Supporting Material for the MLA examination

Design Thinking, Lean Startup, Kanban, SCRUM and Further Literature

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1. Introduction

Within the scope of the Supporting Material for the Machine Learning Application examination, the project management tools **Design Thinking**, **Lean Startup**, **Kanban** and **SCRUM** are introduced. This document is intended for all students of the lecture Machine Learning Application and is to be understood only as an aid and not as a binding working basis. The methodologies presented within this document are useful, agile tools to manage a team project that intents to solve a complex problem statement. So why is project management so important?

Figure 1: Importance of Project Management

Source: https://www.dds-llc.com/blogs/post/Importance-of-Project-Management

Clear project objectives: Agile project management clearly helps to understand the focus, direction, obstacles and objectives of a project. This initial coordination decreases the chances of failing projects.

Planning and scheduling: Meeting project deadlines and eliminating delays is achieved by working alongside a project management methodology based timeline. The start and end date are determined, tasks are allocated and roles are assigned.

Resource utilization: Maximizing available resources is a key principle in lean management. It's highly important since it prevents under-performance or over-performance of team members and increases the overall productivity.

Risk management: Recognizing and quantifying potential risks that could hinder the overall success of a project is essential. Effective project management helps identifying and reducing risks.

Strategic Alignment: Project Management is important because it helps meeting customer requirements and ensuring what is delivered is right and will deliver real value.

The following summary of the project management tools provided to students does not claim to be exhaustive. The students should be able to get first insights and be motivated to read further on the presented methodologies based on the provided links and finally to apply them within the framework of the hackathon.

2. Design Thinking

When it comes to practical and creative problem solving, the design thinking methodology is interdisciplinary used. It is a methodology for solution-focused and action orientated exploring and generating ideas that meet client requirements, combines creative and analytical approaches and requires collaboration across disciplines. Design thinking is an iterating process that can be divided into the five steps Emphasize, Define, Ideate, Prototype and Test. In the context of the MLA examination, Design Thinking can be a helpful project management tool to structure the idea-finding process.
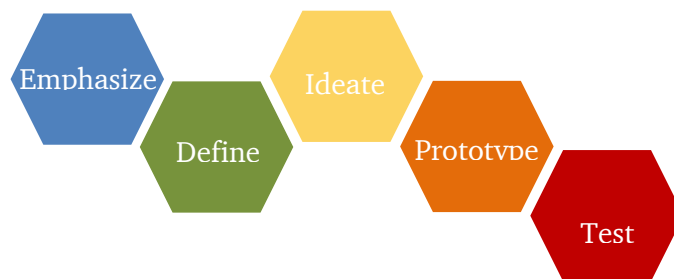

Figure 2: 5 Steps of Design Thinking

Objective of the **Emphasize** phase is fully understanding the user experience of whom you are designing for through observation, interaction and immersing yourself in their experiences. As with the following phases, it is mandatory to work from a divergent to a convergent thinking process.

As a follow-up, at the **Define** phase, the problem collected from the Emphasize process is defined. Hereby, clarity is developed by asking the stakeholders or team members the right critical questions and finally formulating the Point of View (POV) statement. The POV statement is the reframing of a design challenge into an actionable problem statement that launches generative ideation and includes who the users are, what their needs are and the insights gained during the first phase.
For instance, the user need that got observed is the following: *"I am a college student and I hate folding laundry because it seems I can't fold it the right way."* – The POV question could be: *"How might we create a tool to help the college student fold laundry?"*

Objective of the **Ideate** phase is exploring a wide variety of possible solutions by generating a large quantity of diverse possible solutions that are beyond the obvious. So to speak, *"It's not about coming up with the 'right' idea, it's about generating the broadest range of possibilities"*.

In the course of the **Prototype** phase, gained ideas and explorations are put into the physical world. Whether as a paper model, storyboard, wireframe or a cardboard box, the prototypes serve to quickly visualize and identify the best solution among several concepts based on the motto *build with the user in mind*, *fail quickly and cheaply* and *do not spend too long on one prototype*.

Objective of the **Test** phase is gathering feedback about the previously built prototypes by testing within a real context of the user's life in order to refine the solutions and even make them better. Purpose is to learn what works and what does not and then iterate by going back to the prototype and modify until a suitable solution is defined.

