



Metropolia

Aukusti Virtanen

Literature Review: The Connection Between Agile Methods and Lean Thinking

Metropolia University of Applied Sciences

Bachelor of Culture and Arts

Media

Thesis

10.5.2021

Abstract

Author(s): Aukusti Virtanen
Title: Literature review: The connection between agile methods and lean thinking
Number of Pages: 37 pages
Date: 10 May 2021

Degree: Bachelor of Culture and Arts
Degree Programme: Media
Specialization option: Digital Media
Instructor(s): Tero Marin, Senior Lecturer

This thesis aims to create a common understanding of how agile methodologies and lean thinking connect in project management and software development. This thesis will address how agile methods are used in start-ups and more prominent organizations and why agile has helped create a more fluent and valuable workflow. The perspective of this thesis is to observe the connection between agile and lean thinking and how they are used in management.

Lean thinking is a mindset with the term coined by James P. Womack through his research of automobile production, later used in different environments such as software development. The goal of the mindset is to focus on the essential matters through the project while reducing the lack of "waste" and simplifying the workflow.

This thesis was carried out as a literature review. Nine publications were selected for the literature review. The pieces of literature have been selected to each have a crucial element of agile or lean implemented in management and software development. The resources for the literature were all found through online database search tools and previous research on the matter. The first section of the thesis will present the topic and its use in this thesis. The second section is the literature review. The last section brings up conclusions and further discussion about agile and lean together.

This thesis shows, there is a clear connection between agile and lean. The adaptive nature of both agile and lean makes it easier to be used simultaneously in any needed working environment. The numerous different methodologies make it difficult to understand the appeal and clear benefits for this thesis. However, the nature of adapting and using the methods is the advantage of agile and lean.

Keywords: Agile, lean thinking, project management, literature review

Tiivistelmä

Tekijä(t):	Aukusti Virtanen
Otsikko:	Kirjallisuuskatsaus: Mikä on ketterien menetelmien ja lean ajattelun yhteys?
Sivumäärä:	37 sivua
Aika:	10.5.2021
Tutkinto:	Medianomi (AMK)
Tutkinto-ohjelma:	Viestintä
Suuntautumisvaihtoehto:	Digitaalinen viestintä
Ohjaaja(t):	Lehtori Tero Marin

Tämän opinnäytetyön tavoitteena on luoda katsaus, miten ketterät projektinhallinta menetelmät yhdistyvät lean-ajatteluun. Työssä käsitellään ketterän projektinhallinnan ja ohjelmistokehityksen perusteita ja sitä, kuinka kyseisiä menetelmiä hyödynnetään. Lean-ajattelun peruseräät ovat johtamisfilosofiaan pohjautuvia. Tämän työn näkökulman tavoitteena on muodostaa selkeämpi yhteys nykyisempään palvelusuunnittelun työympäristöön hyödyntäen lean-ajattelua ja ketteriä menetelmiä.

Opinnäytetyö on toteutettu kirjallisuuskatsauksena. Työhön on valittu yhdeksän julkaisua. Julkaisut on jaettu niin, että jokaisen julkaisun kohta keskittyy yhteen menetelmään tai siihen, miten lean-ajattelua on hyödynnetty nykyisessä työympäristössä. Tässä opinnäytetyössä on hyödynnetty artikkeleita verkosta ja myös kirjoja. Työn alussa esitellään aihepiiriä, kirjallisuuskatsaus menetelmänä ja sitä, kuinka menetelmää on hyödynnetty tässä opinnäytetyössä. Työn neljäs luku sisältää itse kirjallisuuskatsauksen valituista sisällöistä. Viimeinen luku tuo esille johtopäätöksiä ja ajatuksia kirjallisuuskatsauksesta.

Kun ketterä projektinhallinta on suuremmissa nousussa kuin koskaan ennen, miten yritykset ja suunnittelijat hyödyntävät näitä menetelmiä? Ketterät menetelmät eivät ole uusia tapoja lähestyä työtä, mutta antavat mahdollisuuden kehittää työympäristön, jossa on lisättyä arvoa ja työnkulun helpottamista. Ketterissä menetelmissä käytetään iterointia. Lean-ajattelu on termi kirjailija James P. Womackilta. Womack kehitti termin tutkiessaan autoteollisuutta. Lean-ajattelu keskittyy ratkomaan, miten voidaan vähentää työn yhteydessä muodostuvaa "hukkaa" ja yksinkertaistaa työnkulkua.

Tässä opinnäytetyössä käy ilmi, kuinka paljon samanlaisuuksia ketterillä menetelmillä ja lean-ajattelulla on. Mahdollisuus muokata ja hyödyntää menetelmiä yrityksen ja suunnittelijan tarpeisiin luo monimutkaisen ajatusmaailman, jossa on vaikea ymmärtää menetelmien tarkoitus. Kuitenkin menetelmien mahdollisuus sopeutua eri ympäristöihin on niiden vahvuus.

Avainsanat: Ketterät menetelmät, lean-ajattelu, kirjallisuuskatsaus

Contents

1	Introduction	1
2	Terminology for the thesis	3
2.1	Agile project management	3
2.2	Principles of lean	7
3	Research method	8
3.1	Literature review as a research methodology	9
3.2	The use of literature review for this thesis	11
4	The connection between agile methods and lean thinking	16
4.1	Agile methodologies	16
4.1.1	Teal	17
4.1.2	Kanban	19
4.1.3	Scrum	21
4.1.4	The use of agile methods today	23
4.2	Lean thinking	26
4.2.1	Concept of lean and the link to agile	27
4.2.2	Lean principles for digital implementation	28
4.2.3	Lean and agile processes for software development	30
4.3	The connection between agile and lean	32
5	Conclusions & discussion	33
	References	36

1 Introduction

Project management has been an integral part of organizations. Creating achievable goals and criteria helps motivate and keep people focused on the necessary steps of the project. While the history of project management as it goes back to the 1950s with civil engineering practices to the United States infrastructure (Nokes & Kelly, 2008, pp. 25 - 28).

As time passed, project management methods and techniques also evolved to become more common in people's daily working lives across different fields. The project management methods used by industrial engineers, production management and software development are a stable today. This is how project management was handled and slowly shifted into other methods and techniques to suffice for the new ways of how people work. (Nokes & Kelly, 2008.)

