# SSW-555: Agile Methods for Software Development

## Lean

**Instructor: Prof. Zhongyuan Yu**

**School of Systems and Enterprises**

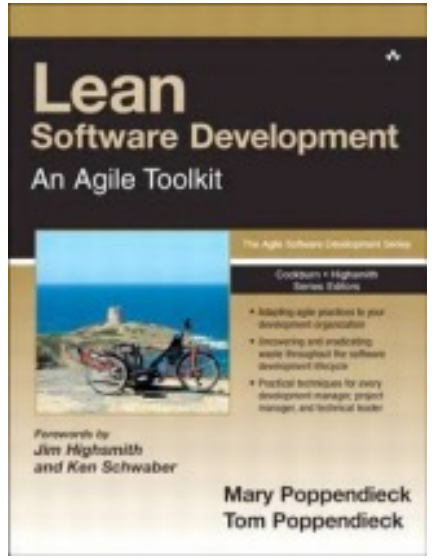
**Stevens Institute of Technology**

This Lecture is based on material from Prof. Jim Rowland

# How Piggly Wiggly changed manufacturing and software development

# Today's topics

- Origin of Lean
- Principles of Lean Practices of Lean
- Kanban
- Kanban principles Kanban practices
- Scrumban




# Origins of Lean

Toyota developed a Lean Production System in the 1950s

- Response to mass manufacturing of Ford and GM
- Japan had a much smaller population and economy than the US
- Needed to be more agile, since volumes were lower
- Needed to shift quickly between different models

  Ford/GM took many weeks to shift production to a new model
- Needed to eliminate waste

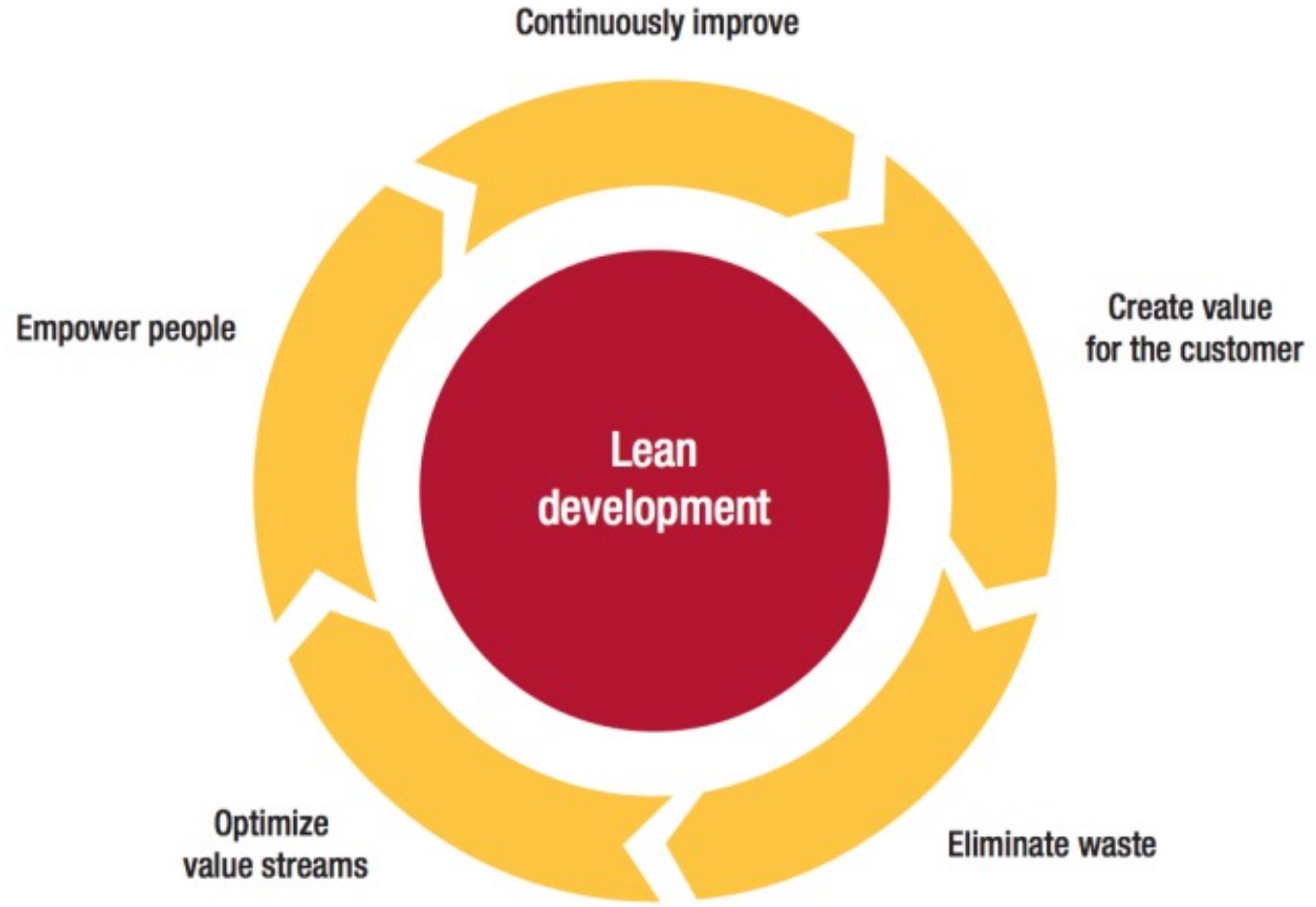
**Poppendieck and others have applied principles of lean production to create Lean Software Development**