The Design Thinking methodology can also be used in combination with the SCRUM methodology which is explained in the last section **SCRUM**. Further literature including vivid examples regarding Design Thinking can be found at the end of this document.

3. Lean Startup

While a startup is a human institution designed to deliver a new product or service under conditions of extreme uncertainty, the **Lean Startup** focus is not on a long preliminary planning, but rather on learning-by-doing through early "bringing to market" of the product and rapidly proposing new business models that are viable. The elements of the Lean Startup theory are the interactive product launch, a very short product development cycle and, as an important element, customer feedback. The feedback on the young product enables measurable learning about customer wishes and the needs of the market. The insights gained then lead to a further product development cycle.

The key principles of Lean Startup are:
- Entrepreneurs are everywhere (means you don't have to be in a garage to be in a startup)
- Entrepreneurship is management (means startups are institutions that require management specifically geared to its context)
- Validated learning (means startups exist to learn how to build a sustainable business. This type of learning can be validated scientifically, by running experiments that allow to test each element of the vision)
- Build-Measure-Learn (means that the fundamental activity of startups is how to turn ideas into products, measure how customers respond and finally learn whether to pivot or persevere)
- Innovation accounting (means in order to improve entrepreneurial outcomes and to hold entrepreneurs accountable it's mandatory to focus on how to setup milestones, measure progress and prioritize work)

The Build-Measure-Learn Feedback Loop is shown below and the important stages pointed out in the following.
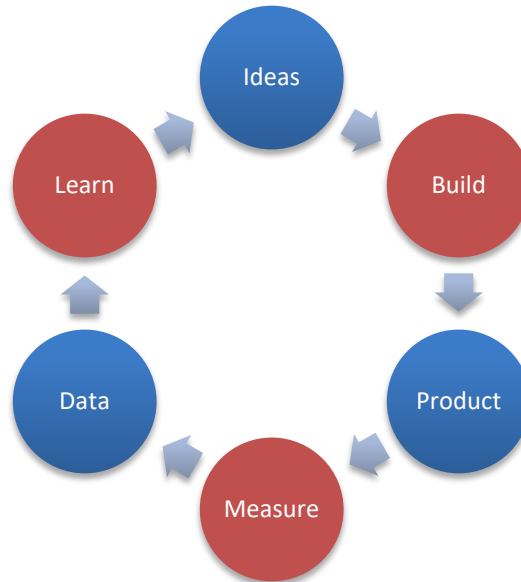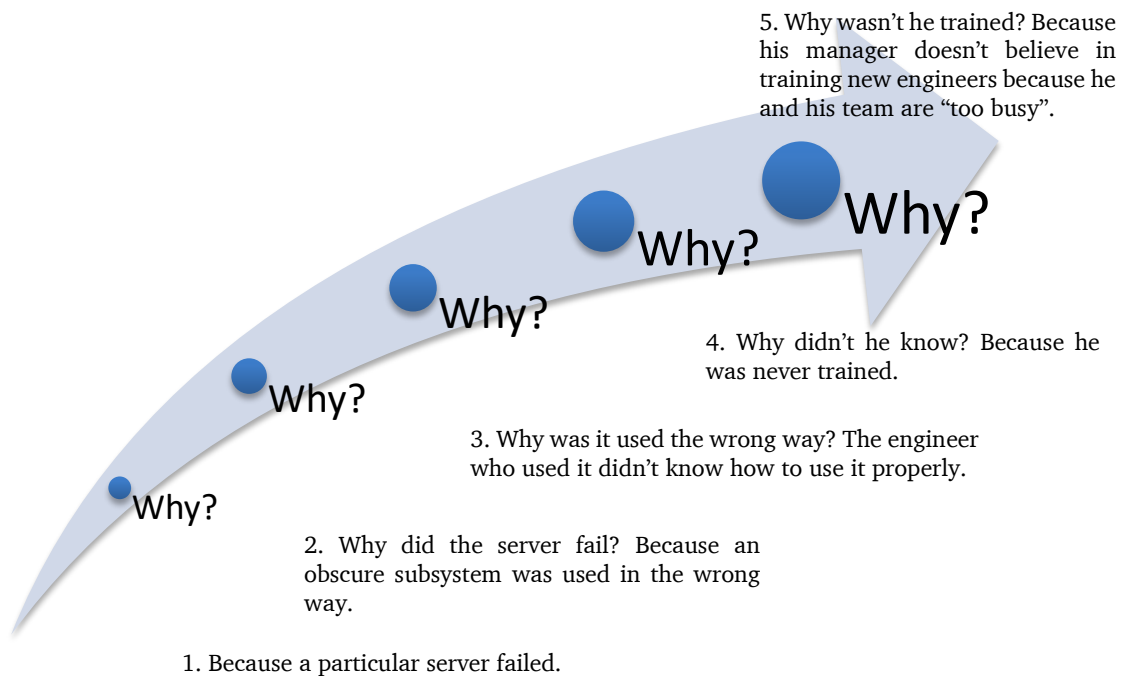