The goal of agile is to give project management ease of access and flexibility to adapt to different working environments and appropriate for any organization to freely use to their ideal norms. This thesis focuses on researching the different agile methods and how they connect to lean thinking — finding common principles and guidelines that link agile and lean thinking or what might differentiate them in project management. (Beck et al., 2001.)

The use of agile and lean has become more transparent in today's world of project management and software development. How agile and lean adapt is bringing up interesting questions of how the used methodologies and principles are helpful. (Adzic, 2011.)

However, the unmistakable sign of these methods moving and adapting to different environments is showcased with different case studies and organizations introducing agile and lean into their workflow from previous

knowledge of bettering the workflow and growth of the organization. (Adzic, 2011.)

Lean is an old technique in manufacturing, after its numerous benefits were noticed, lean quickly became stable in different fields such as digital service design and software development. With the rise of digitalization and advancements in project management, the use of these different methods evolve every day (Gothelf & Seiden, 2013)

This thesis will focus on the basic methods and principles surrounding agile and lean by creating an overview of the similarities and differences. The research will be conducted as a literature review consisting of notable works relating to different agile methods and previous research on the topic to help create a clear picture of what agile and lean is meant and capable of doing for project management.

The first section of this thesis will present the terminology and define what is agile and lean. This is to better understand the core components of this thesis since the broad term of agile as a method can be used in different forms. The aim is to explain agile project management as its own method while later opening the other methodologies.

Lean thinking is the second component opened in the first section of this thesis. As lean thinking is used in many different fields with adaptive capabilities to suit the needs of the project. Understandings the terminology for the thesis will focus on showcasing the original coined term and how it evolved into software development and service design.

The part following the terminology will showcase the method used in this thesis. The explanation of how the literature review works and is used to answer the research question of this thesis. This will give a better understanding throughout the thesis on how the literature review is a valuable part of finding the connection between agile and lean. As for the last part of this thesis, the

conclusions and possible results from the literature review will be showcased for possible findings related to the research question.

2 Terminology for the thesis

This chapter explains and creates a clear picture of the terminology used throughout the thesis. The focus will be on agile and lean and what they are as well as what they are used for. Separating agile and lean in this section makes it easier to understand the methodologies. The capabilities of being integrated into different methods and organization principles.

The different agile methods and how lean is built are opened more with the literature review — giving a clear picture of how the methodologies and techniques come together in agile and lean. Showing how agile and lean are used in organizations today, making it as clear and easy to understand throughout the literature review.

2.1 Agile project management

Agile is used more as an umbrella term throughout the literature review. Agile as a project management methodology and mindset varies depending on the topic and selected publications for the literature review in this thesis. References on agile are solely dependent on how the piece of literature portrays it.

Agile project management is the method of iterating and building on an already established project. Iteration means the process of repeating set instructions numerous times, each time applying it to the result of the previous stage (Oxford University Press, 1948).

Traditional project management consists of five steps; Initiating, Planning, Executing, Monitoring and Controlling and Closing (Project Management Institute, n.d). The agile method builds on these five steps, giving the people

working on the project the ability to adapt and solve flaws that might have been unnoticed otherwise (Beck et al., 2001).

As agile is most often considered a project management method, this is not always the case. The wide variety of different tools makes it difficult to call agile a single project management method. In comparison to other agile methods thinking of it more as a mindset to create the perfect methodology for the current project. (Beck et al., 2001.)

A group of developers called the Agile Alliance wrote a document called The Agile Manifesto because of the profound change in how project management was handled with the shift to using the internet and focusing on software over products in numerous organizations. It details key values and principles that software developers should adhere to for their work. While the manifesto is focused on software developers, the principles and values are easily translated for designers. The Agile Manifesto was originally published in 2001, which is essential to note but it should be kept in mind that the Agile Manifesto does not specify any methodology or frameworks. A valuable mindset for developers. The agile values show on the list can still be used for today's agile project management methods and frameworks, and how it can be seen in these different tools. (Beck et al., 2001.)

- Individuals and interactions over process and tools.
- Working software over comprehensive documentation.
- Customer collaboration over contract negotiation.
- Responding to change over following a plan.

The Agile Alliance goes further into these values with twelve given principles. The highest priority is to satisfy the customer through the early deployment of software to working together throughout the project. When being open to changes, even late in development the essential part of the agile process is to adapt to customers' needs in a shorter timescale. To make the working

environment possible for agile. It is important to find motivated individuals who can get the job done without interfering and added guidance. Showing the working software or design is the primary measure of progress. (Beck et al., 2001.)

Agile promotes sustainable development. The sponsors, developers, and users should maintain a constant pace indefinitely (Beck et al., 2001). To give continuous attention to design and technical excellence while focusing on simplicity and following self-organizing teams' requirements.

As the steps Agile Alliance lists can be extensive and some taken for granted today in digital service design, it is essential not to forget how different organizations worked before agile. Agile Alliance is not mentioned in today's teachings anymore with the continued evolution of agile and how people work and create new methods and frameworks for agile. (Denning, 2018.)

When agile became more known and used, larger organizations began to adopt the mindset into theirs — changing the values and principles to suit their own needs and on a much larger scale with numerous teams and ongoing projects. The Toyota Way is a set principle for Toyota Motor Corporation's management and production system (Stanford, 2011). The Toyota Way is one of the more famous examples of how agile has adapted and is used on a bigger scale. A tool to solve root problems and build a shared understanding inside an organization.

Toyota, throughout the years, evolved the principles to more concrete methods for their practices. It is important to understand small or big organizations' ability to change and use the agile mindset to build a more sustainable environment while still focusing on profitability. (Stanford, 2011.)

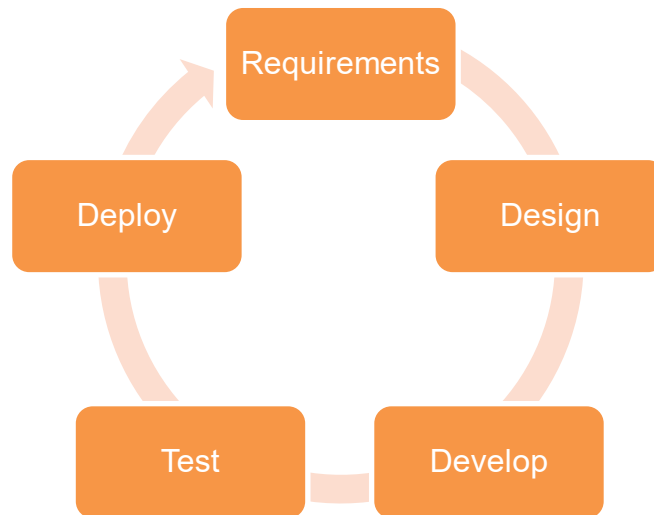


Figure 1. Visual interpretation of the agile cycle and the repeating nature of the production steps.

