CS3213: Foundations of Software Engineering

Agile Origins

Origins of Agile and Lean Methods

https://edition.cnn.com/travel/article/toyota-kaikan-tour/index.html

Origins of Agile and Lean Methods

The new new product development game

Stop running the relay race and take up rugby

Hirotaka Takeuchi and Ikujiro Nonaka

In today's fast-paced, fiercely competitive world of commercial new product development, speed and flexibility are essential. Companies are increasingly realizing that the old, sequential approach to developing new products simply won't get the job done. Instead, companies in Japan and the United States are using a holistic method – as in rugby, the ball gets passed within the team as it moves as a unit up the field.

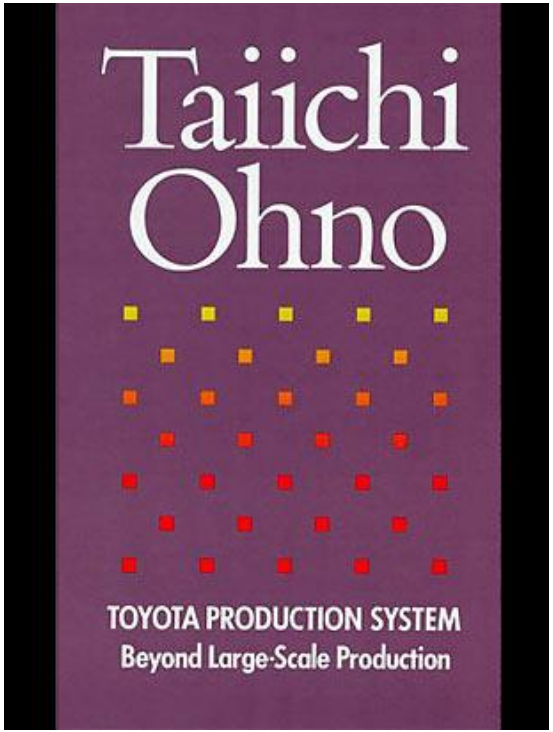
This holistic approach has six characteristics: built-in instability, self-organizing project teams, overlapping development phases, "multilearning," subtle control, and organizational transfer of learning. The six pieces fit together like a jigsaw puzzle, forming a fast and flexible process for new product development. Just as important, the new approach can act as a change agent: it is a vehicle for introducing creative, market-driven ideas and processes into an old, rigid organization.

Mr. Takeuchi is an associate professor and Mr. Nonaka, a professor at Hitotsubashi University in Japan. Mr. Takeuchi's research has focused on marketing and global competition. Mr. Nonaka has published widely in Japan on organizations, strategy, and marketing.

The rules of the game in new product development are changing. Many companies have discovered that it takes more than the accepted basics of high quality, low cost, and differentiation to excel in today's competitive market. It also takes speed and flexibility.

This change is reflected in the emphasis companies are placing on new products as a source of new sales and profits. At 3M, for example, products less than five years old account for 25% of sales. A 1981 survey of 700 U.S. companies indicated that new products would account for one-third of all profits in the 1980s, an increase from one-fifth in the 1970s.[1]

This new emphasis on speed and flexibility calls for a different approach for managing new product development. The traditional sequential or "relay race" approach to product development – exemplified by the National Aeronautics and Space Administration's phased program planning (PPP) system – may conflict with the goals of maximum speed and flexibility. Instead, a holistic or "rugby" approach – where a team tries to go the distance as a unit, passing the ball back and forth – may better serve today's competitive requirements.



The New New Product Development Game (1986)

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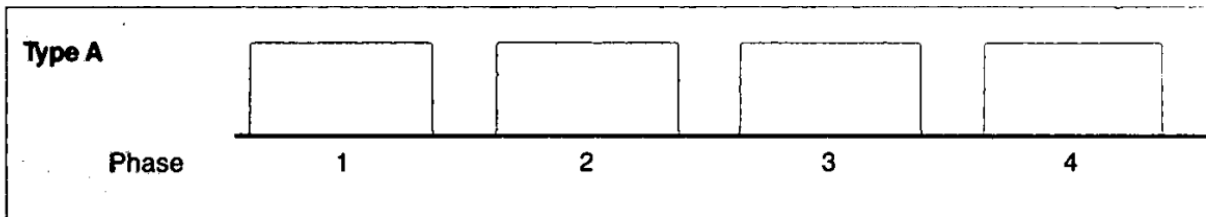