# Piggly Wiggly Story

- Toyota visited Ford automotive plants in 1950
  - Many of Ford's manufacturing methods would not be effective for Toyota
  - More impressed with restocking mechanism at a local grocery store
- Piggly Wiggly
  - First self-service grocery store
    - Before this, customer asked employee behind the counter for each item
  - Only reorder goods when customers had almost depleted current stock
- Toyota realized that they could use this Just In Time (JIT) strategy for manufacturing cars

https://en.wikipedia.org/wiki/Piggly_Wiggly

# Lean Development



# Toyota's 7 Principles of Lean

1. Eliminate waste
2. Amplify learning
3. Decide as late as possible
4. Deliver as fast as possible
5. Empower the team
6. Build integrity in
7. See the whole

**Principles**

*Toyota developed Lean for manufacturing, but how can we use these same principles for software development?*

# 1. Eliminate waste

- Anything that does not add value to the customer is waste
- First, need to identify waste, by employing Value Stream Mapping
- Examples of waste:
  - Unneeded features
  - Delay in development process

    e.g., waiting for a meeting to integrate new code

# 2. Amplify Learning

- Everyone needs to learn and apply improvements as soon as possible
- Reading and refactoring code help
- Short iterations provide helpful feedback from customers, so both developers and customers learn

# 3. Decide as late as possible

- Premature decisions may need to be undone later, which creates waste
- Building only what is needed now avoids premature decision-making
- Still need to do some planning when known options need to be considered
- Defer decisions as long as possible to collect as much useful information as possible

# 4. Deliver as fast as possible

- Just-In-Time production can be applied in software development
- Allow teams to self-organize so that they can most effectively deliver what is needed
- Quick feedback to/from customers is ideal

# 5. Empower the team

- Developers should provide their own estimates of effort
- Developers should choose their own process
- Developers should choose their own tools
- Management should facilitate, not dictate

# 6. Build integrity in

- Invest time and effort to build a good product rather than providing a bad customer experience
- Refactor whenever bad smells are detected
- Test frequently to assure quality, don't wait until the end of the development process to integrate
- Develop releases that provide value to the customer

# 7. See the whole

- All staff need to be committed to the whole product
- Don’t isolate developers from the customer

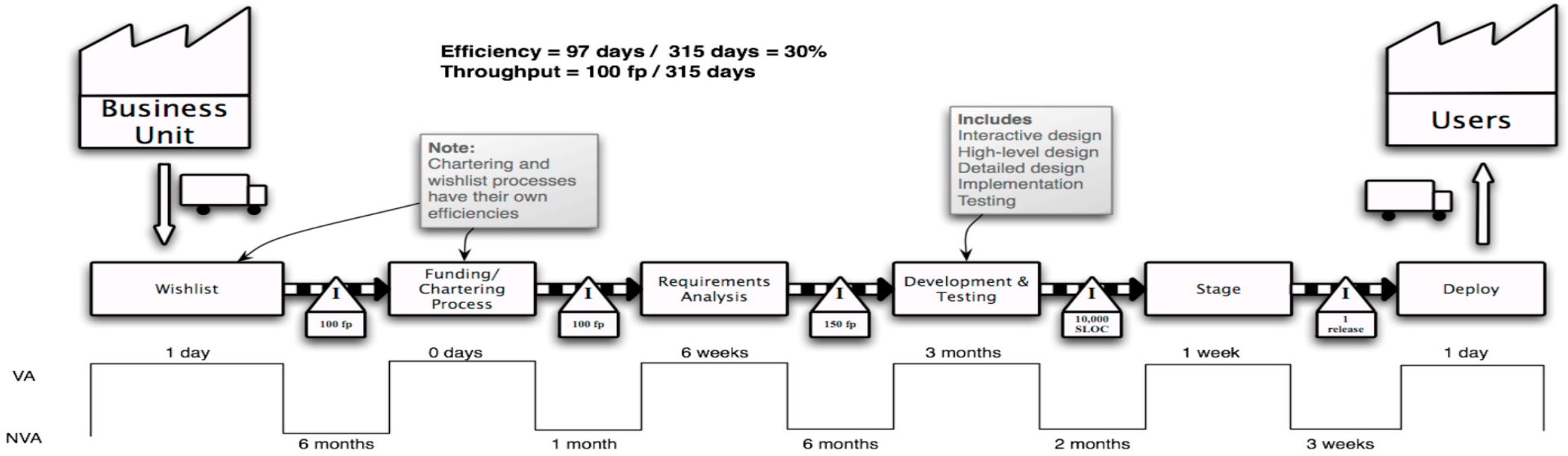
# Lean Practices

- Value stream mapping
- Set-based development
- Pull systems (Kanban)