As seen in Figure 1, cycles in the agile project management make it possible for the designer to plan out when and how their product will be tested and iterated. Building and giving the product a constant lifecycle of new revisions and possible changes, this helps keep the users interested in using the product while following the trends and interest points of those users.

Agile can still be a single method; it can also create a new approach to a problem, building on it with the values the method teaches. The Agile steps and cycles have given the project teams more knowledge to incorporate these techniques into their own specific goals. They are pinpointing key elements they may have found useful and using them in the future, slowly creating their iteration of agile for use in organization management and software development.

This literature review also goes in-depth on the different aspects and methods relating to agile and lean. Some basics of how agile works are essential to help understand the other techniques for agile.

2.2 Principles of lean

Lean thinking is a core component of this thesis. The definition of lean thinking is expansive, but for clarity of this thesis lean is defined by the principles used in the book *Lean Thinking: Banish waste and create wealth in your corporation* by Daniel T. Jones and James P. Womack. Describing lean as a framework to prioritize human activities and return gives more value and reduces waste. (Womack & Jones, 2003.) Originally, Lean production became a known term from the book *The Machine That Changed The World* by Womack and Jones. The results of a five-year study on how the automobile industry was shaped and worked, analyzing and coining it as the term lean.

Lean has since evolved into different forms and adapted into numerous fields such as digital design, which is the focus of this thesis with the term lean thinking.

Lean thinking is a comprehensive and highly used technique in today's working environment. The main concern in all the different project management methods, including lean, is when and how to know which method to use? Lean thinking, therefore, must start with a conscious attempt to precisely pinpoint the needs and capabilities of what the product and service offers. The most typical way of handling and implementing lean into a company's practices is to rethink their fundamental values and needs and redefine their work. Realistically, no manager can implement these changes instantly, but it is essential to form a clear view of what is needed. (Womack & Jones, 2003, pp. 23.)

Other methods, just as agile, had cycles making and giving clear steps for the designers to proceed. Lean implements the same style into five principles that the designer needs to have in the back of their mind, the principles being (1) Define Value, (2) Value Stream, (3) Flow (4) Pull and (5) Aim for Perfection. In the list below these principles are made clearer.

- 1 Understanding where the current projects and works value is, what gives the client/user satisfaction, and is built-in at every step of the process.

- 2 What are the steps required to make the product? What are the steps required to deliver the service?
- 3 Make the value steps in a tight sequence so that the product will flow smoothly toward the client.
- 4 Invest as many resources on the product/service as pull from users to continue interacting with it.
- 5 Deliver exactly what the customer wants when they want it at a minimum price with zero waste.

Following the steps of the list leads to the lack of mentioned "waste." Examples of building up adverse effects such as waiting, overworking, and defects during the creative process. The goal of these principles is to only focus on the five mentioned principles and not straying from them, keeping the flow and value constantly in the users' minds.

As for this thesis, the centred use of lean as a term comes from the works of Daniel T. Jones and James P. Womack. The use of lean in different research papers and pieces of literature can vary, but the main goal for this thesis is to keep it always connected to the original mindset created by Daniel T. Jones and James P. Womack.

3 Research method

The thesis will consist of conducting a literature review related to the connection between agile and lean. This chapter will open the research methodology. Answering questions such as; What the research method is? What is the use of it? How is a literature review conducted? And why? The basic understanding of the review helps better understand the collected conclusions and discussion built upon further research and review of the subject of agile and lean.

This chapter will also consist of laying the foundation for the literature review conducted in this thesis. Showing the selected pieces of literature along with the structure of the review.

3.1 Literature review as a research methodology

A literature review can identify different points of a topic. It identifies areas of controversy or debate while also being informative, critical and valuable (Bolderston, 2008).

A literature review is a commonly used format with different ways of conducting the research. It is capable of being moulded and used for the wanted subject area. The research on what is known in the research topic and analyze the selected literature to evaluate and highlight future research questions. The new research questions can give a new direction and focus on the more essential points. A literature review can also provide a clear and concise review article to give an overview. Furthermore, to give better understanding to the reader of the topic and be easy to understand and comprehensive. (Bolderston, 2008.)

When conducting a literature review, the primary goals should be clear and easily separated and understood. Barbara Steward from the British Journal of Occupational Therapy (2004, p. 496) lists the important key factors in a literature review

- Comprehensive
- Fully referenced, giving reliable sources
- Selective, using and understanding what is appropriate to include and exclude off the review
- Relevant, focusing on the research topic
- A combination of ideas and key themes
- Balanced, comparing different theories and practices
- Critical, evaluating the collected and concluded research
- Analytical, developing new understanding from the available evidence.

A review is not a simple summary of published articles but a method that seeks to define and explain concepts, terms and developments. A literature review should bring discussion and conclusions (Steward, 2004, p. 499). A literature

review typically has different approaches in how the review will be conducted. The notable ones are a systematic literature review, semi-systematic review and integrative review. (Snyder, 2019.)

The systematic literature review aims to identify different forms of empirical data that fit the research topic and answer the research question — using systematic methods such as mapping, meta-analysis and analyzing data (Snyder, 2019, p. 334). Most often used in medicine and human health with the precise and data-driven analysis, not giving much room for discussion (Steward, 2004).

Semi-systematic review often looks at how research within a selected field has progressed over time or how a topic has developed across research traditions. In general, the review seeks to identify and understand all potentially relevant research traditions that have implications for the studied topic, giving future research the chance to be acted upon the conclusions of the review when more questions and a clear picture of the review is conducted and complete. (Snyder, 2019, p. 335.)

The integrative review is closely related to the semi-structured review approach. In comparison to the semi-structured review, an integrative review usually has a different purpose, to assess, critique, and combine the literature on a research topic in a way that enables new theoretical frameworks and perspectives to emerge. (Snyder, 2019, p. 335.)