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The New New Product Development Game (1986)

- New approach: fast and flexible, an “integrated” approach

“Scrum”

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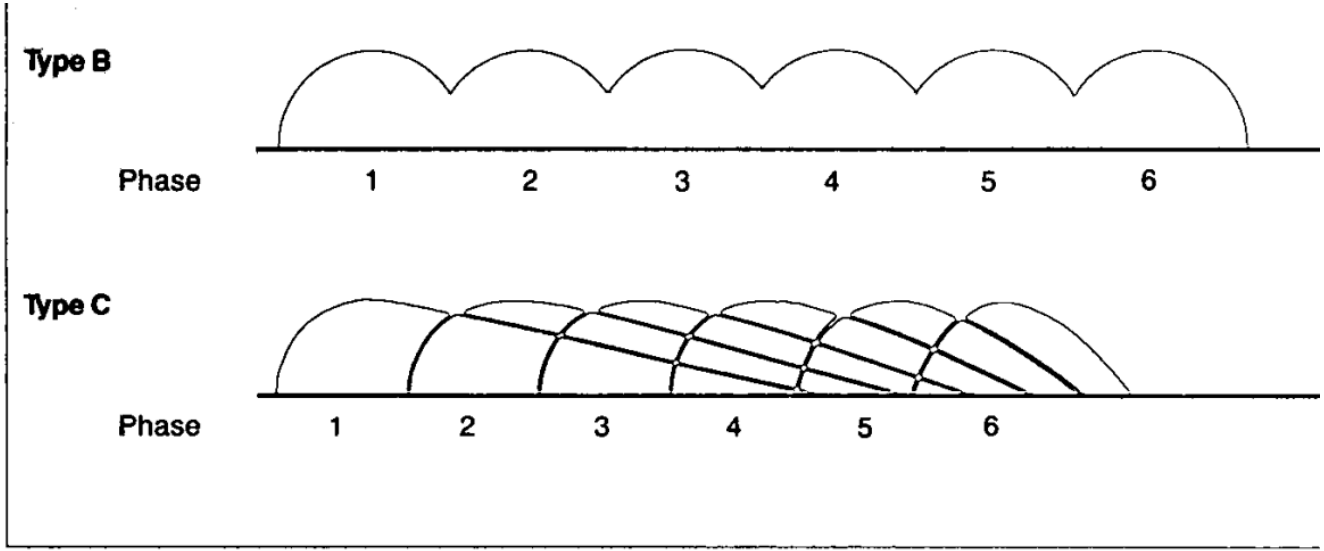

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The New New Product Development Game (1986)

- Built-in instability: management only signals a broad goal, providing team freedom to realize it
- Subtle control: checkpoints, but avoiding rigid control
- Self-organizing project teams
- Focus on learning and transfer of learning within the company

Commonalities with Agile Methods

- “Rhythm” in stages is reflected in Scrum Sprints or feedback loops in Extreme Programming
- Inspired and gave the name to “Scrum”
- Focus on empowering people and teams over following processes
- Cross-functional teams
- Feedback loops and focus on learning