These principles were developed for manufacturing and adapted for software development

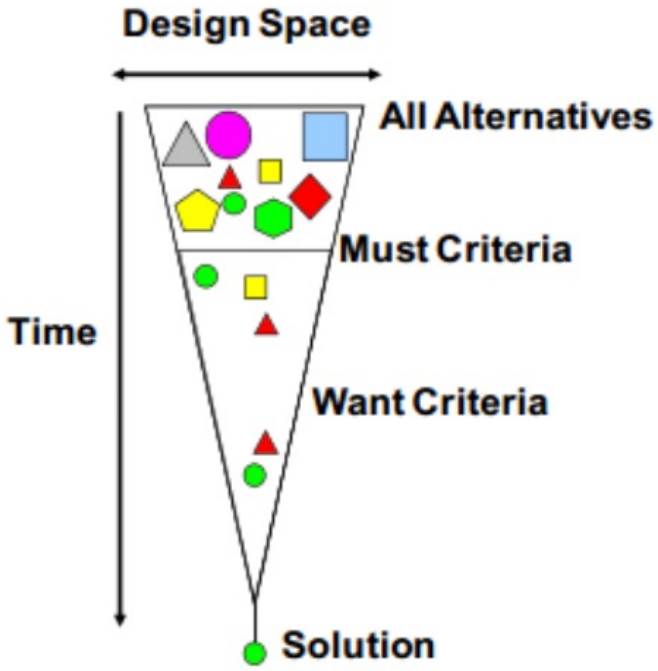
# Value Stream Mapping

- Diagram the flow of goods and/or information:
  - Current map – shows the current situation.
  - Future map – shows the desired situation.
- Identify waste that should be removed from the current map and changes needed to establish the future map.



# Set based development

- Instead of choosing one design, consider several designs that will satisfy the customer requirements
- Invest some time exploring all the alternatives, perhaps even implementing prototypes
- Eliminate alternatives as you gain experience and feedback



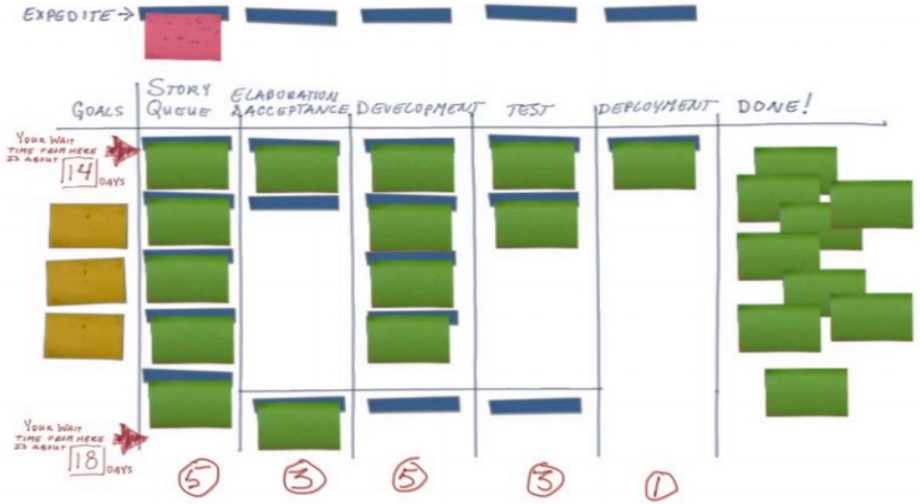

http://lean-consulting.co/training.html

# Kanban method

- Anything that slows the software delivery pipeline is wasteful
- Kanban helps to identify waste and optimize processes

  *“ Kanban is the science of not trying to do too much at once"* - Stephen Palmer

  *“Stop starting and start finishing"*
- Kanban helps the team to prioritize work
- Kanban focuses on process improvement



# Kanban Boards

- Visual display of items at each stage of the process
  - ***Pull*** a task through the flow when capacity is available
  - ***Don't push*** a task through the flow on demand
- **Prioritize** to limit the number of items in each queue at any time
- Focus on ***flow of value***: delivering items with little value quickly doesn't help
- As a task completes, pull it to available spot in next column
- Move people to work on different queues to eliminate backlog


Measure average cycle time

Measure average wait time

Limit the number of items in each column

# Kanban practices

- ***Visualize Workflow***
  - Must understand the current workflow to identify an optimal workflow
  - Include a column for each stage in the workflow
    - Separate columns don't imply handoffs between people, just different tasks
  - Use a card for each incoming work request
  - Move cards from column to column as tasks are completed