For this thesis, the factors of the research topic and scope of the topic make it essential to select and justify the use of one of these review formats for the thesis. Researching the way that literature reviews work and the preceded knowledge of the thesis topic. The selected approach for the literature review will be an integrative review. The opportunity to compare different works in a semi-structured manner while simultaneously selecting a diverse selection of different pieces of literature helps to create clear conclusions and future research perspectives. An already approved format makes it easier to focus on the thesis topic and not the literature review format, having it be straightforward and easy to understand from the very start.

3.2 The use of literature review for this thesis

The literature review for this thesis starts with identifying and retrieving previous literature and papers to figuring out what is essential for this literature review. Information search and documentation retrieval can be done in different ways (Steward, 2004). The list below shows how this thesis will be accomplished.

- 1 Background knowledge and research on the topic.
- 2 Developing the research question.
- 3 Information and documentation retrieval for the review.

Conclusions and remarks from the analyzed review.

4

The search strategy for this thesis was mainly conducted using online search tools among previous knowledge of the thesis topic. Along with the use of abstract and citation databases such as Scopus. In addition full-text databases using Metropolia UAS library services MetCat links to databases such as ScienceDirect, ResearchGate and Emerald, along with ACM Digital Library. Google Scholar, the web search engine, was used to highlight keywords and research the wide range of different sources to see how the topic has previously been researched. The works of literature were handpicked with previous knowledge and understanding of the contents while developing the research topic for this thesis, making it easier to understand and open for this literature review.

Keyword uses on the online search tools varied greatly from simple terms such as Agile, Lean, Project Management. Later, when focusing on the more specifics of the thesis topic, keywords such as Teal, Kanban, Scrum, Digital Transformation, Service design, Process mapping, organizational culture and Lean management were used. All the keywords were looked up were in English, and no further research in different languages was used in the online search tools.

The immense amount of previous research made it essential to separate and take note of the differences while also focusing on the topic of this literature review. Therefore giving connections between agile methods and lean thinking. Consequently analyzing numerous different articles and web publications. The selected pieces for this literature were made with a simple and straightforward goal; to give simple and transparent information on the selected method and how it is used in today's world.

Finally, the material for the research was selected to highlight different works of literature and only a few articles and case studies (table 1). It consisted of mainly works of literature and fewer articles.

Table 1. Selected material for the final literature review.

Author(s)	Title	Theme	Year	Source
Andrew Stellman, Jennifer Greene	Learning Agile: Understanding Scrum, XP, Lean, and Kanban	Learning Agile is a comprehensive guide to the most popular agile methods, written in a light and engaging style.	2014	MetCat - Online database search tool
Frederic Laloux	Reinventing Organizations: A Guide to Creating Organizations Inspired by the Next Stage in Human Consciousness	Practical detail how organizations large and small can operate in this new paradigm of teal.	2014	Previous research on the topic

Gojko Adzic	Specification by Example: How Successful Teams Deliver the Right Software	Practices and case studies for creating software based on realistic examples.	2011	Reference
James P. Womack, Daniel T. Jones	Lean thinking: banish waste and create wealth in your corporation	What is lean? Identifying the value of the sustainable way of thinking.	2003	Previous research on the topic
Eric Brechner	Agile Project Management with Kanban	Use kanban to maximize efficiency, predictability, quality, and value	2015	Previous research on the topic
Jeff Gothelf, Josh Seiden	Lean UX: Applying Lean Principles to Improve User Experience	Lean in use in the world of digitalization and web-driven design.	2013	Previous research on the topic
Gaitis Kasims	Applying Lean to Improve Quality in Software Development projects	Software development has been dominated by agile. How lean might benefit them more.	2018	ACM – Online database search tool
Ken Schwaber, Mike Beedle	Agile Software Development with Scrum	Basics of scrum with a focus on software development.	2001	Google Scholar – Search engine
Pilar Rodríguez, Mika Mäntylä, Markku Oivo, Lucy Ellen Lwakatare, Pertti Seppänen, Pasi Kuvaja	Chapter Four – Advances in Using Agile and Lean Processes for Software Development	Combining Lean-Agile to improve productivity and value.	2019	MetCat - Online database search tool

The selected material covers the basics of some of the agile methodologies as well as lean thinking. Andrew Stellman, Jennifer Greene *Learning Agile: Understanding Scrum, XP, Lean, and Kanban* focus on the basic principles of each agile method being a seminal work for this thesis. Additionally, the book by Frederic Laloux *Reinventing Organizations: A Guide to Creating Organizations Inspired by the Next Stage in Human Consciousness*, Eric Brechner *Agile Project Management with Kanban* and Ken Schwaber, Mike Beedle *Agile Software Development with Scrum* bringing and showcasing the use of teal, kanban and scrum.

James P. Womack and Daniel T. Jones in *Lean thinking: Banish waste and create wealth in your corporation* is the second seminal work for lean in this literature review. The book by Womack and Jones has been used for a lot of research into lean, also being one of the first works to coin the term lean in project management.

For Gojko Adzic *Specification by Example: How Successful Teams Deliver the Right Software*, the literature review will only focus on part 3 of the book going in-depth into different case studies and it provides an example of how agile methods have helped the development of software and how it managed.

The articles *Applying Lean to Improve Quality in Software Development projects* (Gaitis Kasims) and *Chapter Four – Advances in Using Agile and Lean Processes for Software Development* (Pilar Rodríguez, Mika Mäntylä, Markku Oivo, Lucy Ellen Lwakatare, Pertti Seppänen, Pasi Kuvaja) focus on the implementation and use of lean and agile in today's world of digitalization and software development. The use of these articles brings up key elements of this literature review and the possibility of the research done of these articles to give different perspectives and conclusions of how the connection of agile and lean work in project management. *Lean UX: Applying Lean Principles to Improve User Experience* by Jeff Gothelf, Josh Seiden also has a supporting role in this

literature review to give a clear picture of how lean is used in development. A simple step-by-step guide on why and how lean takes part in such a project.

The focus on taking a deeper look at lean as the mindset may become more transparent and easier to understand with the similarities to agile throughout the review.

Table 2. Example of highlighted specifications to categorize the literature review.

Title	Excerpt	Review Chapter
Learning Agile: Understanding Scrum, XP, Lean, and Kanban	But for a Scrum team to become effective, they need to do more than just follow the basic Scrum pattern. Effective Scrum teams are self-organizing.	Scrum
Lean thinking: Banish waste and create wealth in your corporation	We concluded that lean thinking can be summarised in five principles: precisely specify value by specific product, identify the value stream for each product, make value flow without interruptions, let the customer pull value from the producer, and pursue perfection.	Concept of lean and the link to agile

The categorization was separated into two sections and the conclusion because of the two seminal works Andrew Stellman, Jennifer Greene *Learning Agile: Understanding Scrum, XP, Lean, and Kanban* and James P. Womack, Daniel T. Jones *Lean thinking: Banish waste and create wealth in your corporation*. The highlighted specification of each book is focused on the parts of the review with the example shown in table 2.

