers

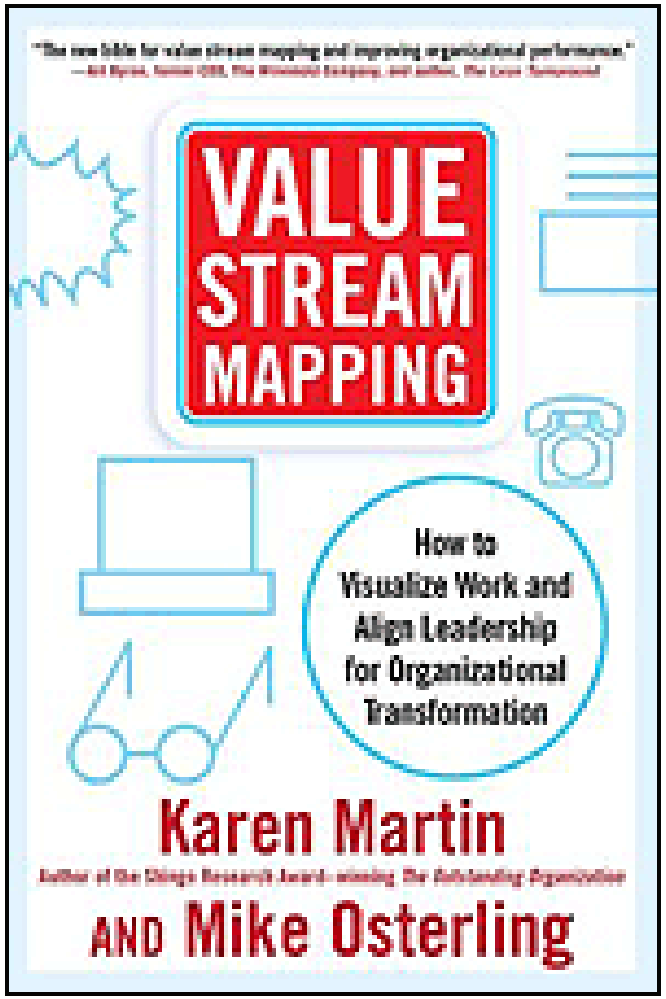


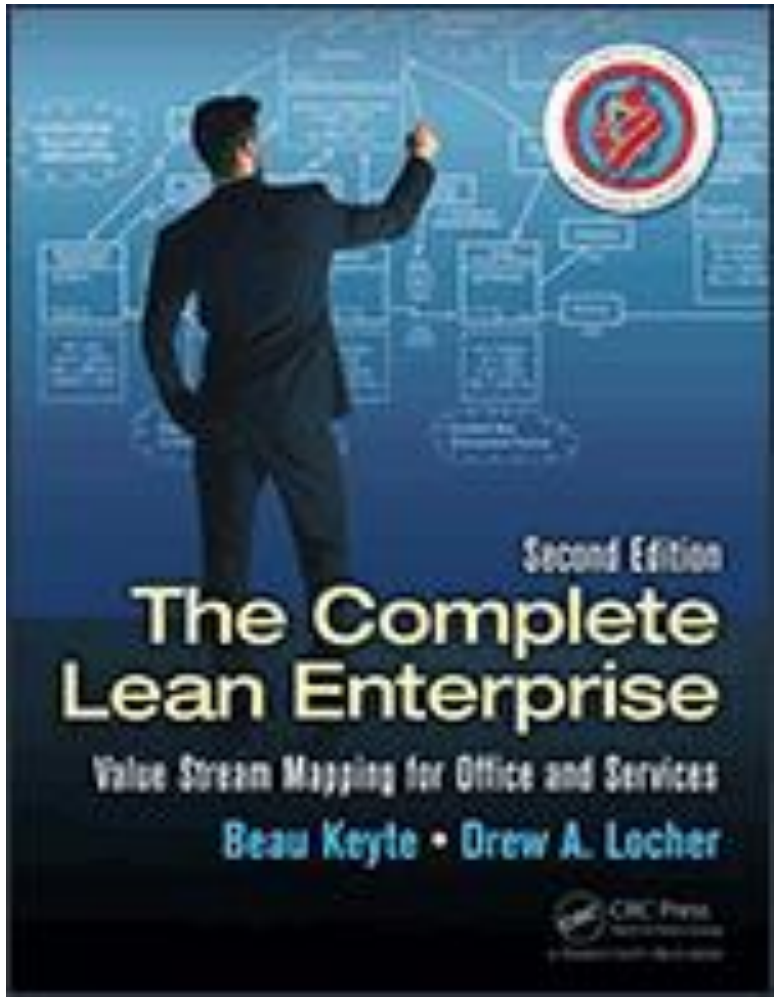
Video

Push vs Pull Production