Figure 3: Build-Measure-Learn Feedback Loop

Build stands for continuous but fast deployment of a Minimum Viable Product (MVP) and working in small batches. Reduce product features to an absolute minimum number that still represent the full product.

Measure marks the innovation accounting where the MVP is used to establish real data on where the company in terms of progress is right now. The engine is tuned from the baseline toward the ideal until the company reaches the decision point: pivot or preserve.

Learn finally stands for Validated Learning, Five Whys and the Cause Analysis. Hereby, Validated Learning is the process of demonstrating empirically that a team has discovered valuable truths about a startups present and future business prospects. In the course of this stage, "Why" is asked five times when something unexpected happens. The root cause of every problem is usually a human error and can be fixed by diving into the elementary root of the problem. An equivalent example is shown below.

5. Why wasn't he trained? Because his manager doesn't believe in training new engineers because he and his team are "too busy".

Why? Why? Why? Why? Why?

4. Why didn't he know? Because he was never trained.

3. Why was it used the wrong way? The engineer who used it didn't know how to use it properly.

2. Why did the server fail? Because an obscure subsystem was used in the wrong way.

1. Because a particular server failed.

Problem Statement:
At the social network company IMVA Inc. they suddenly start receiving complaints: A new release disabled a feature for costumers.

Figure 4: An example on 5 Whys

Applying the key principles of Lean Startup helps preventing failures (e.g. occurring through traditional management of startups or startups applying the just-do-it school). Furthermore, the Lean Startup methodology with its Build-Measure-Learn Feedback Loop is dedicated to fasten the product development process, taking pivot or persevere decisions on low costs and implementing Validated Learning.

Further literature including vivid examples regarding **Lean Startup** can be found at the end of this document.

4. Kanban

The term Kanban is Japanese and stands for „signal card". Kanban as a system originates from lean production (at Toyota) and is a workflow management method designed to help visualize work, maximize efficiency and practicing agile software development. In lean production, whenever a production step has free capacity, it signals the upstream production step to produce more. As long as the upstream production step does not receive the signal to produce, it has to cease production. This pull system guarantees that no production step is overwhelmed with work.

Kanban is mainly used to produce higher quality and greater performance, to shorten lead times, to improve predictability and due-date performance and finally build trust with customers and other departments. In a project management context, the main principles of Kanban are limiting Work in Progress (WIP), visualizing the workflow (typically on a whiteboard with sticky notes) and measuring/managing the workflow.
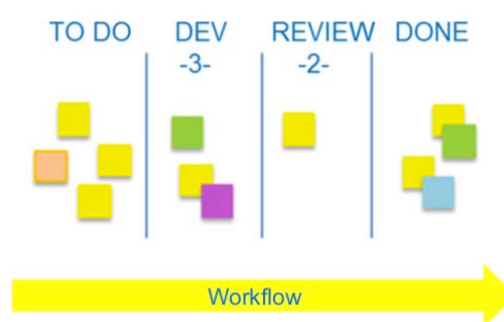

Figure 5: Kanban - Card wall

As shown above, the visualization of the workflow can be achieved by defining a card wall by drawing columns on the board that represent the activities performed in the order they are performed. Hereby, pull is signaled if the number of cards in a column is less than the indicated limit. The team decides to pull an item based on available visual information. The color scheme needs to be defined and represents for instance the work item type, class of service or workflow status (blocked, delayed, stuck). In addition, limits for work-in-progress must be set (typically 1-3 items per person or team).