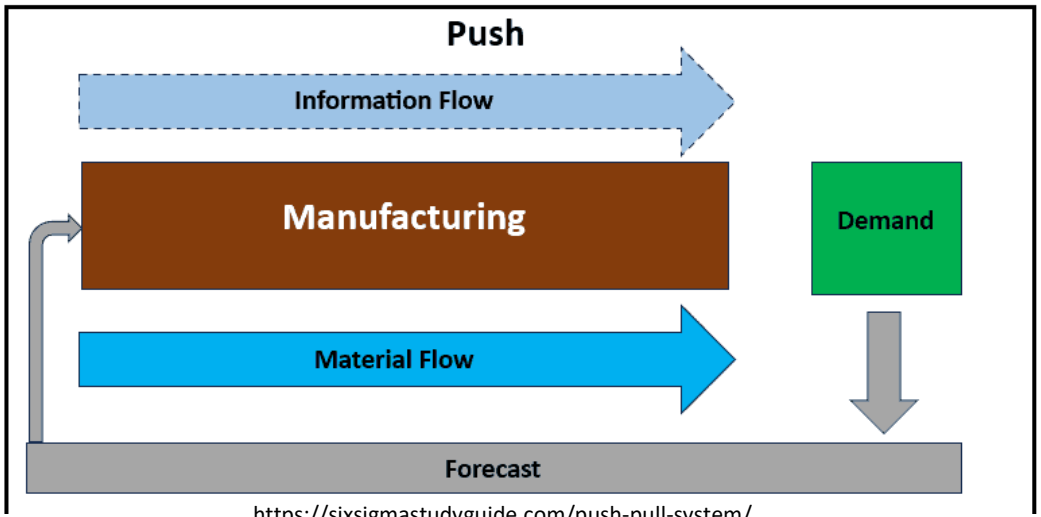
Toyota Production System (TPS)

How Toyota Changed The Way We Make Things

https://www.youtube.com/watch?v=F5vtCRFRAK0

Toyota Production System (TPS)

- Developed while studying (issues in) car manufacturing practices in the US at that time
  - *Push-based system*: cars were produced in large batches irrespective of whether they would be sold



https://sixsigmastudyguide.com/push-pull-system/

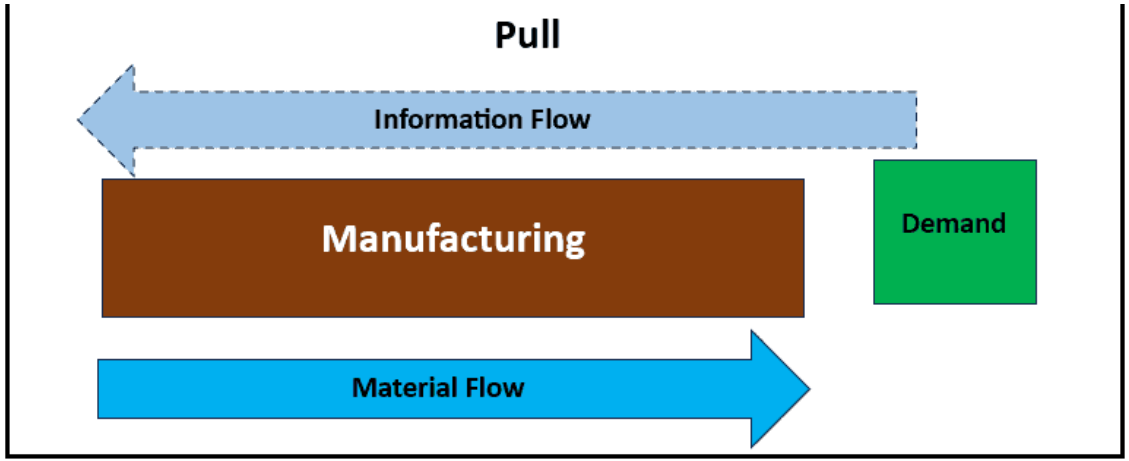
Toyota Production System (TPS)

- Known as a "*lean manufacturing system*" or "*Just In Time" (JIT) system*
  - Lean: focus on creating value and avoiding waste
- Key concepts
  - Just-in-time process
  - Jidoka: Automation with human touch

https://global.toyota/en/company/vision-and-philosophy/production-system/

TPS: Just-in-Time and Kanban

- Pull system: production depends on customer demand
- Approach: each process produces only what is needed for the next process in a continuous flow



