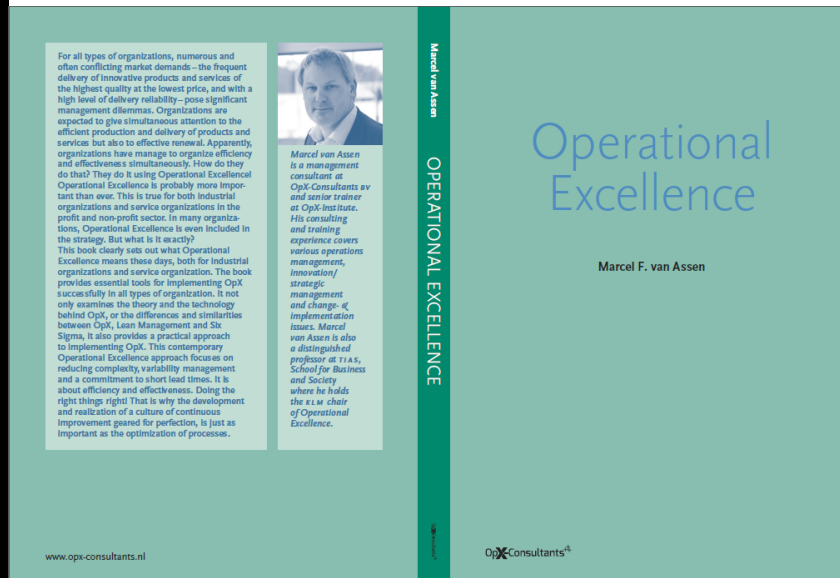# Lean project management methods
Assessment from Operations Management Learnings
–
theory and practice

Prof.dr.ir. M.F. van Assen

Introduction

The structure of this presentation

- How to increase productivity of (NPD-)projects?

- How to speed up development projects?

1. Learnings from operations management
   - Relationship between utilization and lead time of a system in steady state
   - Implications of Little's law → workload control

2. The essentials of agile / scrum

3. The essentials of the Lean startup

4. The essentials of Design Thinking

5. The essentials of the Disney method

6. Integration of these methods and its use in practice: KLM-X

7. What do we learn from this?

Basic Measures

- Throughput (TH): for a line, throughput is the average quantity of good (non-defective) parts produced per unit time.

- Work in Process (WIP): inventory between the start and endpoints of a product routing.

- Cycle Time (CT): time between release of the job at the beginning of the routing until it reaches an inventory point at the end of the routing.

Station Cycle Time: The average cycle time at a station is made up of the following components":

cycle time = move time + queue time + setup time + process time + wait-to-batch time + wait-in-batch time + wait-to-match time

Delay time typically make up 90% of CT

Reducing Queue Delay

Conceptually:

Cycle time	depends on	variability		capacity utilization		effective process time
CT	$=$	V	$\times$	U	$\times$	p

$$\left(\frac{c_a^2 + c_e^2}{2} \right)$$

$$\left(\frac{u}{1-u} \right)$$

Reduce Variability
- failures
- setups
- uneven arrivals, etc.

Reduce Utilization
- arrival rate (yield, rework, etc.)
- process rate (speed, time, availability, etc)

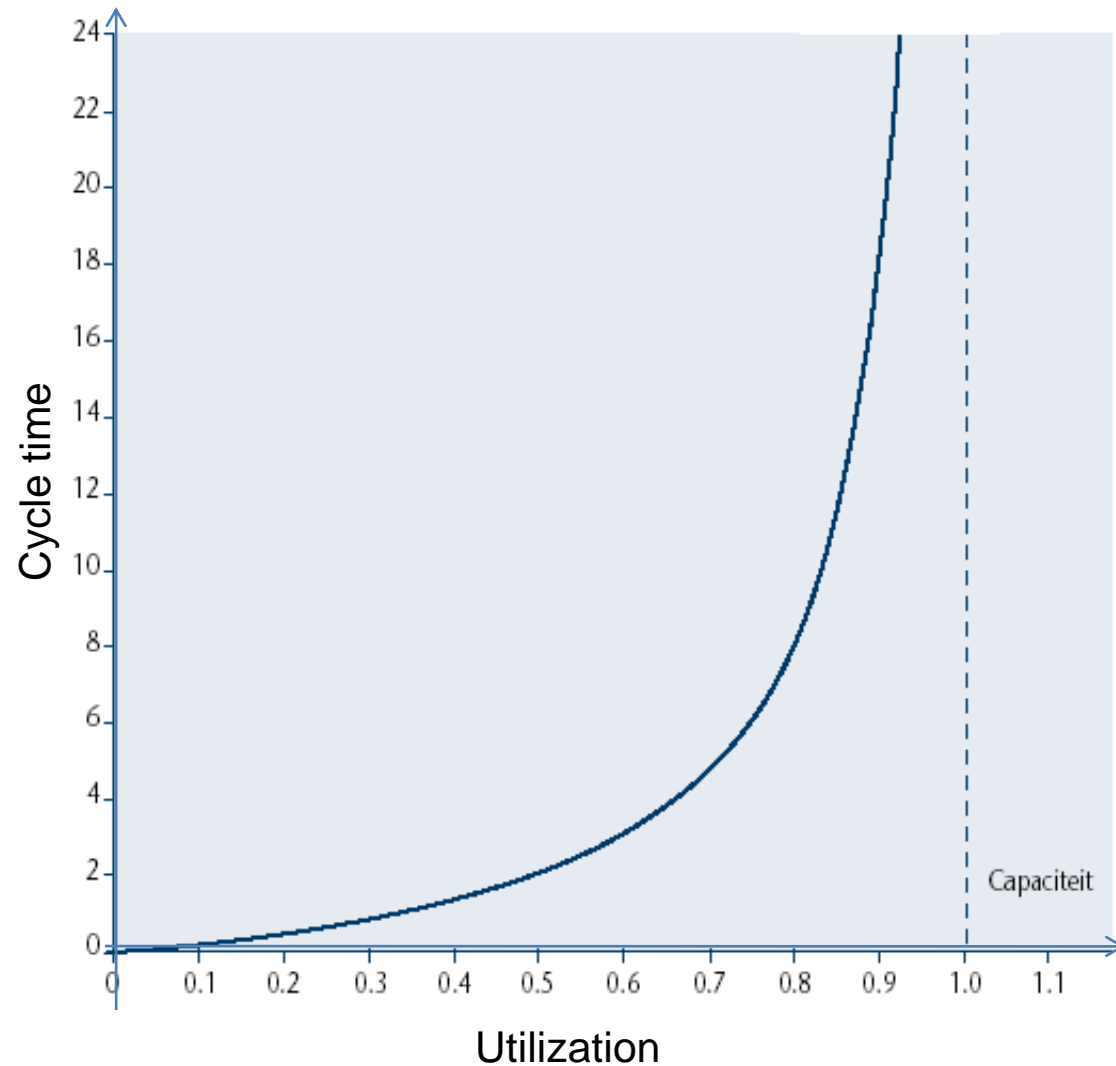# What is the cycle time for different utilization rates (of a system in steady state)?

- A system in a **steady state** has numerous properties that are unchanging in time. This implies that for any property *p* of the system, the partial derivative with respect to time is zero:

$$\frac{\partial p}{\partial t} = 0$$

- If a system is in steady state, then the recently observed behavior of the system will continue into the future. In stochastic systems, the probabilities that various states will be repeated will remain constant.

How is cycle time related to utilization?
(of such a system in steady state)?

A Manufacturing Law

- Little's Law: The fundamental relation between WIP, CT, and TH over the long-term is:

$$WIP = TH \times CT$$

$$parts = \frac{parts}{hr} \times hr$$

- Insights:
  - Fundamental relationship
  - Simple units transformation
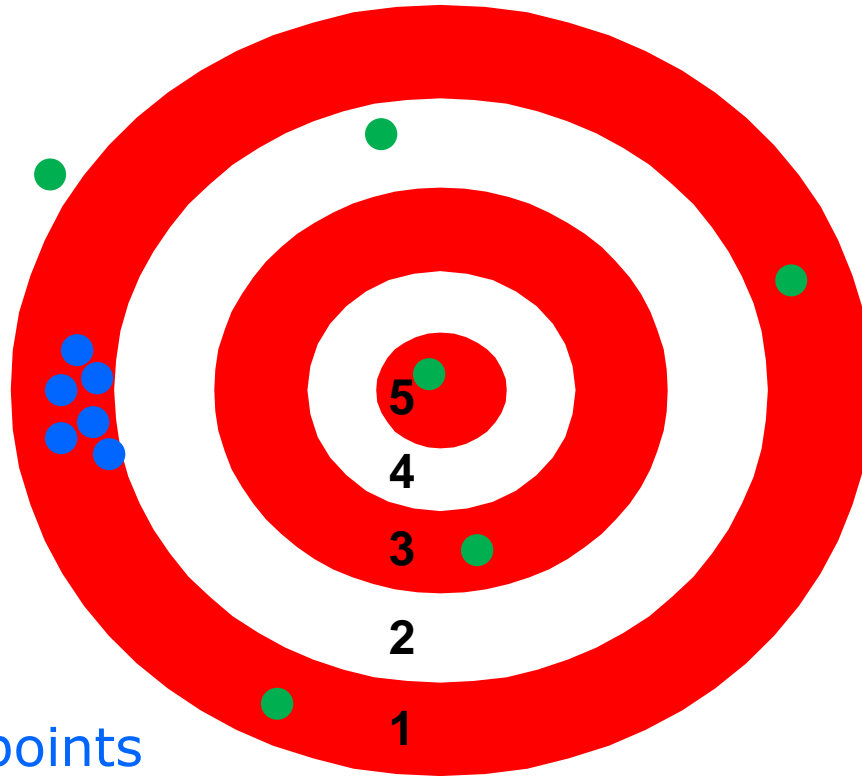 - Definition of cycle time (CT = WIP/TH)