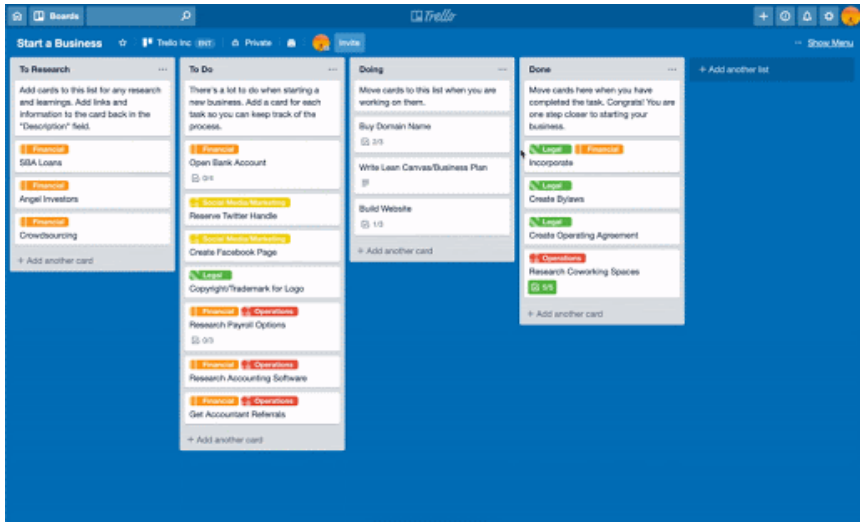
Practices

# Kanban practices

- ***Limit Work In Progress (WIP)***

Practices

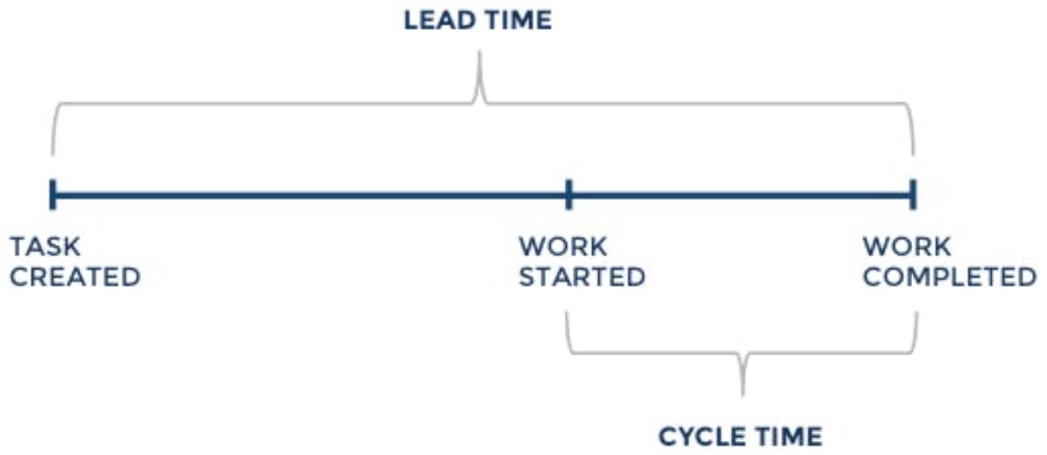
- Start new work only when time becomes available
- Limits amount of work that is impacted by changing priorities
- Restricts the flow of work to slowest step
  - Helps to identify and address bottlenecks
- Reduces cycle time and increases value delivered



# Manage lead time

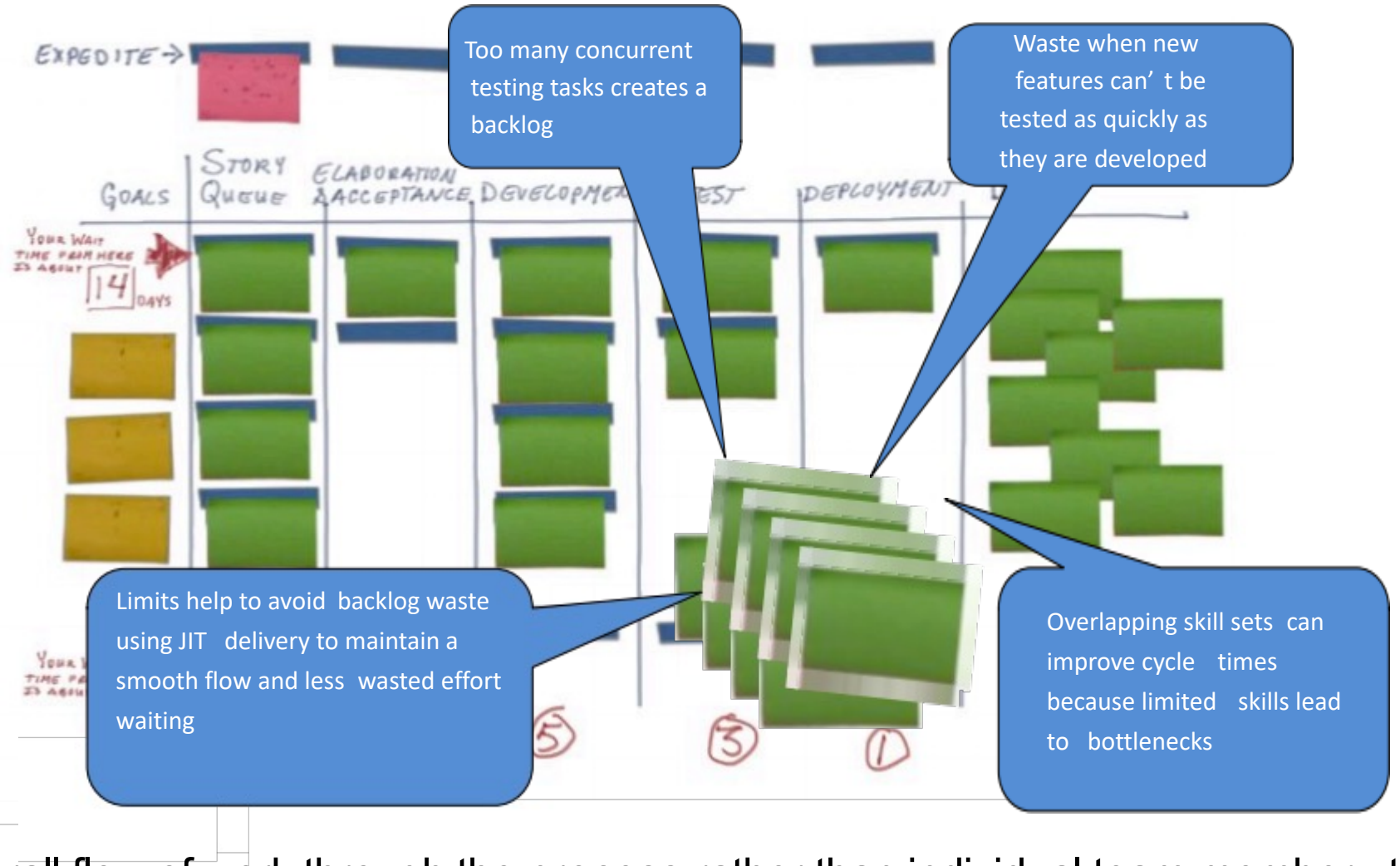
- ***Lead time*** is the average time to pull an item from beginning of the process to the end
- **Cycle time** is the time spent working on the item. Lead time includes wait time between stages