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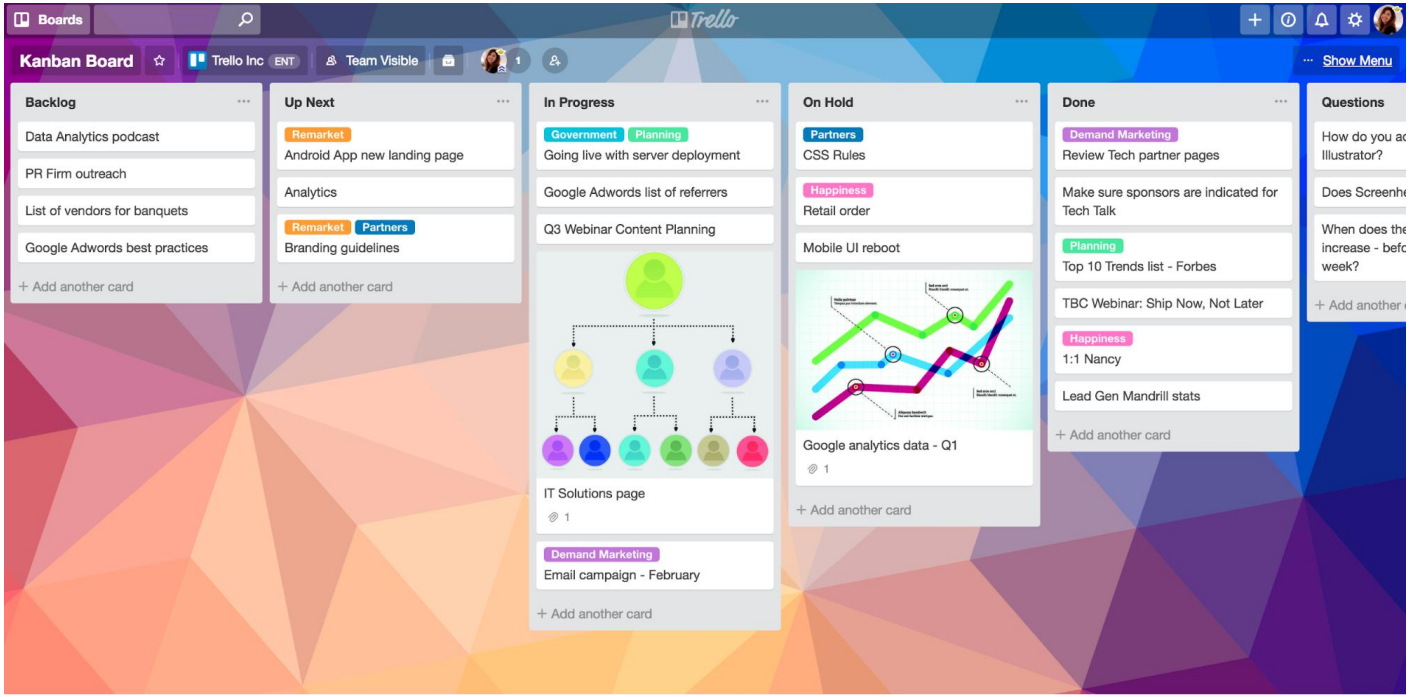
TPS: Just-in-Time and Kanban