Little's Law: TH = WIP/CT,

So same throughput can be obtained with   large WIP, long CT

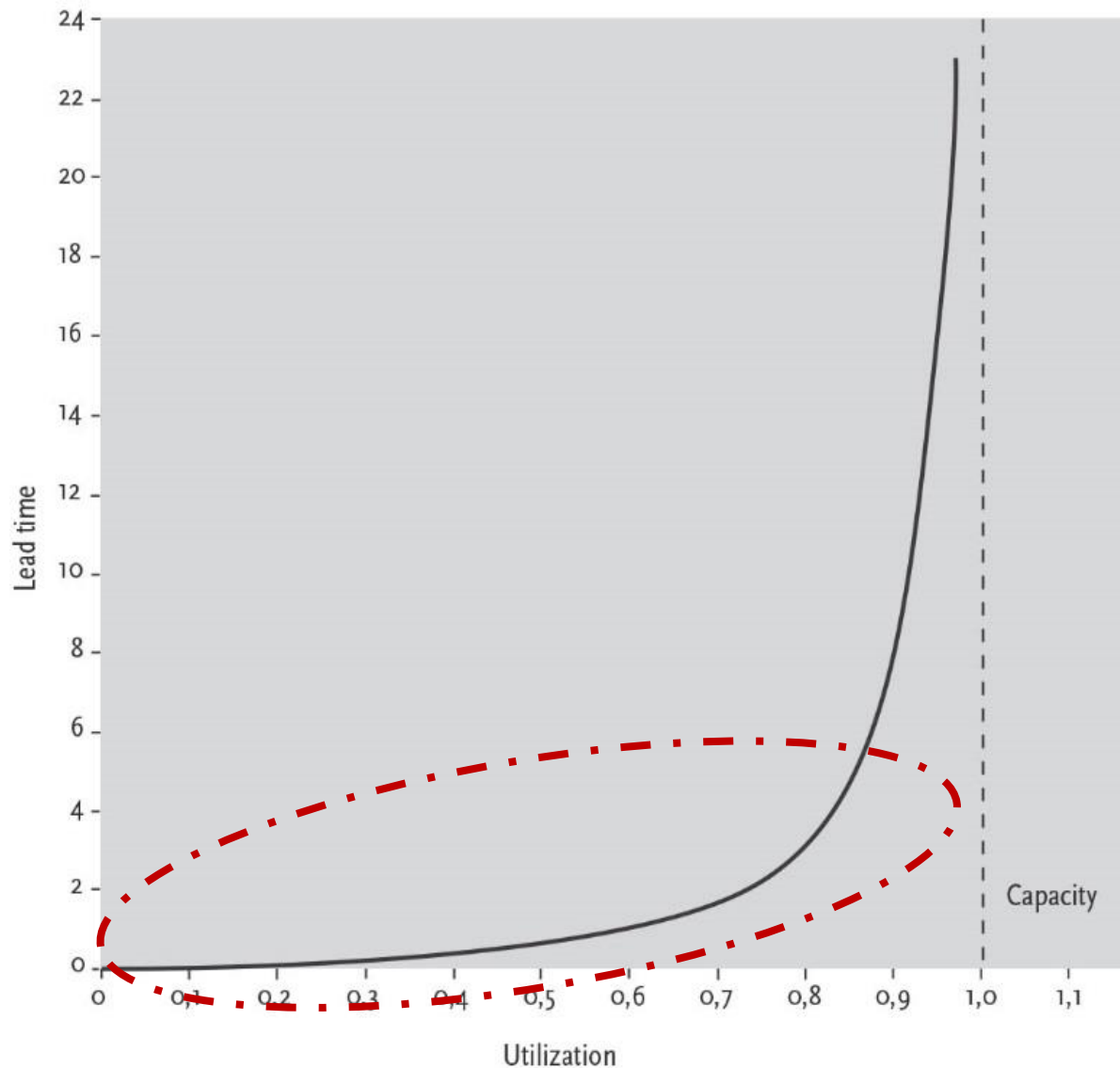or   small WIP, short CT   The difference?

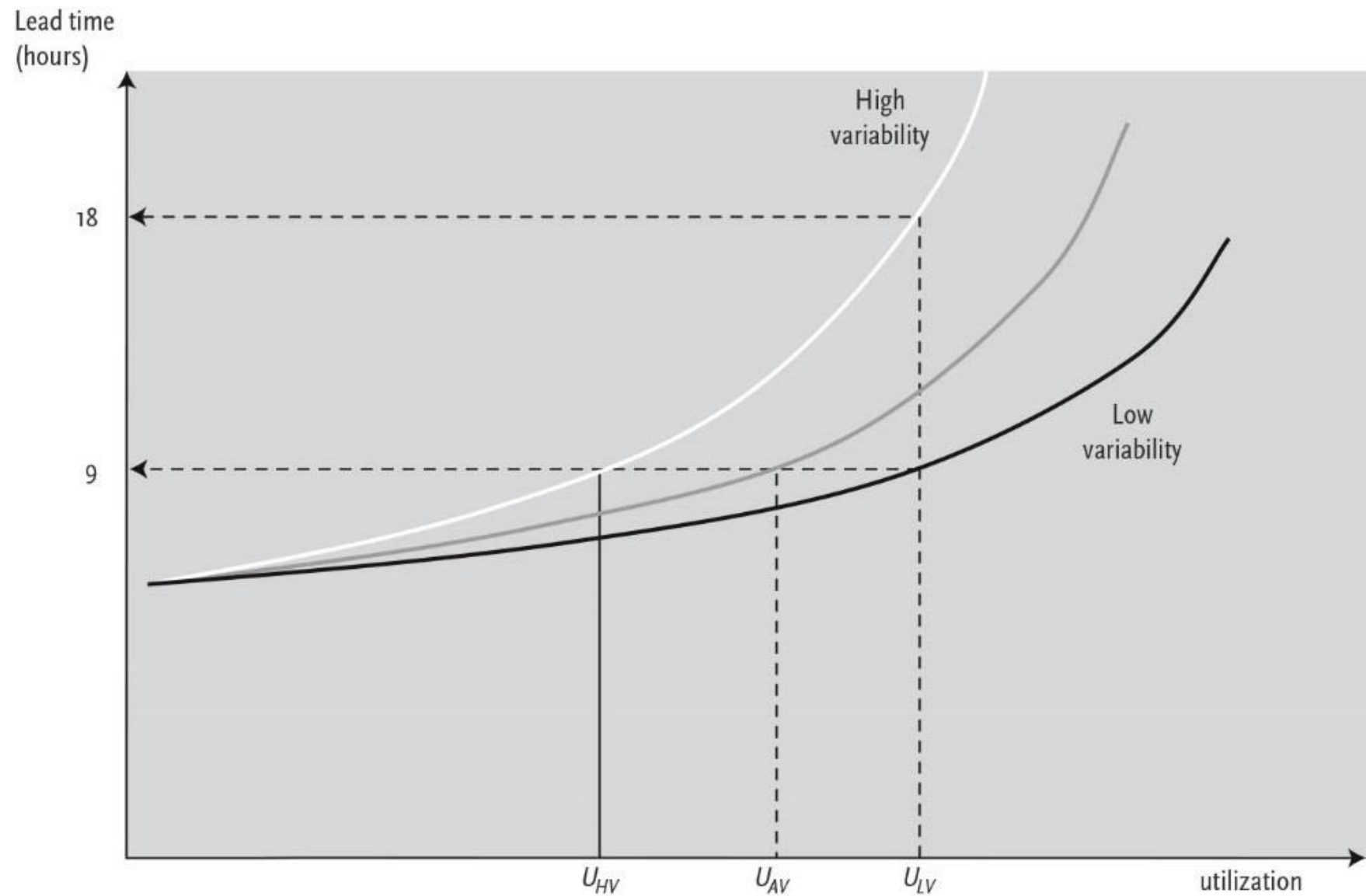# Question: Who is the best shooter?

Green Shooter = 12 points

Blue Shooter = 6 points

5

4

3

2

1

The relationship between utilization and cycle time

The relationship between utilization and cycle time

Influence of variability on any system

- **Variability Law**: Increasing variability always degrades the performance of a production system.

- **Buffering Law**: Systems with variability must be buffered by some combination of:
  1. inventory
  2. capacity
  3. time.

- Interpretation: If you cannot pay to reduce variability, you will pay in terms of high WIP, under-utilized capacity, or reduced customer service (i.e., lost sales, long lead times, and/or late deliveries).

How to reduce lead time / increase speed

- Control (limiting) Work in Process
- Reduce (managing) (unnecessary) variability
  - Improve quality → reduce scrap, reduce rework
  - Improve reliability → increase Mean Time To Failure, reduce Mean Time To Repair, i.e. increase uptime
- Reduce batch sizes – create single-piece flow
  - Eliminate non-value added activities
  - Eliminate waste
- Implement pull control

Reduce unnecessary variation

- Standardization is key for improvement
  - paradoxical tension: formalization versus creativity

- Uniformity is key for flow (and hence speed)
  - paradoxical tension: standardization versus customization

- Lateral and horizontal cooperation is key for smoothness
  - paradoxical tension: individual responsibility (target & pay) versus team work

- Simple and visual communication methods are key: visual management

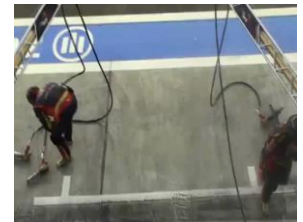- Quick adaptation and flexibility where required

"Where there is no standard, there can be no kaizen."

Taiichi Ohno

Vice-president, Toyota Motor

Standardization and teamwork (cooperation) are prerequisites for speed (and hence for Operational Excellence).