Wait time implies waste




Source: https://www.shortcut.com/blog/what-is-lead-time-and-why-should-agile-teams-care

# Why limit WIP?

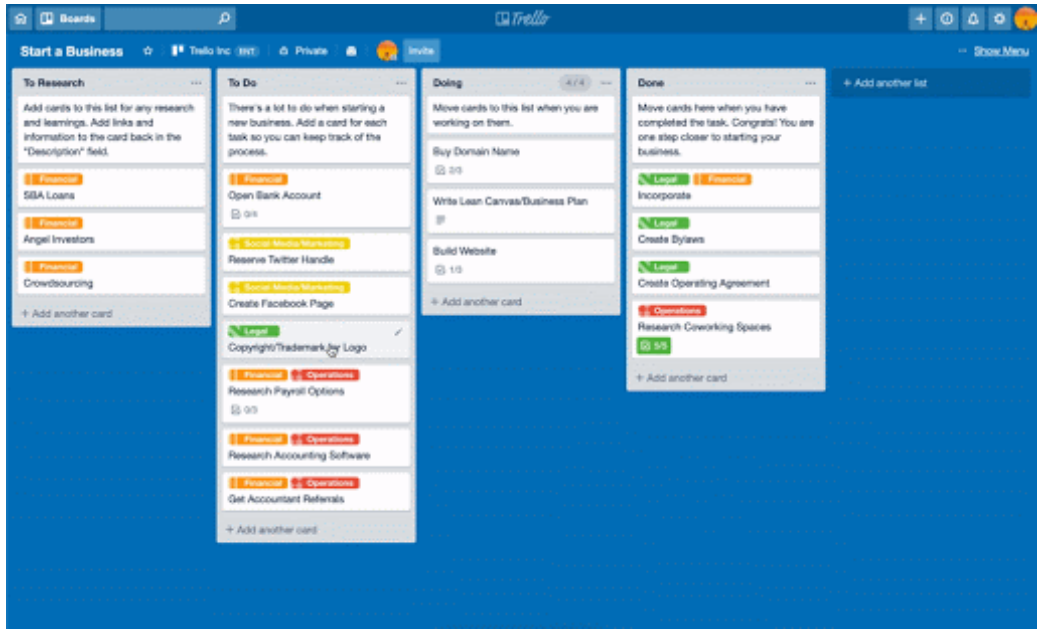



Focus on overall flow of work through the process rather than individual team member utilization

# Kanban practices

- ***Manage Flow***
  - Use flow to identify problems
    - Where do tasks stall?
  - Review the process and eliminate waste

**Practices**



# Kanban practices

- Make process policies explicit
  - Process must be defined, published, and socialized
  - Get everyone on board, e.g., definition of done
  - Can’t improve what you don’t understand
- Improve collaboratively and continuously
  - Make small, incremental, evolutionary changes
  - Implement feedback loops and collect data

# Kanban key principles

| | |
|---|---|
| Foster leadership at all levels of the organization | Encourage all members of the organization to act as leaders, not just the bosses |
| Start with what you do now | Overlay Kanban on current process to evolve current process |
| Pursue incremental changes to existing process | Frequent, small changes are more effective than large changes |
| Respect current methodologies and roles | Keep what already works, but fix what's broken |