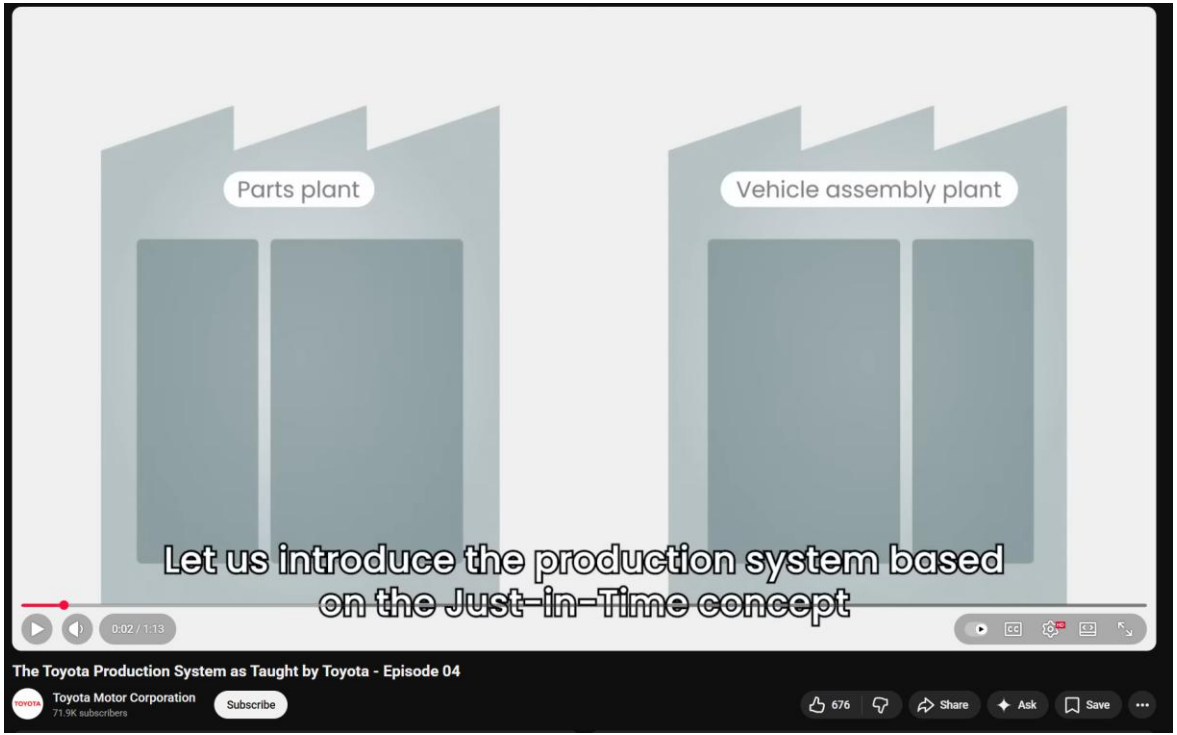
- Kanban board
  - Signal board or billboard
  - If a process needs another input, the process transfers a Kanban card to the preceding process, asking it to produce the input

TPS: Just-in-Time and Kanban



https://www.atlassian.com/agile/kanban/boards

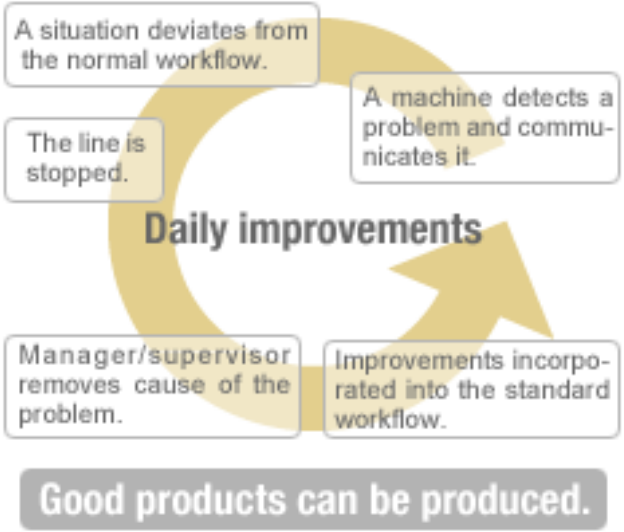
TPS: Just-in-Time and Kanban



https://www.youtube.com/watch?v=HIEufX83EEY

TPS: Jidoka

- Can be loosely translated as “automation with a human touch”
- Andon Cord
- Kaizen: continuous improvement of the process



https://global.toyota/en/company/vision-and-philosophy/production-system/

Andon Cord/Button

[Toyota Production System] Jidoka: Stopping Production, a Call Button and an Andon Electric Board

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

TPS and Agile

- Lean manufacturing inspired “lean software development”
- Kanban has been adopted as an agile method
- Introspection and continuous improvement is part of agile processes as well as DevOps

“Waste” in Software Engineering

- Alternative, more modern interpretation of waste: **hardship in our daily work**
- **Partially done work**
- **Extra processes** that do not add value to the customer
- **Extra features** not needed by the organization or the customer
- **Task switching**, such as people working on multiple projects
- **Waiting** for any input required to finish the current work
- **Motion**, such as handoffs that require communication
- **Defects**, such as software defects or unclear information

Summary and Key Points

- Many modern management frameworks for software engineering (e.g., Scrum and Kanban) stem from product development and car manufacturing
- Includes principles such as empowering people, cross-functional teams, continuous improvement and having feedback loops
- Concepts like “Waste”, “Lean”, and “Scrum” were adopted to a software engineering context