Kaizen: Strive for perfection (in a learning culture)

Evidence-based experimentation for rout-cause analysis of 'problems'

Learnings from operations management / Lean management

1. Control / Limit your workload → never release more work than the workload limit, i.e. the point just before congestion or even blocking occurs

2. Avoid large batches → decompose / reduce large batches into small batches or even single piece flow.

3. Reduce waste from a customer perspective

4. Continuous improvement – hypothesis driven improvement: Plan Do Study Act

5. Hard on the process (follow the best practice), soft (empathy) for employees

Learning 1: Control / Limit your workload → never release more work than the workload limit

USE OF KANBAN BOARDS

Essence

- The essence of using a kanban board is controlling (limiting) the work in progress inventory (WIP) so that the work continues to flow.

- For this, it must therefore be determined what the WIPcap is. For instance WIPcap = 2 tasks

- By periodically discussing the progress and eliminating obstacles (and not letting the workload become too high) the work will be completed 'faster'.

KANBAN BOARD

Board meeting / daily standup

Topics of the agenda:
Occupation
Announcements
Looking back to yesterday:
- What went well?
- What could be better?
- How are we going to do that in future?

Looking forward to today:
- What are our goals?
- Are we going to make it and if not, how?
- Are there still bottlenecks and how do we solve them?

Improvement actions

That seems like a lot, but a team that is accustomed to this can handle these points within 10 minutes.

The start of the day is a daily consultation that takes 10 minutes, standing around the performance and improvement board with a fixed agenda. The start of the day will show how employees have performed the previous day and what the concerns for today are.

The agenda has a fixed layout that comes back every day and ensures clarity.

Preconditions

- There is a committed objective
- There is ownership
- There is an improvement language / approach
- Make activities must be known. There is not a lot of ambiguity about what to do

- The meeting itself is the easy part. Preparation and especially implementation (follow-up) is the difficult phase
- The level of preparation by the team is essential. It is also a measure of commitment. People who do not prepare for a daily standup will also make little effort in progress of work.
- The experience of both the leader (supervisor) and the facilitator (supervisor ≠ facilitator) of the board meeting partly determines the success.

Pitfalls

- Lack of management support

- Insufficient training (too little investment, too little time) and therefore insufficient knowledge and understanding of the Lean principles

- Too little commitment (buy-in) from key figures who were not involved in implementing the results

- Too little data (knowledge) to find real causes of problems

- The meeting itself is the easy part. Preparation and especially implementation (follow-up) is the difficult phase

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Learning 2: Avoid large batches ▯ decompose / reduce large batches into small batches or even single piece flow

Learning 3: Reduce waste from a customer perspective

AGILE / SCRUM METHOD

AGILE (SCRUM) FRAMEWORK

Essence

- A (renewal) project is carried out in sub-blocks, which we call 'sprints'.
- Within each sprint a number of tasks are done and executed, after which feedback is requested from the client. This can also be the product owner.

- Each sprint lasts two to a maximum of 4 weeks.
- The sprints are executed in a fixed rhythm.
- The sprints are in themselves short projects that are sent via scrum board.

Method

- Scrum is originally a method for the iterative development of software.

- The core of Scrum is a multidisciplinary and self-managing team. Together the team will pick up the project. Everyone is involv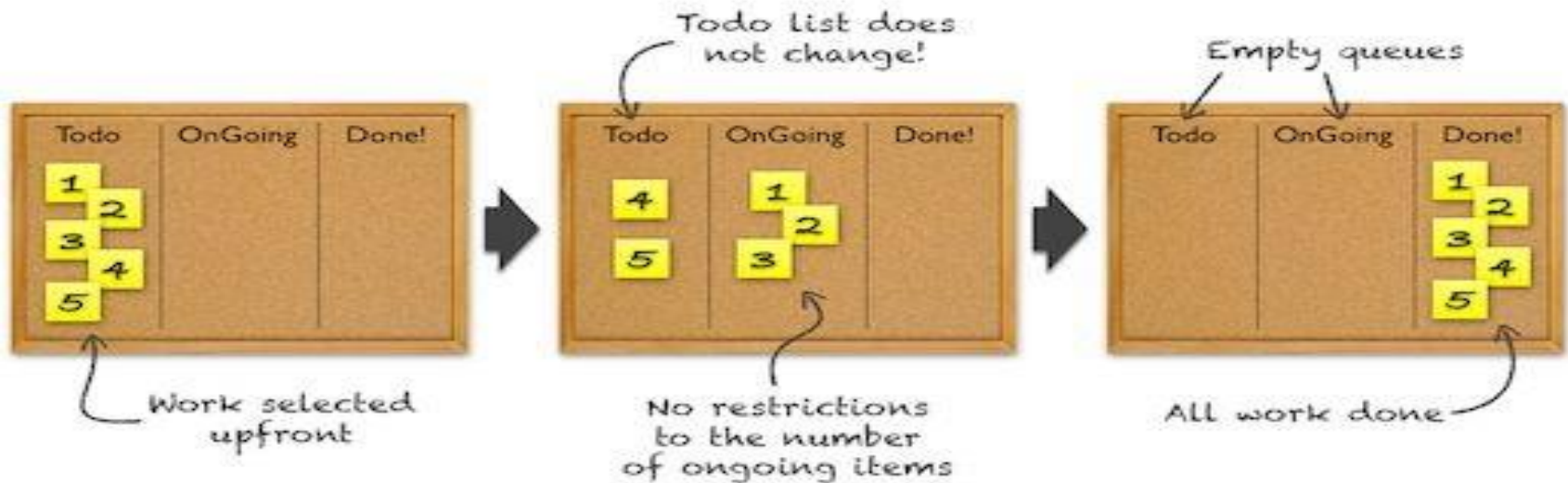ed in planning, naming blockades and distributing tasks. Scrum assumes that the required knowledge is present in the team itself.

- The Product Owner, together with the customer and other stakeholders, makes a list of the requirements and tasks. We also call this a 'User Story'.
  - *It is important that the most important features are implemented first. These then go to the team.*

- Together, the team makes an estimate of the amount of development capacity and time required for each User Story. The Stories are regularly discussed with the client and the entire team. This allows the team to give a reliable estimate and the work almost never expires.

- The team is led by a Scrum Master. This involves a so-called 'Daily Scrum' meeting at the beginning of each working day. This meeting is also called 'Daily Standup' and lasts a maximum of 15 minutes. Each team member answers the following three questions: What have I done? What am I going to do? And what are the problems? Partly because of this meeting, the team members work closely together and a lot of knowledge is exchanged.

Method

- The progress of the project is clearly visualized with a Scrum board

- The Scrum framework involves the setting of goals. These goals are set not only per Sprint, but also per day. This ensures that the team can organize itself flexibly around these goals. The fact that everyone shares the same goals ensures coherence and a clear direction. The goals per Sprint are set together with the client. This means that you as a client are aware and your expectations are in line with what the team is doing. Because the team itself gives an estimate, for the time required for the work divided into small pieces, the goals are also achievable.

- At the end of the project you also have the product you need and had in mind. Each Sprint is evaluated by the team both with each other and with the customer. This invites you to give feedback and thus to openness within the team. Open teams are more productive, because obstacles are discussed on a regular basis and solved as much as possible.

SCRUM BOARD

Todo list does not change!

Empty queues

Todo	OnGoing	Done!
1 2 3 4 5		

Work selected upfront

Todo	OnGoing	Done!
4 5	1 2 3	

No restrictions to the number of ongoing items

Todo	OnGoing	Done!
		1 2 3 4 5

All work done

KANBAN BOARD

Flexible Todo list

Flexible ongoing list!

Todo	OnGoing	Done!
1 2 3		

Top priority work in the queue

Todo	OnGoing	Done!
A 4 5	1 2	

No more than 2 items in the queue

Todo	OnGoing	Done!
6 9 10	8 7	1 2 A 4 5

Keep the workflow

X!

10 conditions / pitfalls

Pitfall 1: user stories are too big

- If user stories are too big, then the team has too much work and cannot show any results at the end of the sprint. You can prevent this by dividing user stories.

Pitfall 2: tasks are too big

- At the beginning of a sprint, the team splits the user stories into tasks. Every task receives a Post-it on the scrum board. If tasks are too big, Post-its will stay on the scrum board for days on end. In that case you do not sufficiently use the positive effect of the 'visible progress'. It is not clear what a team member is doing. The progress of the sprint is unclear.

Pitfall 3: user stories are not worked out deeply enough

- If user stories are not worked out deeply enough in the refinement sessions, then team members within the sprint make assumptions that they forget to communicate with each other. The result is that not everyone goes the same way anymore. A lot of consultation is needed to fill in the details. Often there is not enough time left for the realization.

10 conditions / pitfalls

Pitfall 4: user stories are not picked up in the order of priority within the sprint

- If team members do not pick up user stories in the order of priority and if the sprint is too big (trap 1), then all user stories are not completely finished at the end of the sprint. The team can not give a demo.

Pitfall 5: focus on individual tasks

- If a team member says: "I made exactly what is in the design.", Then that person is focused on their own tasks. He works on an island and does not feel responsible for the result of the team as a whole

You can break this behavior by investing in a team session in which you establish together what the common goals and responsibilities are. Do your team members fall back into old behavior over time? Then repeat this session.

Pitfall 6: team strives for perfection

- If the team strives for perfection, valuable time is lost on details that have a small value for the stakeholders. Because it takes a long time before you provide a functionality, you receive feedback too late. Perfectionism is the enemy of productivity.

10 conditions / pitfalls

Pitfall 7: team forgets the definition-of-done

- In the rush to deliver workable software for the demo, teams tend to forget tasks. They do not (testify) the software and do not document the realized functionalities. The product owner has no opportunity to approve the software.

Pitfall 8: mini waterfall within the sprint

- Within the sprint it sometimes happens that a team member can only get started after the other team member is ready. Colleagues are waiting for each other.

- During the development of a product there are always dependencies. The front-end developer and designer wait until the content is ready; the tester is waiting for the delivery. You cannot ban the waiting, you can minimize it. You do this by making components smaller.