# Kanban advantages

- Easy to implement on top of many methods
- Applies to many different types of organizations
  - Especially helpful for managing frequent changes
  - Software development
  - Product development
  - Customer support
  - Manufacturing
- Visually control the process
- Focus on continuous delivery of value

# Scrum vs Kanban Method

- Scrum and Kanban may be complementary or competitors
- *Scrum* focuses on *project management*
  - What should we build?
  - When will it be ready?
  - Does it meet the customer's needs?
- Kanban helps the team to prioritize work

# Kanban vs Scrum Method

| KANBAN | SCRUM |
| --- | --- |
| No prescribed roles | Product owner, scrum master, develops |
| Continuous delivery | Time boxed sprint |
| Pull work through system | Pull work through in batches |
| Changes can be made at any time | Define sprint, then don't allow changes |
| Measure cycle time | Measure velocity |
| Ideal for high variability | Ideal for batch deliveries |

# Scrumban: Scrum + Kanban

- Scrum features:
  - Scrum roles
    - Product Owner, Scrum Master, Developers
  - Scrum meetings
    - sprint planning, stand up, sprint review, sprint retrospective
  - Time-boxed deliverables

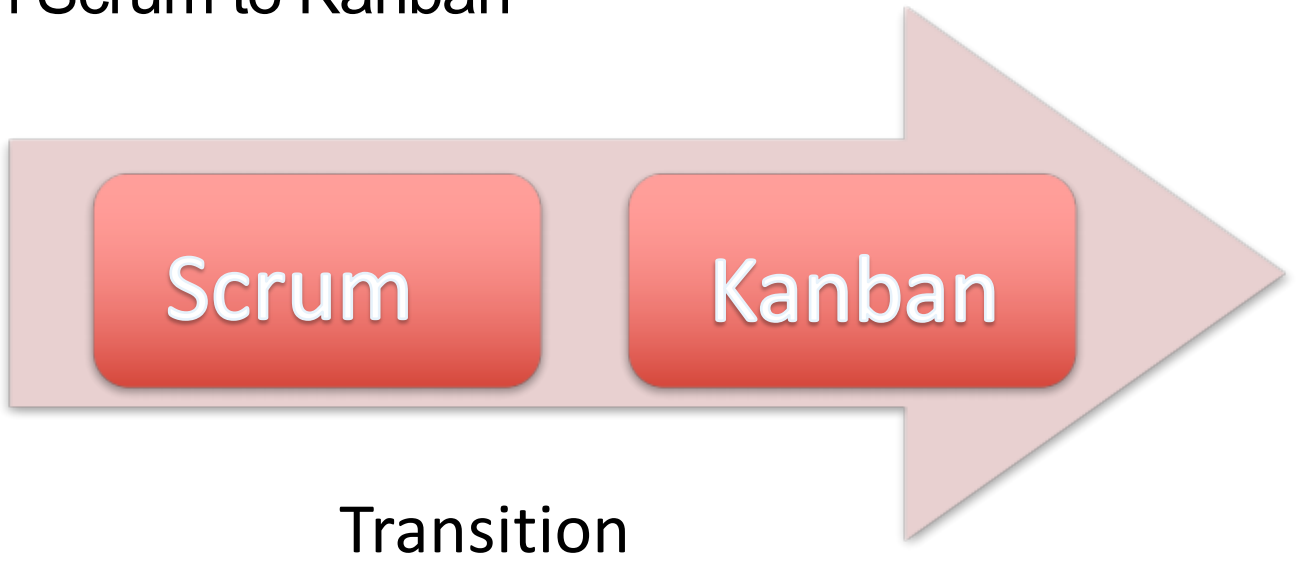
- Kanban features:
  - Just in time planning
  - Work In Progress limits