4 The connection between agile methods and lean thinking

Separating the review into two sections helps focus and separate agile and lean. At the same time, this review aims to find the connection between the two methods. When separating them into their own categories and topics before presenting the connections and findings from the literature review, it is easier to open the methods and create an understandable baseline to the connection between agile and lean. The first part of this review also explains the reasoning behind the selected methods and the better use and connection between lean and agile.

4.1 Agile methodologies

This first section of the literature review will focus on the fundamental principles and most used agile methodologies. The methods show how agile is used in organizations and how it has helped management and made a more significant contribution to organizations. It is still essential to take a neutral attitude towards the methodologies during this literature review, such as some literature pieces. There is no reason to force an agile method into a work cycle if there is no clear incentive.

This section will also pinpoint key principles from each of the selected methodologies, trying to find common ground between all the methods. What the purpose truly is in agile project management, and how does it work and get intricately with lean thinking.

The book by Andrew Stellman, Jennifer Greene *Learning Agile: Understanding Scrum, XP, Lean, and Kanban* focuses on XP as a method in agile. This review is not focusing on it with the distinct similarities of scrum. Also mentioned by Andrew Stellman, Jennifer Greene in *Learning Agile: Understanding Scrum, XP, Lean, and Kanban* how scrum, XP and lean overlap. The focus on overlapping only scrum and lean help separate and make distinct differences between agile methods and lean.

XP (Extreme Programming) is very strictly built around software development and focusing on adapting to change, such as the other methodologies. However, besides the connection of clients and programmers, the method does not give anything else to other teams inside organizations. Scrum and the other methods cover the software development in the same framework while also incorporating everyone else in the team to contribute. (Saleh et al., 2019.)

4.1.1 Teal

In the book *Reinventing Organizations: A Guide to Creating Organizations Inspired by the Next Stage in Human Consciousness*. Frederic Laloux explains teal organizations. A theory that enables self-management inside organizations using it to adapt to further give growth and change (Laloux & Wilber, 2014).

The idea of teal came to Laloux as he began thinking and breaking down the past and present organizational models, finding them to impact human consciousness negatively. The goal is to create a more human-centred management method, creating less hierarchy and central command for peers to follow. (Laloux & Wilber, 2014.)

Developmental Stage	Guiding metaphor	Breakthroughs	Examples
Teal	Living Organism	Evolutionary purpose Self-organization Wholeness	Design agencies Software development
Green	Family	Focus on empowerment Boost employee motivation Shareholders as primary focus	Franchising businesses Airlines
Orange	Machine	Beat competition Accountability Meritocracy	Multinational companies Investment banks
Amber	Army	Hierarchy Formal roles Stable and scaleable	Government Military
Red	Wolfpack	Top-down authority Division of labor Short-term focus	Organized crime

Figure 2. Development stages of the Laloux cultural model.

The term teal derives from the previously mentioned book. Differentiating organizational structures with basic human needs and collaboration breakthroughs. Laloux breaks down these systems with the use of metaphors to better explain the human-centred approach of the book. For this purpose Laloux gives examples of the structure.

Example of Impulsive-Red being a hierarchical structure built by Laloux. As for teal being more self-managed and replacing the pre-existing ways (Figure 2). As Laloux explains, teal as an evolutionary purpose, wanting to refine and shape the organizations' purpose, for now, allowing it to adapt for the future of management. (Laloux & Wilber, 2014, pp. 193).

The way Laloux breaks down these different hierarchies is also known as the Laloux cultural model, which has been adopted into agile (Denning, 2018). Giving the means of differentiating how organizations work and innovate the way people approach the values of corporations (Womack & Jones, 2003).

In the book, Laloux finds the importance of human-centred management significant. This connects to the agile mindset of collaboration and self-organizing to support the needs of the end-user. Laloux does not forget to mention the structure of teal and the importance but still claiming the significance in flexibility and adapting. Overall, in agile other methods may have a more precise structure than others, making it essential to find the necessary methods to work in the wanted collaboration.

Laloux's research results and the book do not prove or disprove that teal will deliver better human performance in organizations. In addition, mentioning how personal experience may conclude a more apparent answer of the benefits of teal showing the importance of first-hand experience and non-theoretical aspect of agile (Laloux & Wilber, 2014, pp. 287). The key drivers of breakthrough performance such as individuality, learning through self-management, better use of talent and less wasted energy on menial tasks (Laloux & Wilber, 2014).

4.1.2 Kanban

Eric Brechner *Agile Project Management with Kanban* showcases the basics of kanban and the value the method can give to projects. The whole book acts as a case study from Microsoft for the development of Xbox. Eric Brechner is a software developer at Microsoft, showcasing how a large corporation uses kanban as a method and technique to help development in a large organizational environment. (Brechner, 2015.)

Kanban is a workflow management method. It aims to help visualize work, maximize efficiency, and improve continuously (Brechner, 2015). From Japanese, kanban is translated as billboard or signboard. Originating from manufacturing, it became a stable part of agile project management and software development. Later, after more prominent organizations started to use kanban, business units started getting recognized across various industries such as digital service design companies and smaller start-ups. (Brechner, 2015.)