Pitfall 9: stakeholders lack overview

- Stakeholders need overview. Without an overview, the stakeholders cannot give good feedback. The demo then passes its goal.

Pitfall 10: stakeholders expect the team to pick up the feedback immediately

Preconditions / pitfalls for the scrum master

The scrum master is the process supervisor, the facilitator:

- responsible for the process.

- helps the team to learn, to perform and to celebrate successes.

- provides overview and interrupts when necessary.

- supervises the ceremonies and creates an open and safe atmosphere.

Pitfalls:

- Likes the content too much

- Want to understand the content 100%

- Sit on the seat of the product owner

- You feel (too) responsible for the result

- Want to stay too nice and be liked

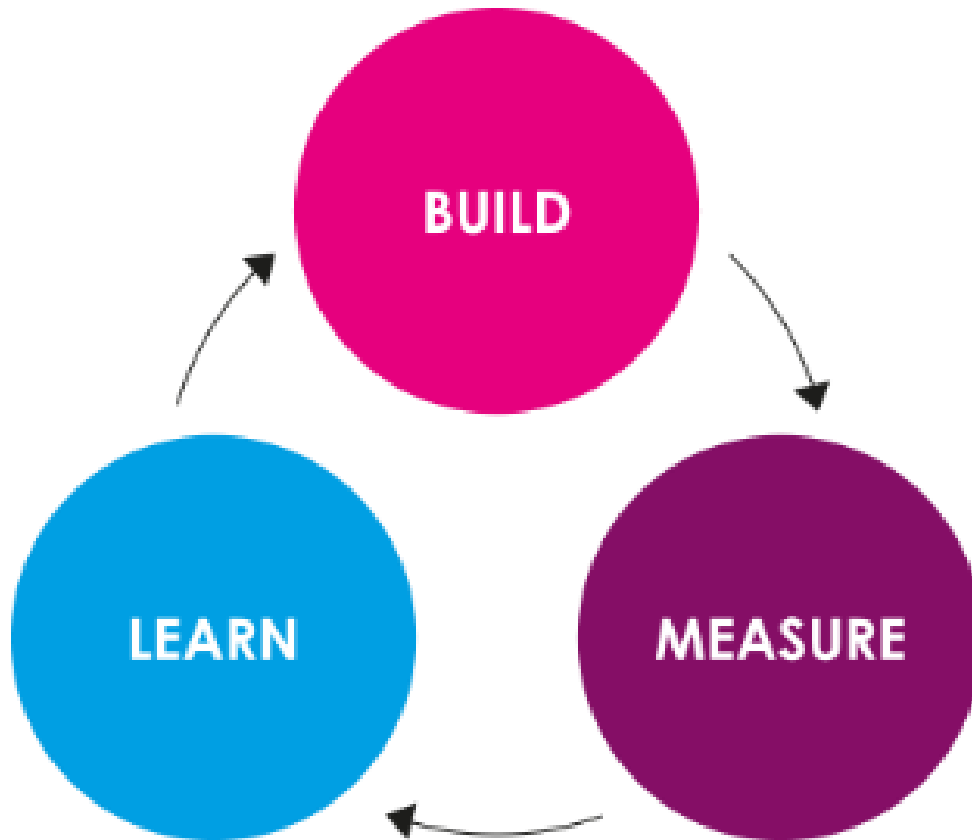- Allow yourself to be seduced into 'scrumming'

Learning 4: Continuous improvement – hypothesis driven improvement: Plan Do Study Act

LEAN START-UP: VALIDATED LEARNING BASED ON MVP

Essence (1)

- A structured approach to develop and manage startups in a very uncertain world, which are able to quickly bring a new product to the market.

- The Lean Startup method is based on the idea that every startup is one big experiment: does the market need this product?

- That is why the Lean Startup wants to have an answer as quickly as possible to the question of whether a product (idea) should be made at all (and not so much whether the product can be built).

- Core elements of the Lean Startup method are
  - MVP (Minimum Viable Product): the minimum workable product. The smallest, most minimal, fastest to create product that can be used to indicate whether there is sufficient market for the idea.
  - Validated learning: Launch the MVP and See (based on evidence)
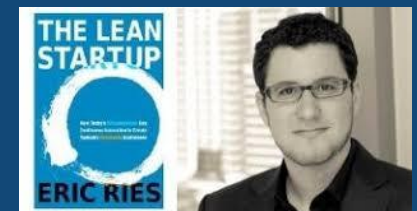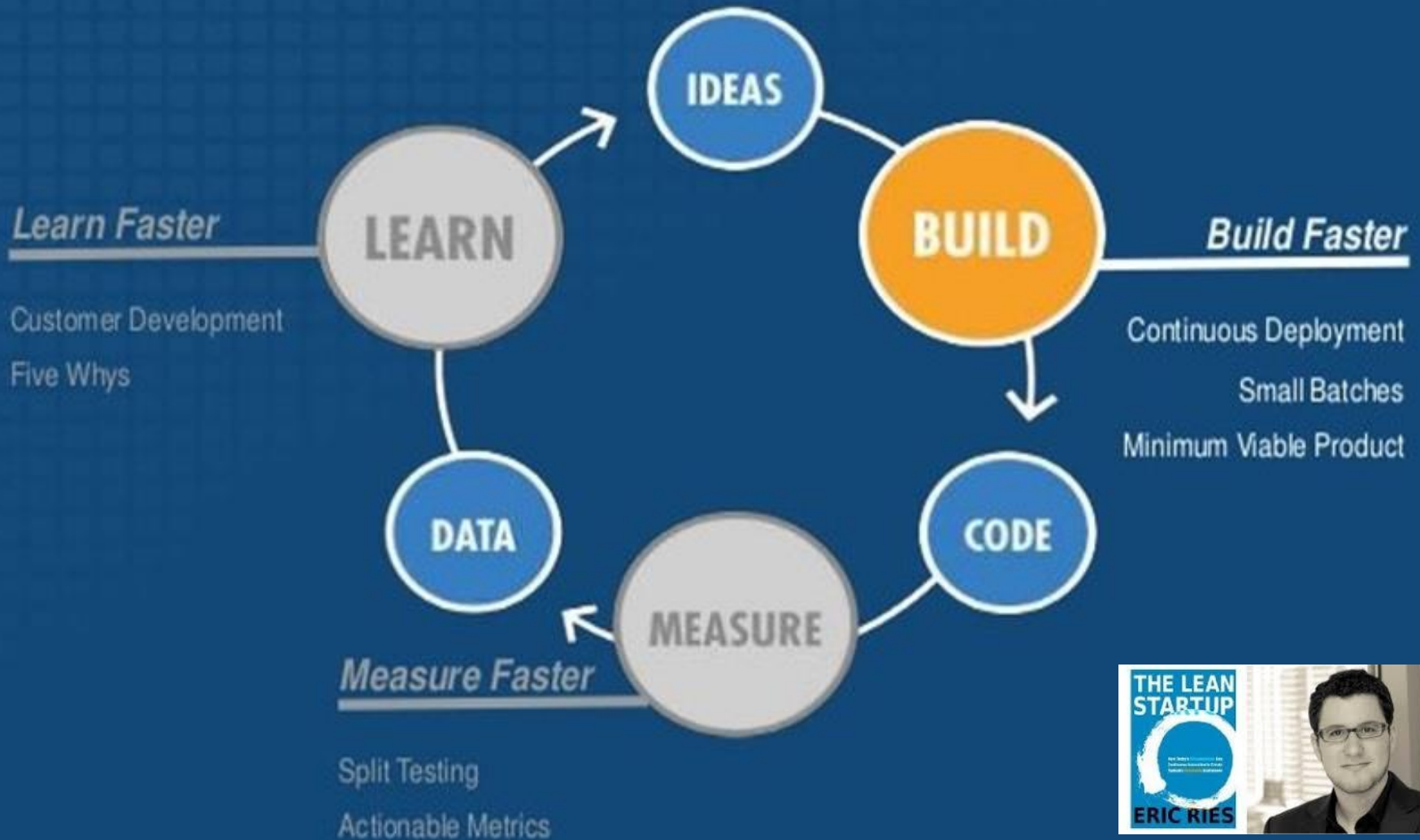 - Build-Launch-Measure-Learn feedback loop (PDSA cycles).

Lean startup: validated learning

- The Build–Measure–Learn loop emphasizes speed as a critical ingredient to product development.
- In the Build phase, an MVP is developed and launched to test the commercial viability of the product idea.
- This testing takes place e.g. scientific quantification. The results are learned and a new cycle is started.
- A team or company's effectiveness is determined by its ability to ideate, quickly build a minimum viable product of that idea, measure its effectiveness (in the market), and learn from that experiment.
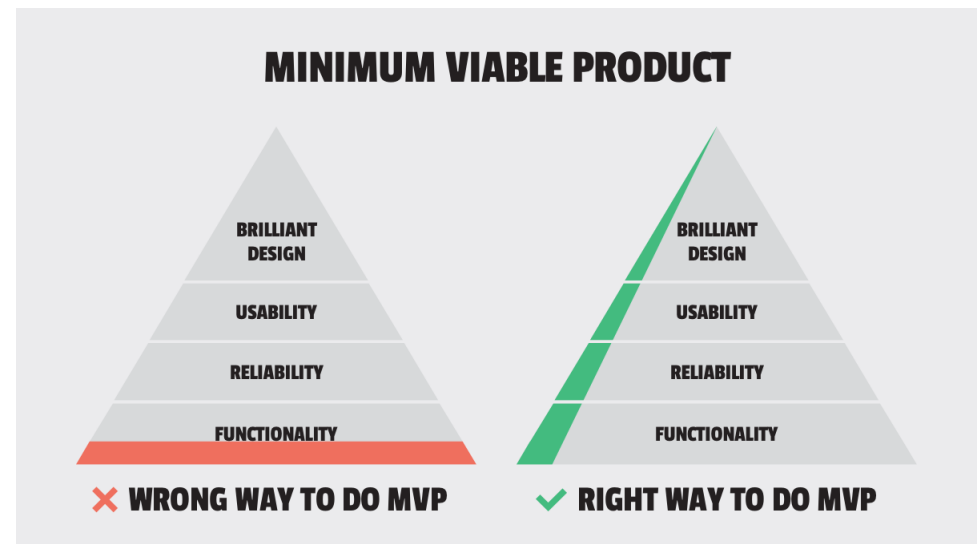
Essence (2)

- Work Smarter, not harder: develop a MVP - A core component of Lean Startup methodology is the build-measure-learn feedback loop.