# Scrumban alternatives

- Include Kanban techniques in your Scrum process

$$\text{Scrumban} = \text{Scrum} + \text{Kanban}$$

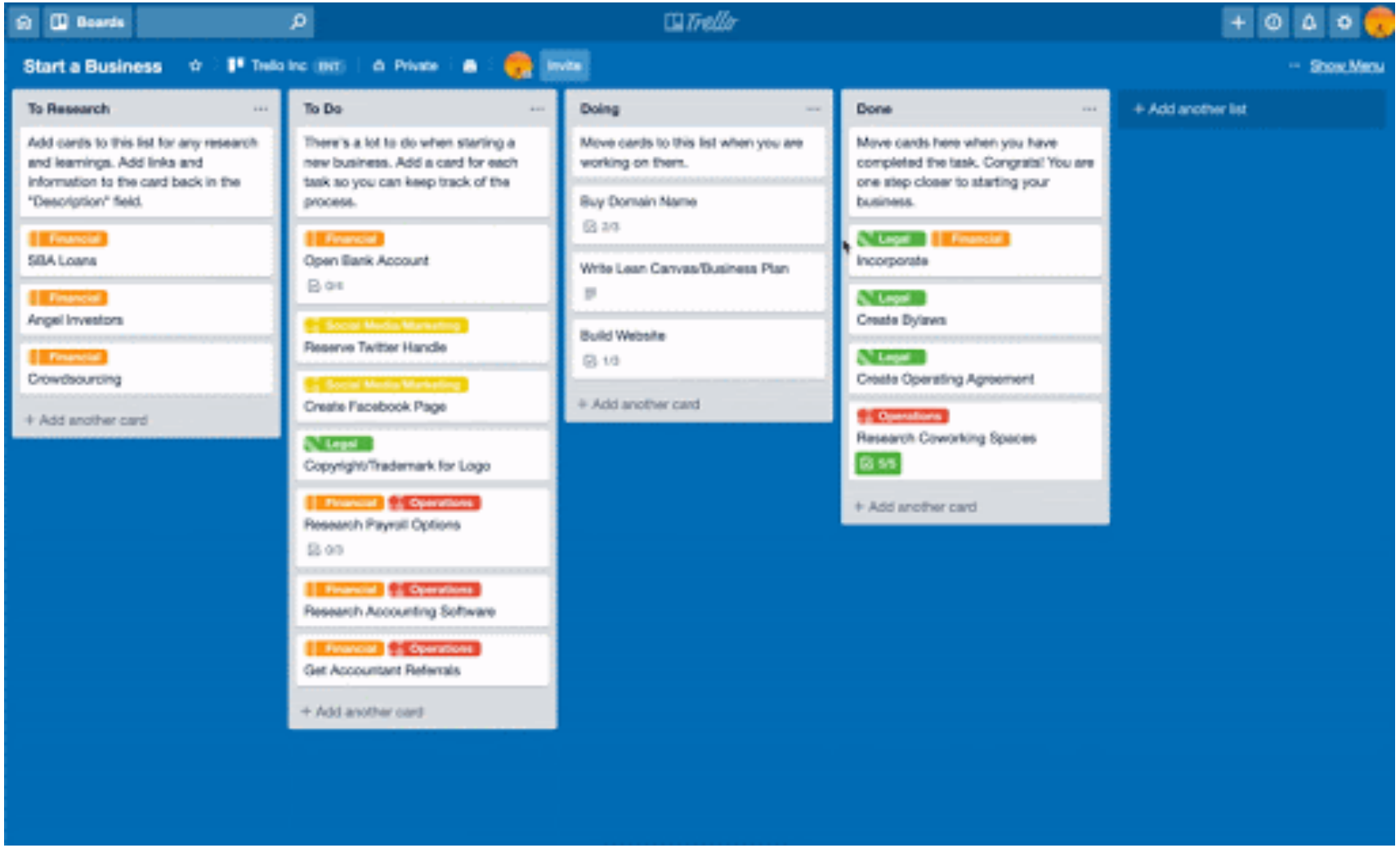
- Transition from Scrum to Kanban



# Why Scrumban?

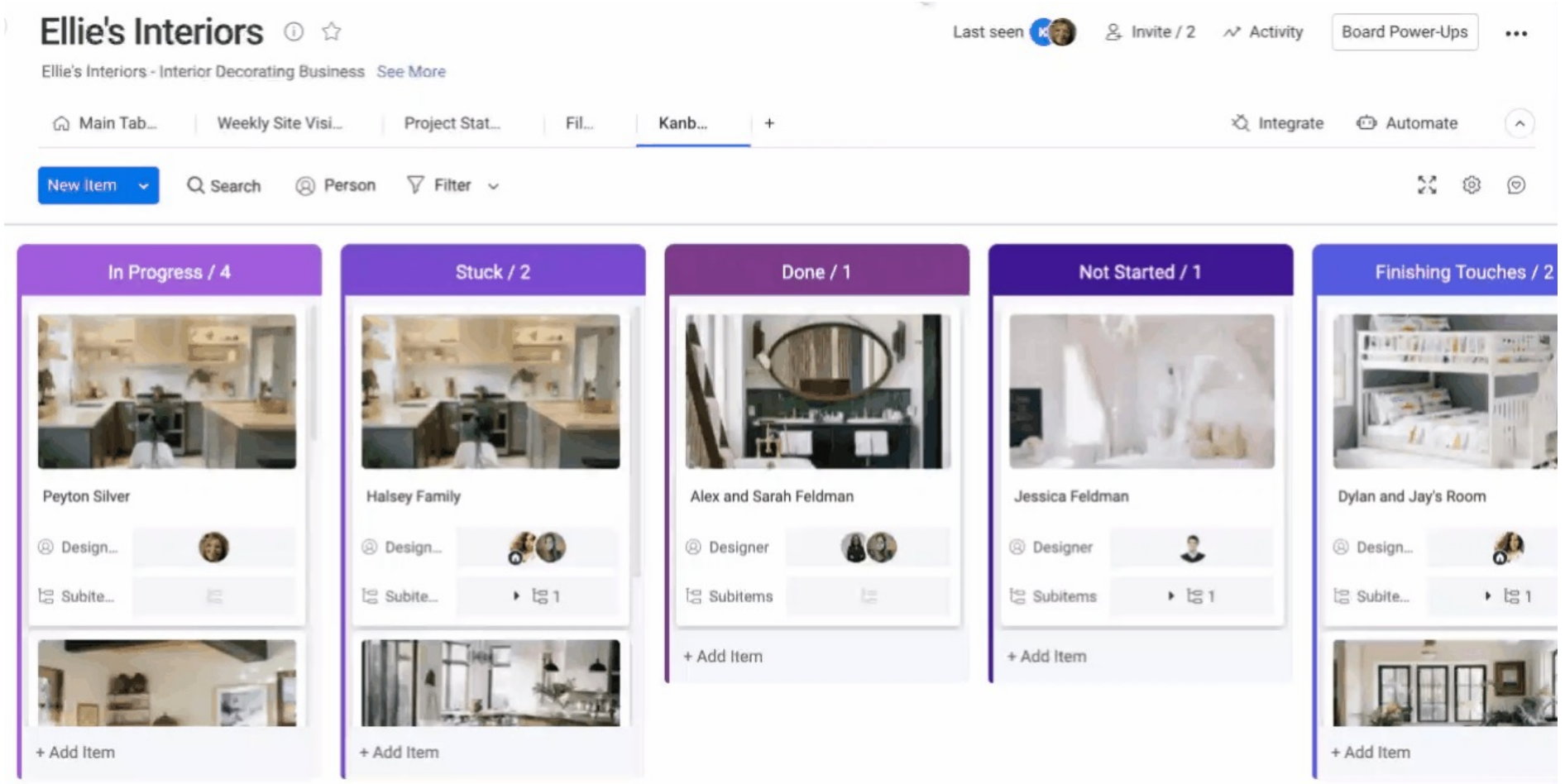
- Scrum planning may be inefficient and wasteful
  - Why estimate effort for user stories not delivered?
  - Planning may take up too much time
    - Build code rather than talking about building code
- May need more frequent releases than Scrum supports