https://www.youtube.com/watch?v=K3axU2b0dDk

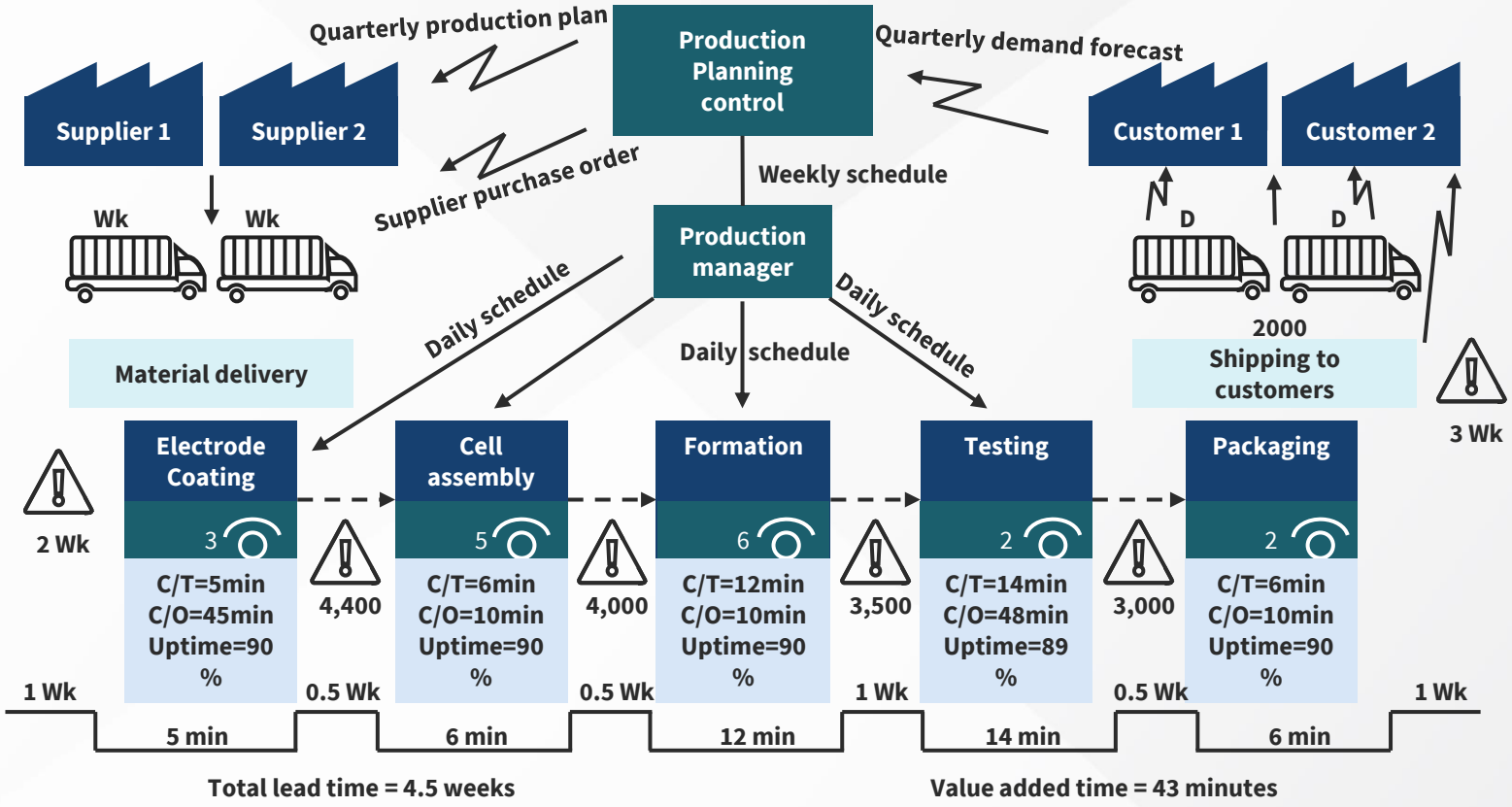
Recommended Reading



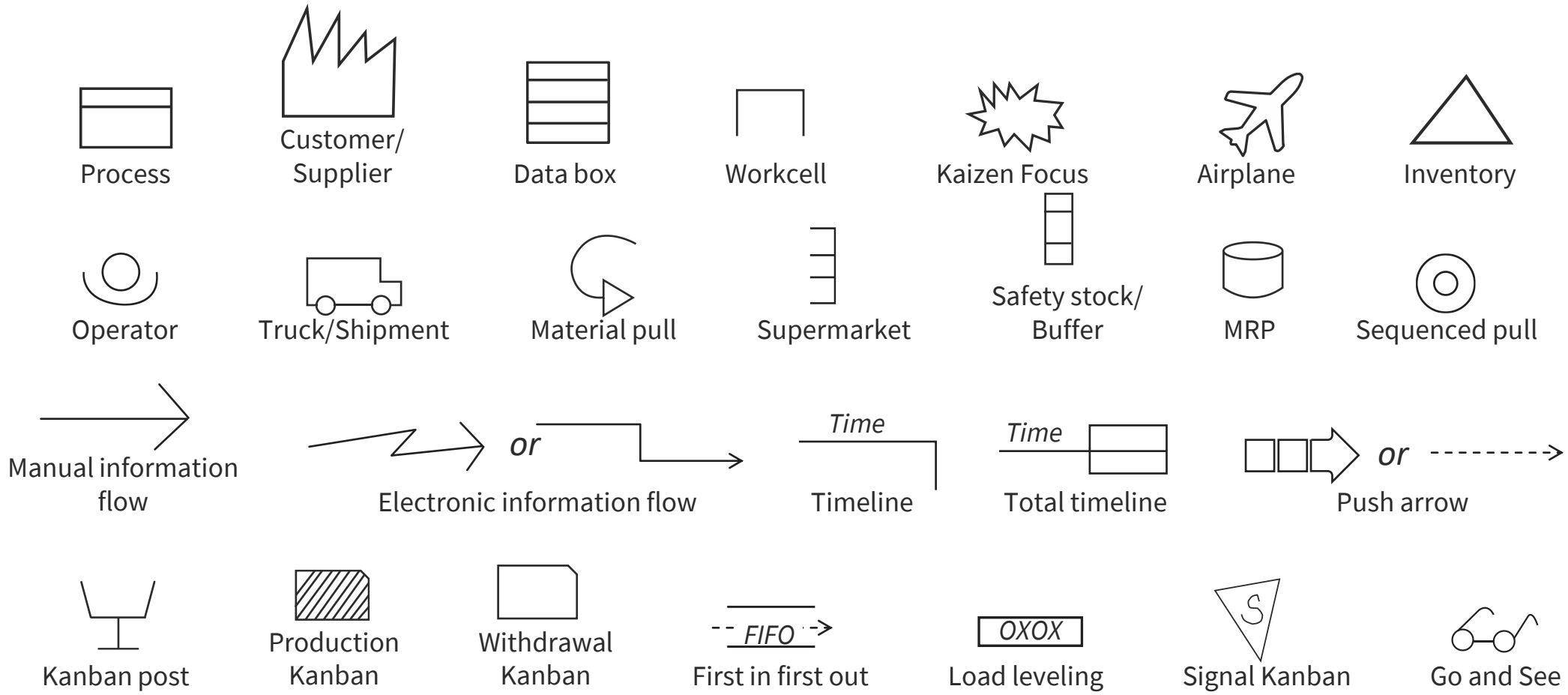


Homework:

Create a Value Stream Map to Improve Process Efficiency



Value Stream Mapping Symbols



Tool Earned!

Value Stream Mapping