- The first step is figuring out the problem that needs to be solved

- Then developing a minimum viable product (MVP) to begin the process of learning as quickly as possible.

- Once the MVP is established, a startup can start the validated learning cycle. This will involve measurement and learning and must include actionable metrics that can demonstrate cause and effect question.
  - Develop a hypothesis
  - Design an experiment
  - Run the experiment
  - Analyze the results
  - Accept, Revise, Reject hypothesis

- Validated learning: The more you can try, the greater the chance that the product will improve. But trying it out only makes sense if you can see what the consequences are.

- Brainstorming and generating ideas are important, but the quick 'killing' of ideas is even more important (fail fast).

MVP

- The minimum viable product (MVP) is a strategy for fast and quantitative market testing of a product or product feature.
  - Test a product hypothesis with minimum resources
  - Accelerate learning
  - Reduce engineering waste
  - Get the product to early customers as quickly as possible

MINIMUM VIABLE PRODUCT

BRILLIANT DESIGN
USABILITY
RELIABILITY
FUNCTIONALITY

✕ WRONG WAY TO DO MVP   ✔ RIGHT WAY TO DO MVP

MVP voor Dropbox?

The virtual warehouse Dropbox did not even start a product (the technology was too complex for a simple MVP), but sent a YouTube video into the world, with a reference that interested people could sign up for access.

"Our beta waiting list went from 5,000 people to 75,000 people literally overnight."
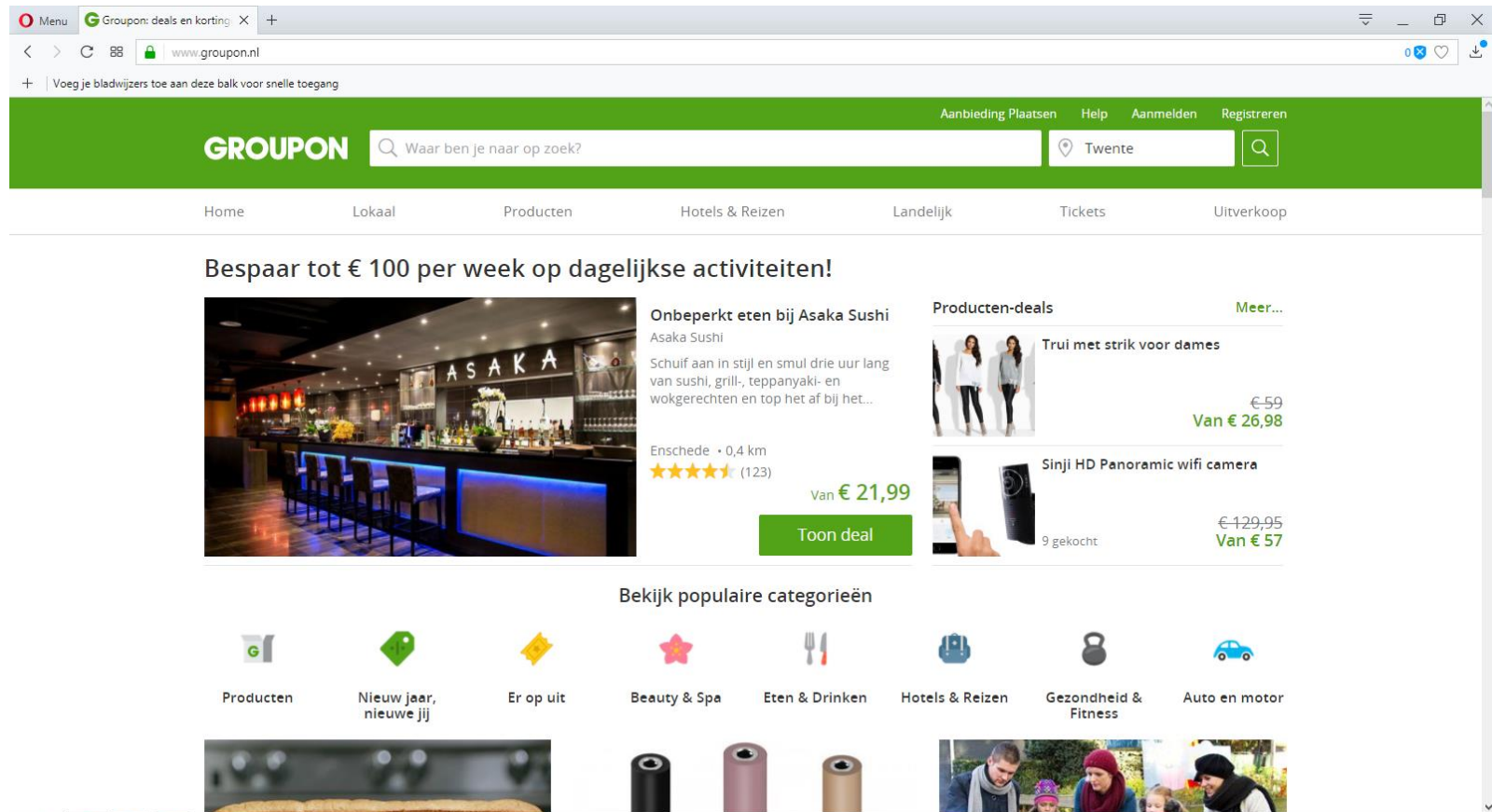
Drew Houston

MVP for Zappos

Founder Nick Swinmurn approached local shoe stores, took pictures of their inventory, posted the pictures online, bought the shoes from the stores at full price after he'd made a sale, and then shipped them directly to customers

MVP voor Groupon?

- When the company first started, it was an online activism platform called The Point. After receiving almost no traction, the founders opened a WordPress blog and launched their first coupon promotion for a pizzeria located in their building lobby. Hence, the first site was actually a WordPress site that did not contain any technique, and that was put together in one afternoon. To order the customer had to send an email. The coupons were made by hand in FileMaker. Although they only received 20 redemptions, the founders realized that their idea was significant, and had successfully empowered people to coordinate group action. Three years later, Groupon would grow into a billion dollar business.

Learning 5: Hard on the process (follow the best practice), soft on (empathy for) employees

DESIGN THINKING: (RE)FRAMING

Essence

- Design Thinking (DT) is a method, a way of thinking and working to solve problems in a practical and creative way or to develop new products and services.

- The focus lies on people (the user): Human-centered design

- DT consists of several essential skills in a combination of empathy, creativity and rationality to meet the needs of users and create new value.

- DT offers as a method an appealing way to view our world in a different way and to discover other aspects.

- Instead of making the best choice from existing alternatives, it is about developing new, appealing alternatives.

- In this process, problems are (re)framed again by asking the right questions and developing ideas. Everything starts with asking correct questions in combination with active participation of all stakeholders in the process.

Framing the design question

- Asking the right design question is crucial for any DT-project.

- It should not be too specific so that possible solutions are closed, but it should not be too broad and vague with which a design team can not get to work.

WHAT TO KEEP IN MIND

A. Is the question focused on ultimate impact?

B. Does the question allow for a variety of solutions?

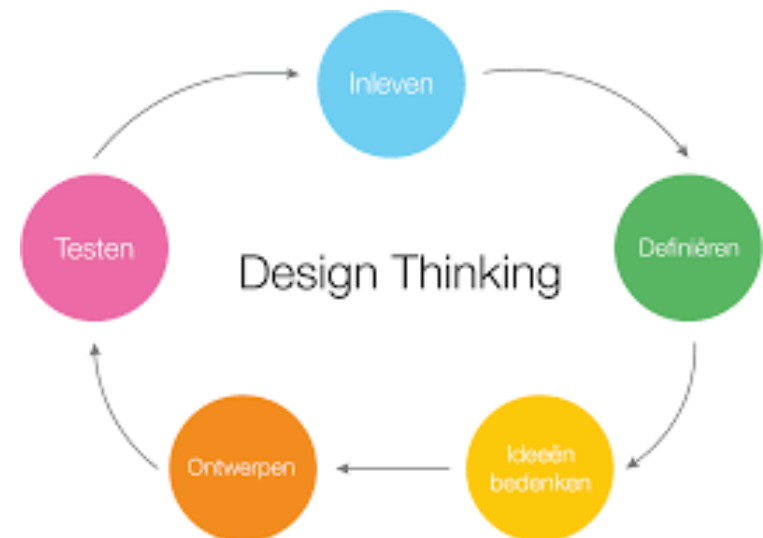C. Does the question take into account context and constraints?

Method

The 7 steps of Design Thinking

1. Define
2. Investigate
3. Generate ideas
4. Develop prototype
5. Choose
6. Implement
7. Learn

The 5 steps of Design Thinking

1. Empathy: have Empathy
2. Define: Define the problem
3. Ideate: Generate ideas
4. Prototype: Create a prototype
5. Testing: Test the solution

PROCESS*

Implement
Monitor
Learn
Do
Ask
Define Problem
Observe
Develop Insights
Frame Opportunities
Reflect
Test against intentions
Try
Choose using criteria
Evaluate and re-envision
Generate Ideas

Inleven
Testen
Definiëren
Design Thinking
Ontwerpen
Ideeën bedenken

We are all DESIGNERS!