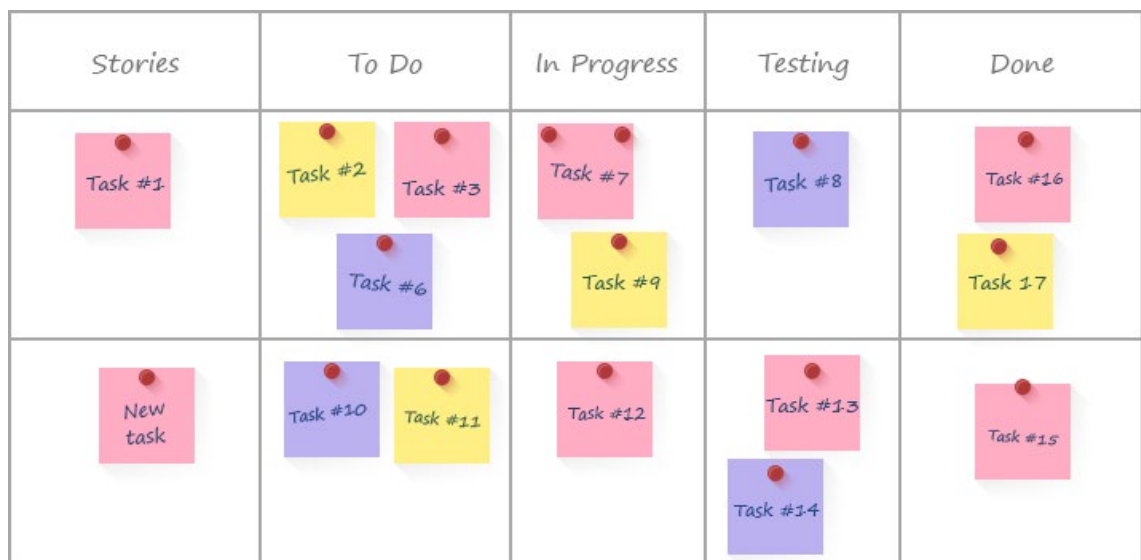


Figure 3. Example of a kanban board with kanban notes.

Kanban is a unique method because it is an even more hands-on approach than any other agile methods as seen in figure 3. The use of a flexible selection

of "kanban boards" and "kanban notes". These simple basics let anyone create and control their kanban boards with different current project stages. In today's world, Agile teams' usage is so widespread that it can often be heard that people refer to Kanban boards as agile task boards (Brechner, 2015).

An author named David J. Anderson in the late 2000's revised how kanban was managed. The focus moving from building kanban as a tool for agile and not its own methodology. Utilizing the methods that kanban is known for. (Brechner, 2015.)

Brechner explains how adapting from a different method to agile and kanban can be a daunting request in a larger organization, likewise the shift from the waterfall technique and a more linear development streams to agile. A clear and structured beginning needs to be made to keep the workflow and efficiency up and ongoing through the project. (Brechner, 2015, pp. 14-18.)

Throughout the book, Brechner reminds the reader of remembering how kanban started as an evolution of another method (muda, mura and muri — the wastes of unevenness, overburdening, and futility) and the agile mindset, making a reasonable assumption and letting the reader ponder if there is an even better method to be used in the future or could kanban be adapted further into another mindset such as lean (Brechner, 2015). Significant steps to improve beyond kanban Brechner lists are critical thinking, lean development to reduce waste, and optimization on a more global scale, mainly focused on larger organizations such as Microsoft to act on. (Brechner, 2015, pp. 143-146.)

Andrew Stellman, Jennifer Greene in *Learning Agile: Understanding Scrum, XP, Lean, and Kanban* sums up kanban as an adaptive system to catalyze a lean outcome for the organization. The core values of kanban translate very clearly to lean thinking with the practices both kanban and lean use (Stellman & Greene, 2013). The difference between kanban and the other mentioned methods is the visualization of the workflow. The other agile methods have visualization methods, but it is never the focal point besides MVP's (Minimum viable product) as the main reasoning behind the method.

4.1.3 Scrum

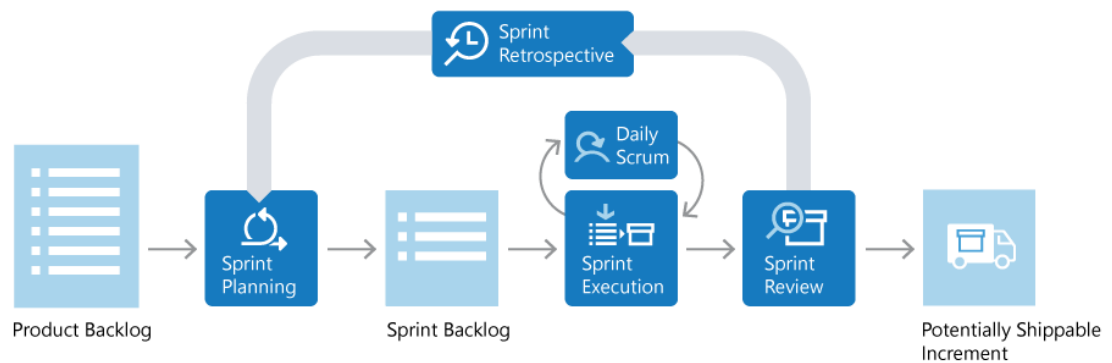
Scrum is one of the more popular agile methods being used by organizations and software developers, making the findings and connection to lean more complex. Whereas using two pieces of literature, first being by Andrew Stellman, Jennifer Greene *Learning Agile: Understanding Scrum, XP, Lean, and Kanban* and secondly Ken Schwaber, Mike Beedle *Agile Software Development with Scrum*. These works of literature will explain the use and basic framework of the method to understand it better.

Scrum gives the opportunity to self-organize teams to find and work towards the common goal using iteration and adapting to new changes, letting the team quickly create viable products to be tested and for gathering feedback.

Scrum consists of fixed standards used to make the given time and work as efficiently as possible. Scrum consists of three roles: product owner, Scrum Master, and development team. It is using fixed-length iteration periods called sprints which are smaller deadlines inside the product development process, allowing for further iteration with the constant use of sprints with a new one starting immediately after the previous one's conclusion (Stellman & Greene, 2013, pp. 87). It is essential to carefully plan the sprint with clear goals, scoping the work, and expect it.

The product owner works with the rest of the team to maintain and prioritize a product backlog of features and requirements that need to be built (Stellman & Greene, 2013, pp. 87). The Scrum Masters' job is to keep the project rolling, working with the team to solve roadblocks discovered from sprints. Scrum Master demonstrates the product to the client. Every day there is also a daily scrum which are timed meetings held possibly at the same time each day to go through everyone's progress and possible roadblocks on the project's development. Daily scrums are different from sprint reviews which are retrospectives held after a sprint has concluded, reviewing progress and seeing how to better the next sprint (Schwaber & Beedle, 2001).

Figure 4. The flow and cycle of the scrum process (Boer, 2017).



The scrum rules may sound strict and not flexible. However, the simple methods and steps allow for further agile working inside the sprints and reviews. The strict values and timetables allow the work to be followed through progression and constant adapting for the clients' needs before the deadline, following the structure of figure 4. The similarities to other methods come more transparent and give the strict and not flexible method a better and simpler understanding.