Free Kanban board software like Trello or Kasban can be accessed and used via the following links: www.trello.com and www.asana.com/apps/kasban

As part of measuring and managing the flow, a Cumulative Flow Diagram (CFD) can be used. It visualizes lead time, due date performance, throughput, blocked work items, flow efficiency, initial quality, failure load and tracks the work in progress – basically how stable your flow is.
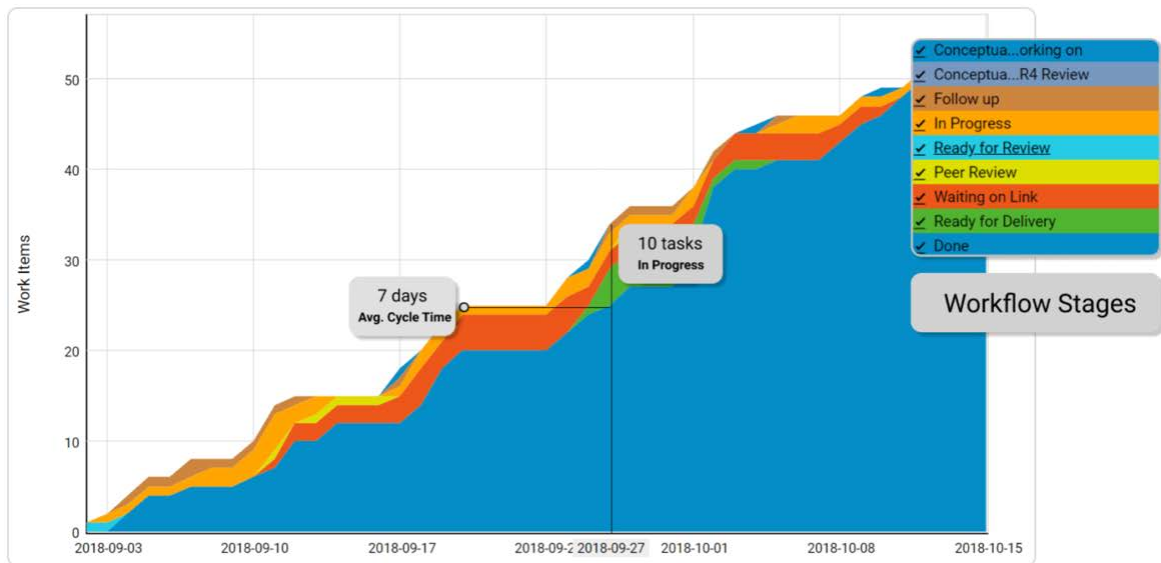
Figure 6: Cumulative Flow diagram (CFD)

Source: www.kanbanize.com/kanban-resources/kanban-analytics/cumulative-flow-diagram

The kanbanize website is suitable for a detailed description and can be accessed via the following link: www.kanbanize.com/kanban-resources/kanban-analytics/cumulative-flow-diagram

CFD are even available in Excel's built-in charting capabilities and a guidance on that can be accessed via the following link: www.ardalis.com/excel-cumulative-flow-diagram

The goals of the implementation of Kanban to one's project are summarized in the following chart. Further literature on Kanban including vivid examples can be found at the end of this document.