Have empathy
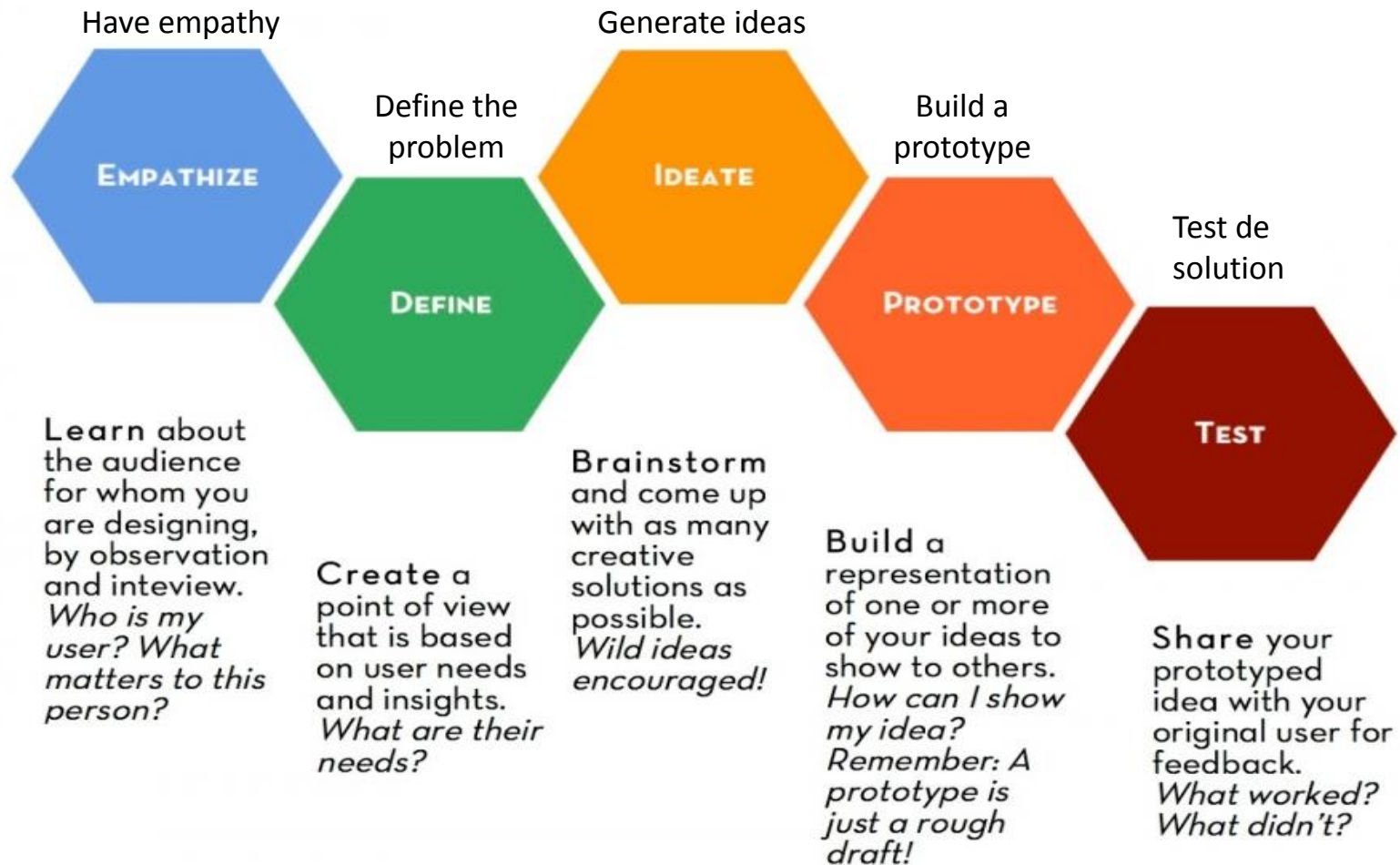
Generate ideas

Define the problem

Build a prototype

Test de solution

EMPATHIZE

DEFINE

IDEATE

PROTOTYPE

TEST

Learn about the audience for whom you are designing, by observation and inteview. *Who is my user? What matters to this person?*

Create a point of view that is based on user needs and insights. *What are their needs?*

Brainstorm and come up with as many creative solutions as possible. *Wild ideas encouraged!*

Build a representation of one or more of your ideas to show to others. *How can I show my idea? Remember: A prototype is just a rough draft!*

Share your prototyped idea with your original user for feedback. *What worked? What didn't?*

Method: The 7 steps of Design Thinking

1. Define (scoping)
- Which issues are you going to solve or what opportunity are you going to create
- For whom are you going to do that
- What are the success indicators
- Make sure you agree on the basic concepts. This prevents a lot of fog during the process.

2. Investigate (inspiration)
- Research the history and context of the issues
- In what way have others tried to solve this
- Who are all involved or should be involved
- What are the pain points of everyone involved
- Talk and involve the end users: they provide the most important input.
- Talk to important influencers.

3. Generate ideas (divergent thinking)
- Identify the needs, motivation and decision-making processes of your end users
- Generate as many ideas as possible to provide for this
- Document everything (yellows, video, audio ...)

4. Prototype/Design (co-create and share)
- Combine, refine or broaden ideas
- Make multiple concepts
- Key concepts, especially for end users
- Present a selection
- Do not (still) judge, stay neutral.

5. Choose (convergent thinking)
- Evaluate goals again
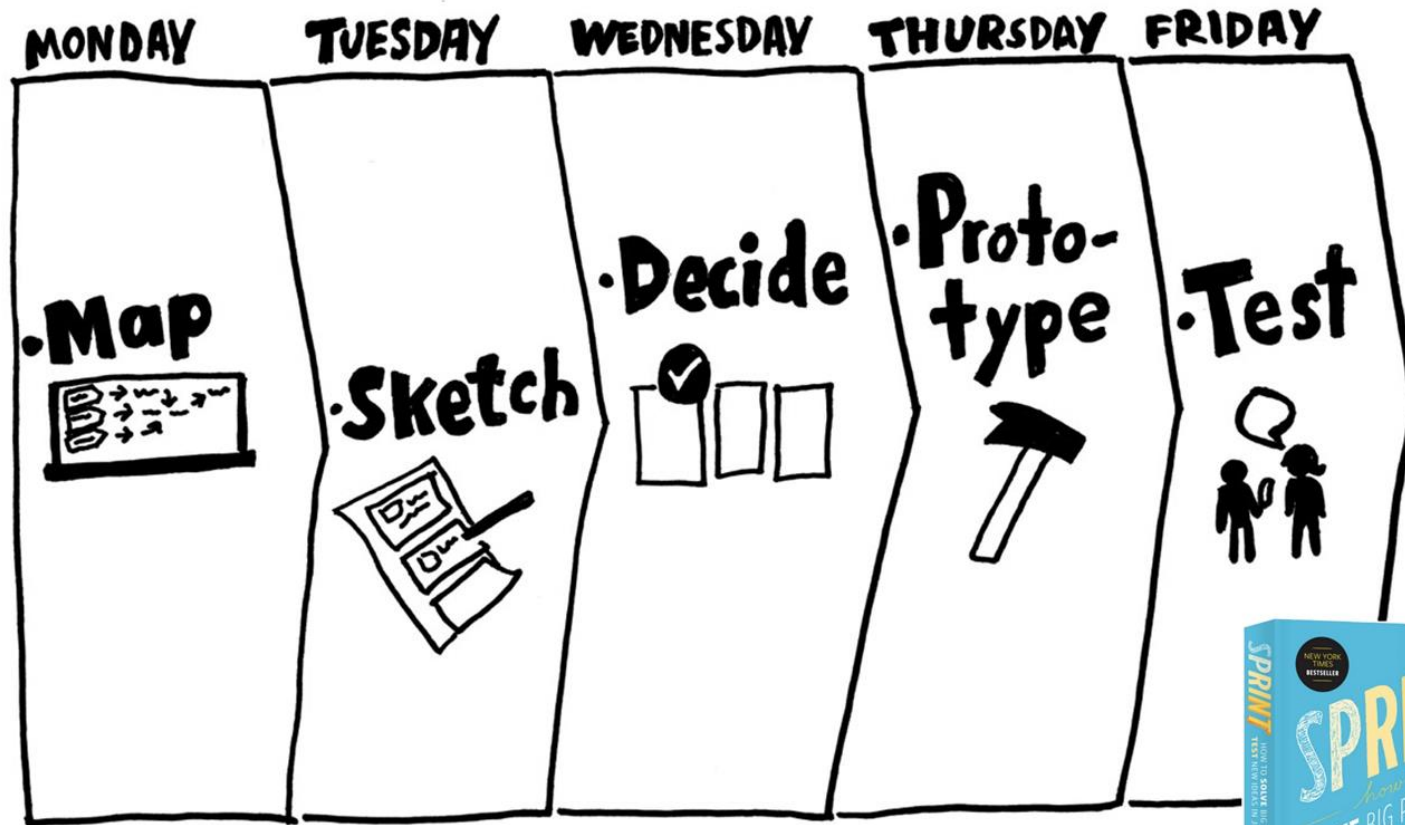- Choose from the most promising ideas.