For a long time, scrum has been used by software developers, having been integrated further into more giant corporations. Scrum has evolved to adapt into big product groups with the help of other agile methods. Large Scaled Scrum (LeSS) is the same structure as the basic scrum framework. However, the structure has been changed to better benefit and incorporate larger teams and coordination between sprints, daily scrums, and agile principles. Giving a chance for the corporations to coach newcomers the mechanics more easily (Schwaber & Beedle, 2001).

Schwaber and Beedle explain, the basics and intricacies of scrum. The framework for scrum is very structured, and team focused. The idea of scrum being a self-organized agile method sounds as if it allows adaptive behaviour, which might happen following the meetings, unlike the stable working environment of the previously mentioned agile methods. Scrum strives for

continuous iteration and improvements, optimizing it throughout the use. (Schwaber & Beedle, 2001.)

Scrum is easy to adopt into any organization but challenging to master the practices and collect the wanted results (Stellman & Greene, 2013). The book *Learning Agile: Understanding Scrum, XP, Lean, and Kanban* the commitment that scrum needs to be a viable method, making it not as adaptive as the other methods.

4.1.4 The use of agile methods today

Specification by Example: How Successful Teams Deliver the Right Software by Gojko Adzic showcase case studies of different agile methods in use through development cycles in big and small organizations for software development. The notable works for this review are selected from part three. As the other pieces of literature have focused more on the way the methods work in the larger scheme, Adzic gives a clear picture of how agile methods have been used in the natural working environment, revealing possible positives and negatives. (Adzic, 2011.)

The case studies described by Adzic may feel like common knowledge to someone with knowledge of the field. It is still important to note and have a clear example of how agile was used and adapted to different scenarios and not just the theory side of the method and framework.

Adzic showcases six different cases with the process, results and key lessons. This review will focus on the common points of all case studies and the variety of different agile methods. How did the organizations and development teams succeed?

Notable case studies for this review are uSwitch, Sabre Airline Solutions, and Songkick. The listed case studies all had a revelation of switching to agile methods by different means, with more successful results. Adzic does not

hesitate to mention the possible negative effects and how some project teams did not handle the move to agile as nicely as it is always stated. (Adzic, 2011.)

The UK electricity supplier uSwitch, one of the most active and used websites for services and products for matters significant to people's daily lives, such as insurance and credit card providers. The complexity of the number of features and necessities the organization had made it difficult for the company to adjust to new methods to benefit them and ease the workflow. (Adzic, 2011.)

The organization was using the known Waterfall development process for a long time, but after a small operations negotiation, the organizations decided to attempt to go agile, implementing a straightforward scrum model and quickly realizing the improvement both in productivity and quality. (Adzic, 2011.)

Adzic mentions that it is essential to note that the organization did not mention moving the development process to agile but only wanting to improve the quality, leading to the use of scrum. Instead of making a sudden movement to agile, the organization did it slowly with over time improvements. As the method made it easier for people inside a large organization to cooperate and trust each other. (Adzic, 2011.)

Sabre Airline Solutions is a Software as a Service company (SaaS) giving solutions to the aviation industry with the use of software and help better market the client's organization.

SBE (Sabre Airline Solutions) prioritized quality and little room for mistakes in the stringent aviation industry. The process of reorganizing the organization made it a risky process. The main goal of SBE was to find collaboration inside the organization leading to better the quality of the product while letting the clients contribute and engage in the development process. As the industry was not keen on change, prior training and explanation of the change were necessary, leading to difficulties. After some forms of failed attempts and not meeting expectations, SBE would continue development on a more linear

process, but still incorporating collaboration from the development teams and clients from time to time. (Adzic, 2011.)

The important note from the SBE case study shows the importance of what field is capable of such vast change in a short period. SBE did not specify they moved into agile, but collaboration and engaging in smaller groups to solve problems throughout the projects made it clear what the incentive was. However, with a vast amount of legacy code and older clients, it became a problem to implement appropriately.

Songkick is a UK-based start-up operating a website about live music. Adzic specifies the importance of this case study as Songkick is a start-up implementing agile methods in the early life of the organization without worrying about the reaction of older clients and a legacy framework. The route Songkick decided to pick for going agile was based on the kanban flow. Separating teams and all were contributing to the exact chosen kanban method. (Adzic, 2011.)

Adzic describes the benefits Songkick got from early implementation and using kanban from collaboration, shared understanding and focusing on the crucial matters and not getting caught up in minor problems alongside explaining their reasoning for using agile. (Adzic, 2011.)

As all these case studies and numerous more focus on how an organization adapted to innovations. Some succeeding better than others. The key lessons learned from these showcases some of the previous literature pieces this review consists of while finding new exciting points for further research. Adzic, in most cases, does not go too deep into the reasoning of why the organizations did the switch, raising more questions on why the leap into the new methods was taken. Seeing how other organizations succeeded and benefited from the use of more agile methods? The companies did not select a method but slowly adapted and formed a more coherent method such as kanban or scrum (Adzic, 2011). It could be interesting to see more case studies of organizations simply picking an agile method and seeing how it evolves in the organization, for example, how Songkick implemented kanban.

Most of the case studies focusing on software development moved to the route of scrum, which has been mentioned in the other works as an easy to implement method for software development even in larger organizations. The prior knowledge of agile and lean could have had a hand in incorporating the frameworks into the organizations, but it is unsure if this were the case with no precise results.

As the book by Adzic is also older and the fast evolution of agile and lean the companies listed for the case studies could have changed how they work inside the organization.

4.2 Lean thinking

The second part of this review focuses on lean thinking. On some notable pieces of literature and previous research papers on how lean has evolved and adapted with digitalization and how organizations work in today's world of project management. alongside the other pieces of research done with the differences and uses of lean and agile together. The book by James P. Womack, Daniel T. Jones *Lean thinking: Banish waste and create wealth in your corporation* is used through all the different pieces of literature in this part of the review.

Andrew Stellman, Jennifer Greene *Learning Agile: Understanding Scrum, XP, Lean, and Kanban* section of the book with lean focus on the mindset it gives for agile project management, mentioning the overlap of the different agile methods and lean. The overlapping elements of the previously mentioned agile methods and frameworks are straightforward for lean, such as focusing on essential steps, feedback, and iteration (Stellman & Greene, 2013).