# Trello.com Kanban Boards



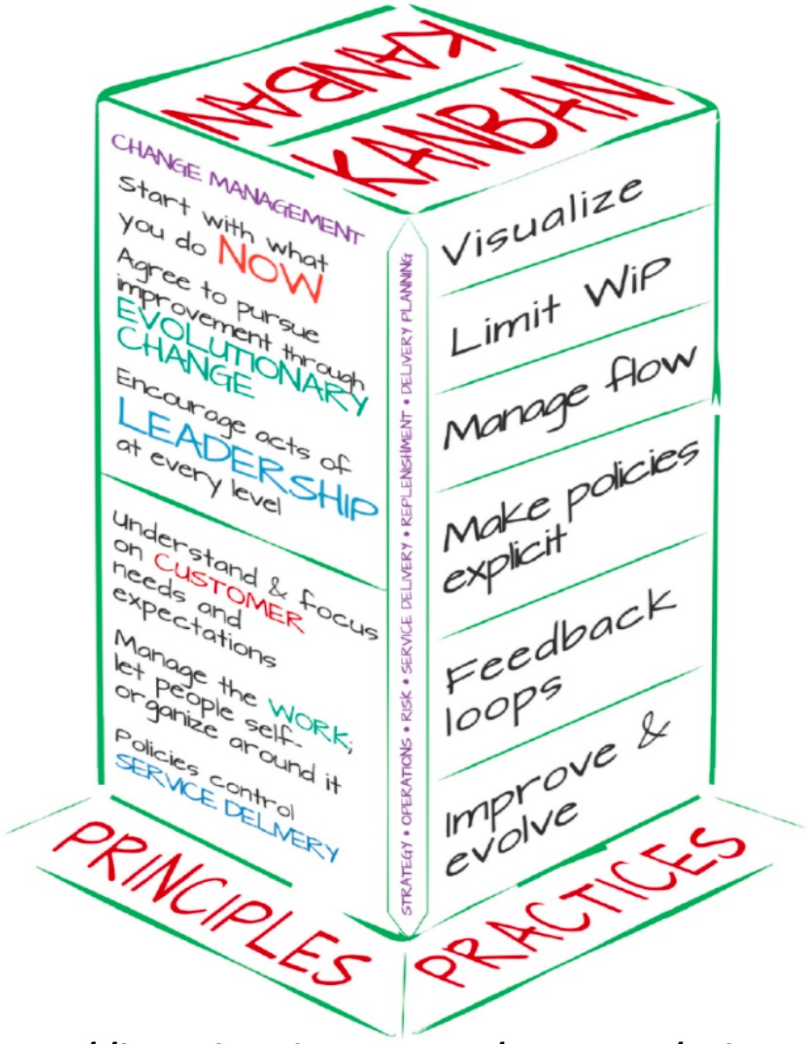

https://blog.trello.com/kanban-data-nave

# monday.com Kanban Boards




https://support.monday.com/hc/en-us/articles/360000661379-The-Kanban-View

# Kanban Summary




http://leankanban.com/project/what-is-km/

STEVENS
INSTITUTE OF TECHNOLOGY
1870

# THANK **YOU**

**Stevens Institute of Technology**
1 Castle Point Terrace, Hoboken, NJ 07030