6. Implement (convince and do)
- Make task and role assignments
- Determine budget, time and necessary tools
- Plan and assign tasks

7. Learn (feedback)
- Provide feedback from customers
- Determine whether the solution reaches the objective
- See what can be improved
- Determine degree of success, collect data
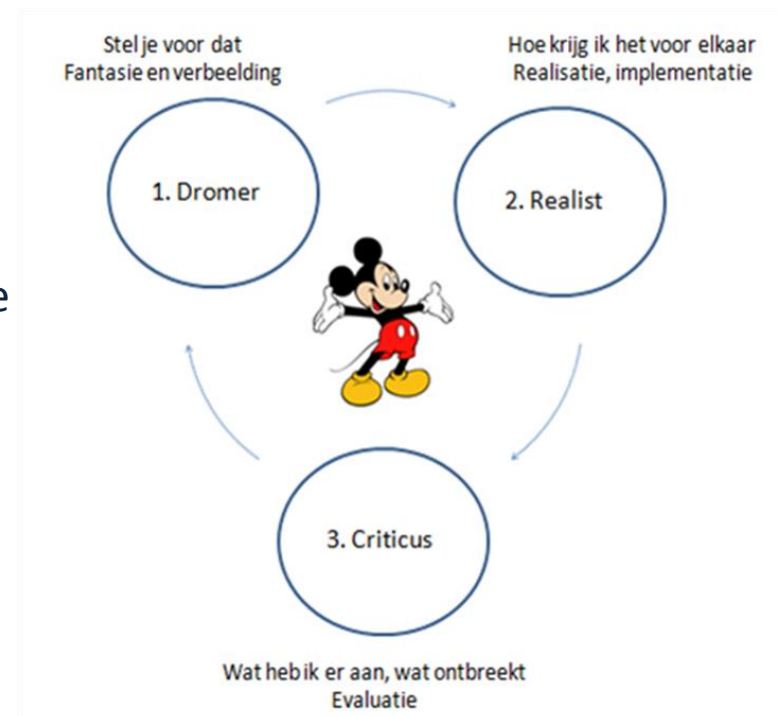
Design sprints

Learning 5: Hard on the process (follow the best practice), soft on (empathy for) employees
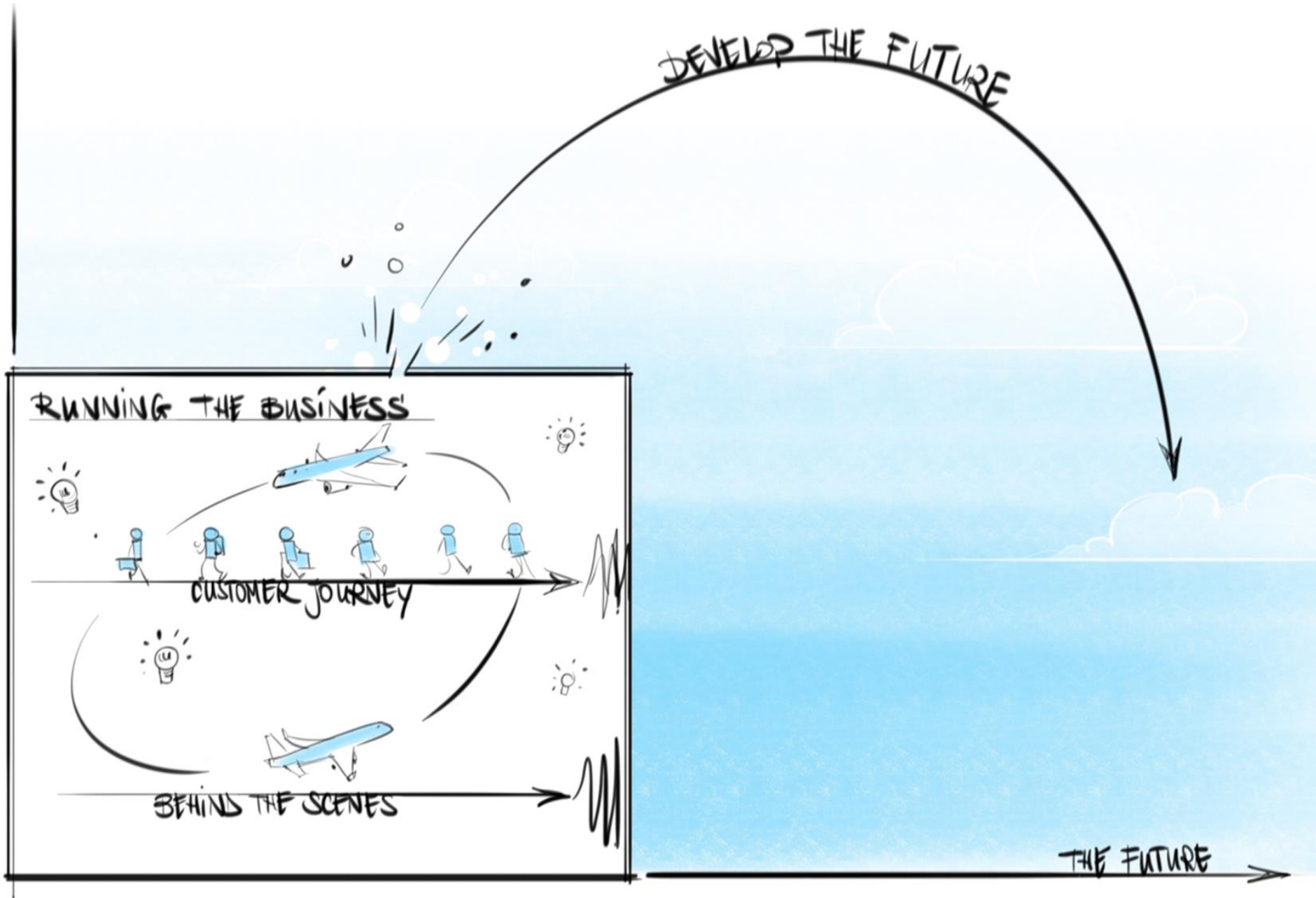
DISNEY ROOM METHOD

Essence

- Disney was a master in transforming his fantasy into reality and reality. His main point of departure was to view something from different perspectives.

- To emphasize the different perspectives, Walt Disney used three different roles:
  - **Dreamer -** The dreamer is free of any straitjacket and thinks creatively and full of imagination and sees unprecedented possibilities.
  - **Realist -** The realist looks at the practical possibilities to actually implement an idea. The realist, among other things, looks at the amount of resources and time available.
  - **Critic** - The critic does not criticize the dreamer's plan and the realist's insight, but looks at the plan as a spectator, filters and extracts crucial errors.

Stel je voor dat Fantasie en verbeelding — 1. Dromer

Hoe krijg ik het voor elkaar Realisatie, implementatie — 2. Realist

3. Criticus

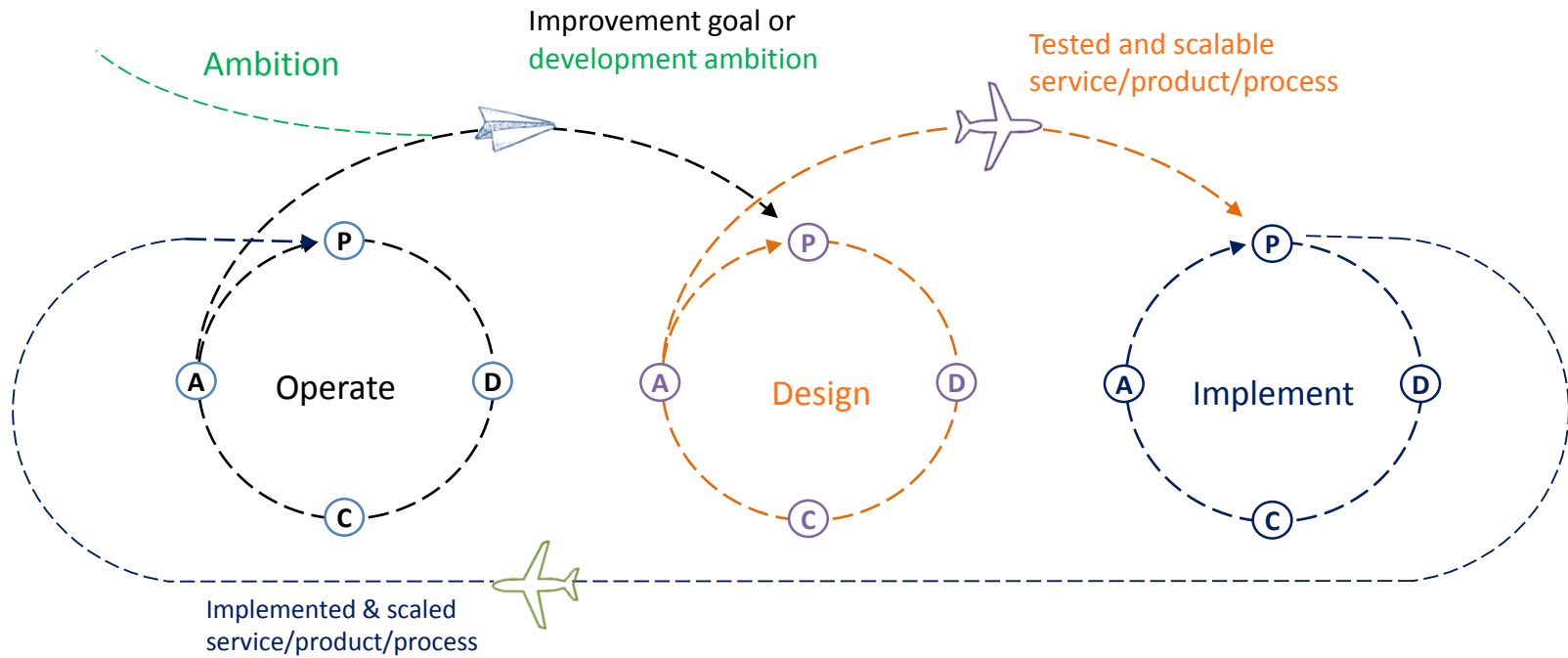Wat heb ik er aan, wat ontbreekt Evaluatie

Essence

- For proper application of the Walt Disney method, three places are reserved in the same room in which the role of dreamer, realist and critic can be taken in turn.

1. From the perspective of the **Dreamer**, the objective is looked at. The creative and visual thoughts that arise must not be hindered by reality and possible risks. It is about the power of brainstorming and about the quantity of all ideas that have been put forward.