Figure 7: Kanban Goals

5. SCRUM

SCRUM is an iterative and selective development method for sub-functions (sprints), which is based on clearly defined sub-goals and associated tasks. SCRUM is designed for cross-functional teams between 5-7 members and splits work load into *time boxed events*, i.e. tasks with a deadline, that cannot be extended. Operation cycles usually have a duration of four weeks and correspond to *sprints*. Development tasks are selected from the product backlog, a prioritized list of all development tasks that are necessary to complete the product, and realistic goals are set in the sprint backlog during the sprint planning. Every day the work progress and following steps are discussed during the 15-minute daily SCRUM. Hereby, each team member has to answer the following questions *"What have I achieved since the last meeting? What am I going to do until the next meeting? What obstacles may arise?".*
At the end of each sprint, the results are presented and decisions taken to ensure improvements of process and planning for the following sprints. The SCRUM methodology is shown below and the numbered steps outlined in the following.
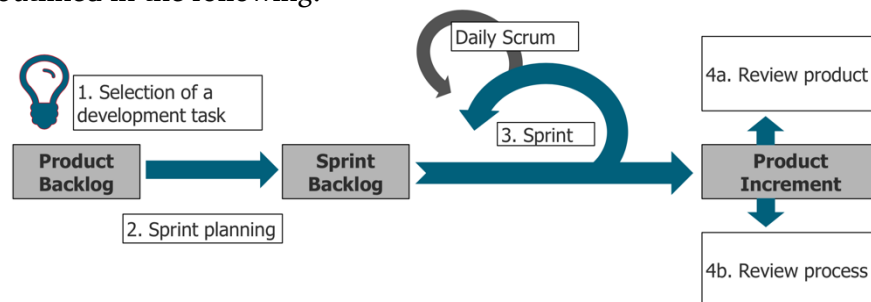

Figure 8: SCRUM methodology

1. Initially, the product idea is divided into boxed development tasks that are ranked in the order of priority in the Product Backlog
2. Based on the Product Backlog, development tasks with the highest priority are being selected and assigned to the responsible team member or even a group of team members within the team. The Sprint Backlog serves as documentation
3. Sprints are performed and daily SCRUMs hold
4. Finally, the results of the Sprint are presented, critically discussed and evaluated. As a conclusion, decisions are taken in order to ensure improvements of process and planning for the following sprints

In order to guarantee a seamless process, the following roles are assigned.

Product Owner: Creates the product vision, defines the features of the product, sets priorities and sets up the Product Backlog

Development team: Develops the product, organizes all the tasks and keeps everybody up to date

SCRUM Master: Teaches the SCRUM schedule, ensures the SCRUM methodology and supports the team

Stakeholder: Supervises and evaluates the development process

For numerous applications and problem statements linking **Design Thinking** to SCRUM can be very useful. Especially when the problem and solution are not clearly specified it can be very reasonable clearing the user needs with Design Thinking and taking the output of this process at the Product Backlog for SCRUM. Another approach is integrating the Design Thinking process in each Sprint.
Further literature on SCRUM including vivid examples can be found in the following chapter.

6. Further Literature

6.1. Design Thinking

Stanford School - *Design Thinking Process Guide*
https://dschool-old.stanford.edu/sandbox/groups/designresources/wiki/36873/attachments/74b3d/ModeGuideBOOTCAMP2010L.pdf

Tilmann Lindberg, Christoph Meinel, Ralf Wagner - *Design Thinking: A Fruitful Concept for IT Development?*
https://hpi.de/fileadmin/user_upload/fachgebiete/meinel/papers/Book_Chapters/Design_Thinking_-_A_Fruitful_Concept_for_IT_Development.pdf

Adam Leon - *3 Great Examples of Design Thinking in Action*
https://medium.com/swlh/3-great-examples-of-design-thinking-in-action-a96461538c4a

6.2. Lean Startup

Eric Ries - *Lean Startup*

Website The Lean Startup Methodology
http://theleanstartup.com/principles

6.3. Kanban

David J. Anderson - *Kanban*

Henrik Kniberg, Mattias Skarin - *Kanban and Scrum - Making the Most of Both*
http://www.agileinnovation.eu/wordpress/wp-content/uploads/2010/09/KanbanAndScrum_MakingTheMostOfBoth.pdf

Website Kanbanize
https://kanbanize.com/kanban-resources/getting-started/what-is-kanban

6.4. SCRUM

Website Scrum.org
https://www.scrum.org/resources/what-is-scrum

Website ScrumAlliance
https://www.scrumalliance.org/about-scrum/overview

Jumpstarting SCRUM with Design Thinking
https://www.researchgate.net/publication/255710860_Jumpstarting_Scrum_with_Design_Thinking

Creativity at Work
https://www.creativityatwork.com/design-thinking-strategy-for-innovation