2. From the perspective of the **Realist**, the possible ways to achieve the objective are examined. It is about realizing a dream. Restrictions and potential risks should therefore not be seen as obstacles, but as challenges.

3. From the perspective of the **Critic**, we look at how the end-user will experience the plan or idea. There is a critical look at possible gaps and risks and changes and points for improvement are suggested..

KLM-X

The capability to integrally design, test, rollout and execute is ramped up

Ambition

Improvement goal or development ambition

Tested and scalable service/product/process

Operate

Design

Implement

Implemented & scaled service/product/process

Deliver as promised & enable intelligent steering & digitized decision making

Determine the right customer promise and assure scalability to set priorities and maximize focus

Increase launch rate and line mgt accountability: "it isn't over till it's implemented"

The core principles of KLM-X

AMBITION DRIVEN

We always start with an ambition, never with an idea.

DATA DRIVEN

We always use data and observations, never gut feeling.

INTEGRAL APPROACH

All step-changes impact our operation, customer & employees. We involve them all.

LEARN BY DOING

We just go out in the field and do it. Fail fast, succeed sooner.

LIVE TESTING

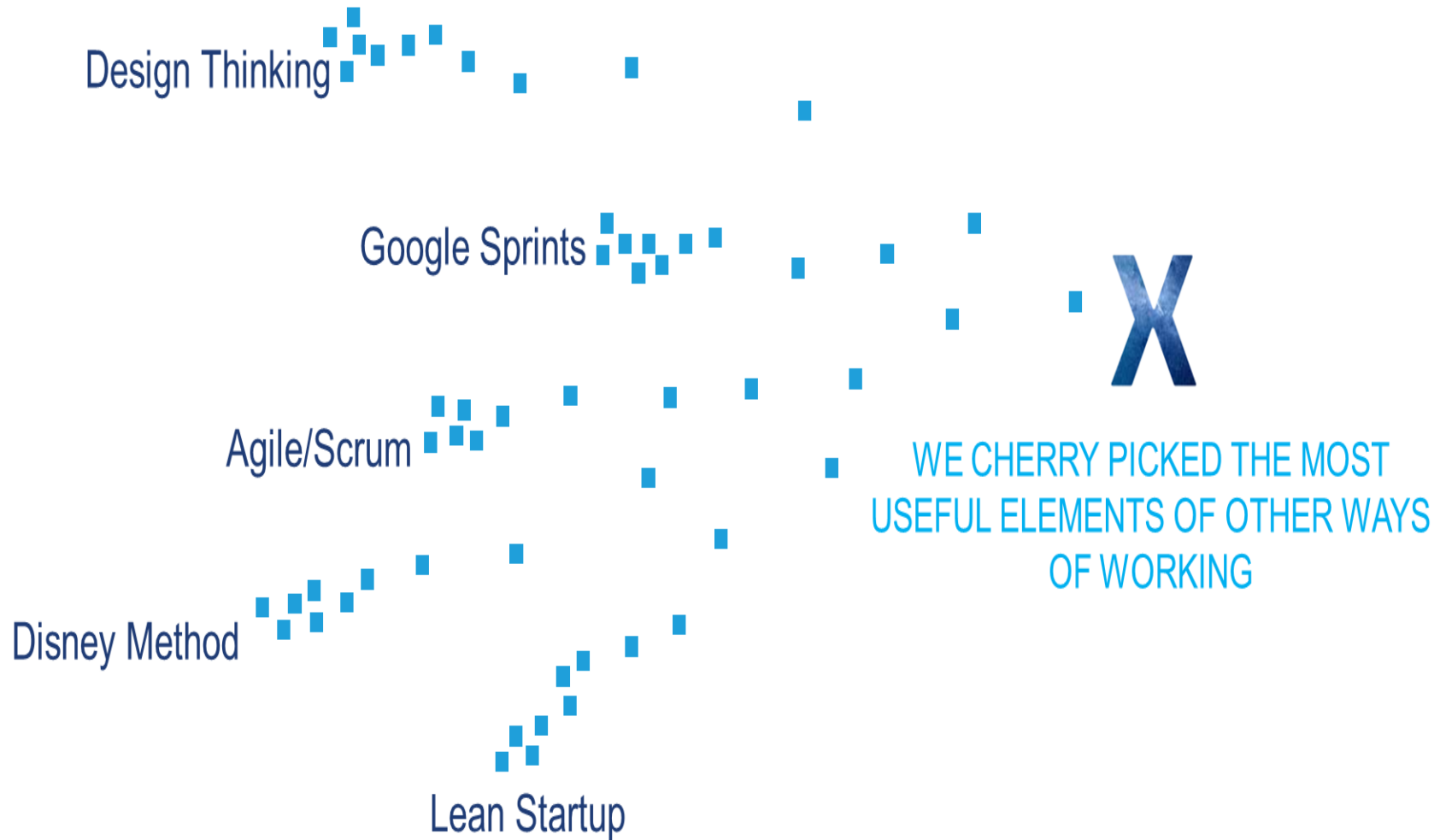We always test ideas in our live operation. Never a lab environment.

X IS ALIVE & CONTEXT DEPENDENT
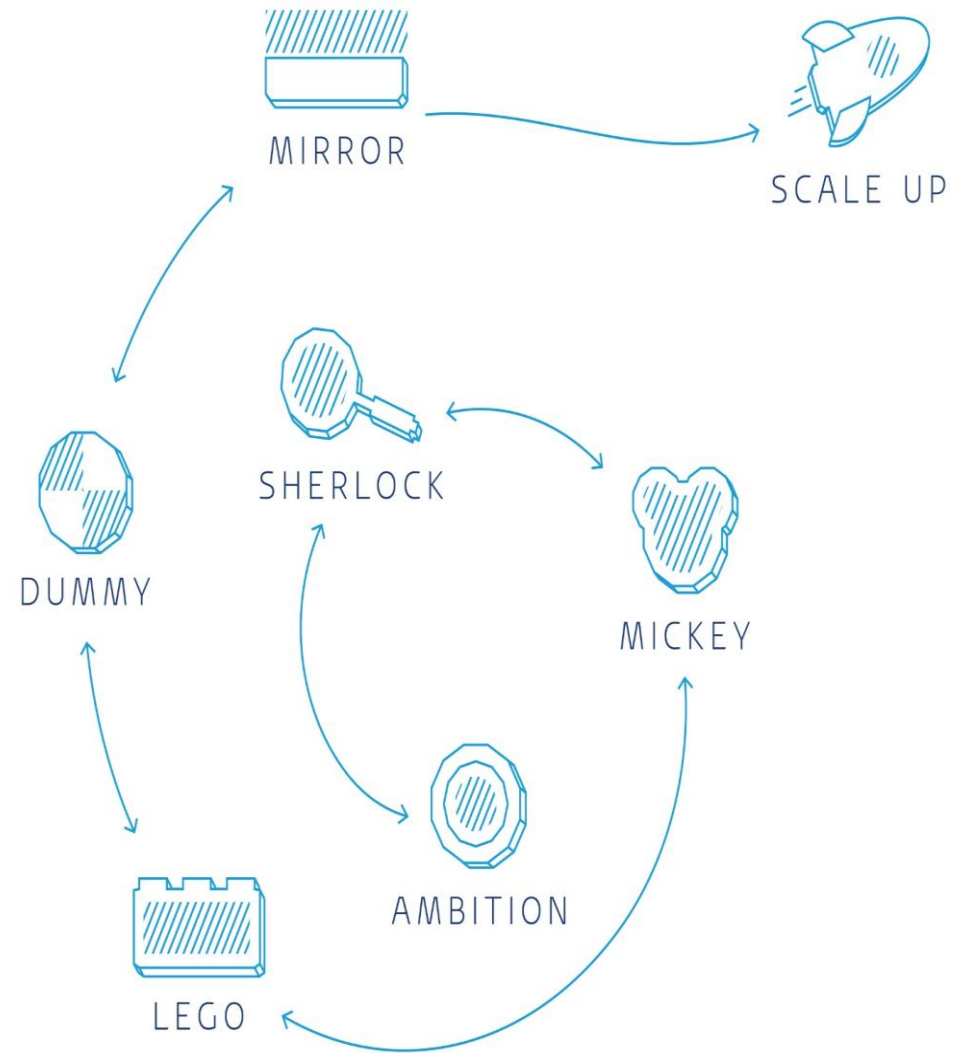
X is continuously evolving, to make sure we build the right thing, build it right, and build it fast

The core principles of KLM-X

Can we deliver it safely, consistently and transparently?

THING RIGHT

RIGHT THING

Are we making the thing that works best for our employees, customers *and* operation? We need to think big.

THING FAST

We don't want to waste time. We start small and learn by doing.

Essence of KLM-X

Design Thinking

Google Sprints

Agile/Scrum

Disney Method

Lean Startup

X

WE CHERRY PICKED THE MOST USEFUL ELEMENTS OF OTHER WAYS OF WORKING

TO CREATE A TAILOR MADE
START-TO-FINISH PROCESS
FOR STEP CHANGE INNOVATION

Learnings from operations management / Lean management

1. Control / Limit your workload → never release more work than the workload limit, i.e. the point just before congestion or even blocking occurs

2. Avoid large batches → decompose / reduce large batches into small batches or even single piece flow.

3. Reduce waste from a customer perspective

4. Continuous improvement – hypothesis driven improvement: Plan Do Study Act

5. Hard on the process (follow the best practice), soft (empathy) for employees

Learnings

- How to increase productivity of (NPD-)projects?
- How to speed up development projects?

- Limit the work in process. Sometimes you finish more if you start less.
- Start with a clear ambition and the end in mind.
- Empathize with the user's problem
- Work smarter, not harder.
- Reframe by asking the right questions
- Decompose in simpler building blocks – built in sprints
- Fail fast, fail cheap by live testing of MVP's
- Scientific method: hypothesis and data driven