The parts of the review will focus on elements of lean such as eliminating waste and building a transparent and whole picture of the use of the lean mindset and how it adapted into a mindset for agile from lean manufacturing and production lines (Womack & Jones, 2003).

4.2.1 Concept of lean and the link to agile

In the book *Lean thinking: Banish waste and create wealth in your corporation* James P. Womack, Daniel T. Jones go in-depth in the principles of lean, noting and identifying the reasons behind the (5) principles that make lean. Womack and Jones' view through the book is comprehensive and focuses more on the lean production and manufacturing, a hybrid of the manufacturing method Toyota incorporated into their manufacturing pipeline. The coined method used by Toyota was later described as an agile method. Womack and Jones use it as a pure example for lean thinking along with different production case studies such as Tesco and the production of a carton of cola. (Womack & Jones, 2003.)

The book by James P. Womack and Daniel T. Jones separates the contents into different parts. The first part being principles, second the lean leap and finally use in enterprises. The first part of the book focuses on the core five principles of lean thinking, as well as the mentioned reduction of waste explaining the reasoning behind the principles and what added value they bring to the mindset of lean thinking. Womack notes how he defined and created the principles, with the core component to challenge the traditional values given through management. The goal of giving the principles such as "value" a new understanding of what it means. (Womack & Jones, 2003.)

The second part of the book focuses more on case studies and different tests that lead Womack to further research and introduce the principles of lean. The second part consist more of case studies of manufacturing and engineering design proposals. (Womack & Jones, 2003.)

The principles of lean described by Womack and Jones are easily relatable to different agile methods. Still, with the focus of removing waste and giving a clear point by point examples of what is the goal of lean thinking without having the same goals as an agile method (Stellman & Greene, 2013).

These case studies have difficulties in translating to the needs of this thesis and literature review. Some elements of the studies have apparent similarities to

agile methodologies, but not enough to bring a clear understanding of it in today's era and ways of management and development.

The last part of enterprise and organization management has clear similarities to the works from Frederic Laloux *Reinventing Organizations: A Guide to Creating Organizations Inspired by the Next Stage in Human Consciousness*. They are giving common goals of how to communicate and build a coherent structure in an organization. Womack and Jones do not focus on smaller organizations such as start-ups, possibly because of the publication date and how start-ups are more relevant in today's world.

When lean is thought of as a mindset, the clear comparison to agile methodologies can become problematic. Understanding the value stream Womack and Jones describe through the book makes it easier to understand and connect the principles to agile methods of showcasing products and iterating based on the client's needs.

4.2.2 Lean principles for digital implementation

In the book *Lean UX: Applying Lean Principles to Improve User Experience* by Jeff Gothelf, Josh Seiden goes further into the usage of lean while developing the user experience of a service or software. Gothelf and Seiden have a common principle of not limiting software development and design into principles already used and known beforehand. In this case the benefit of experimenting with new ways of approaching different scenarios in a project. In particular the possibility of using techniques from other fields for development and design. (Gothelf & Seiden, 2013.)

This is where lean comes in as the internet has changed how software is distributed in different ways. Most software is distributed online. Given the opportunity not to limit ourselves in old processes and working in strict timeframes. (Gothelf & Seiden, 2013.)

Gothelf and Seiden explain how UX (User Experience) is the modern version of product design. Implementing lean into UX can give better chances of collecting feedback, engagement on the product and communication between the team and the client. The book also notes the important matter mentioned with lean. Being that lean is a mindset, simply understanding the process and principles can benefit the designer's workflow.

Gothelf and Seiden differentiate the lean principles into something more straightforward and more understandable from the principles Womack and Jones have written in their works. Creating a foundation to better understand lean and agile.

Design thinking is a broad term like lean thinking to conceptualize designs and the development route. The book itself very simply explains design thinking from Tim Brown, CEO and president of IDEO Design, the focus on observation and understanding the needs of the users and client. Understanding and taking part in every process of the development and design. The opportunity to give everyone in the team the chance to work beyond their typical boundaries. (Gothelf & Seiden, 2013.)

Gothelf and Seiden explain the importance of understanding design thinking to better understand Lean UX (Gothelf & Seiden, 2013). In the previous pieces of literature throughout this review, design thinking has never been mentioned as a core mindset.

The other parts of the foundation by Gothelf and Seiden focus on Agile and Lean. Mentioning how iteration and communication with the team and client are still the most critical factors, such as the previous pieces of literature in this review. The book itself jumps around different known frameworks and mindsets, showcasing the opportunity for anyone to adapt and find the method they might see fit for themselves.

An interesting point in the Lean UX book is how implementing lean into different agile methods such as agile is shown to be more accessible and revealing the

possible similarities between scrum and the structure of how lean is used in UX design. (Gothelf & Seiden, 2013, p. 98.)

The book *Lean UX* focuses more on how lean is used in user experience design rather than explaining why it might be more viable as a method — going deep into the different aspects of UX design and how to iterate and create MVPs for the client's needs is very important. Collaboration during a project is important in UX design, like in all the agile frameworks.

The similarities can be noticed through the book with different agile methodologies and some distinct differences. In contrast, the previous works of literature focus on lean. This book gives a glimpse of it in a more complex and diverse field such as UX design. Allowing the reader to figure out the best route to take and how lean might benefit them or the organization. Gothelf and Seiden conclude *Lean UX* as a blend of Lean thinking, Agile and design thinking. To Give the idea of thinking of *Lean UX* as its own mindset for user experience designers and software developers and straying away from the mindset of lean and more of a framework such as agile has showcased.

4.2.3 Lean and agile processes for software development

The final part of this segment in the literature review focuses on two recently published articles relating to the connection of lean and agile in software development. *Applying Lean to Improve Quality in Software Development projects* (Gaitis Kasims) and *Chapter Four – Advances in Using Agile and Lean Processes for Software Development* (Pilar Rodríguez, Mika Mäntylä, Markku Oivo, Lucy Ellen Lwakatare, Pertti Seppänen, Pasi Kuvaja).

In this review, a comparison between these two articles for similarities and differences. Thus showing the approach from two different views while using the exact keywords such as agile and lean in software development. Both articles cover the basics of agile and lean, from the agile manifesto to the age of information being the critical turning point. Similar to how Gothelf and Seiden

discussed the use of digital resources allowing more measured and focused development.

The article from Kasims builds the focus on the assumption that each of the previous works around agile methods and lean give to the development process. Therefore, the clear and distinct advantage of delivering a product faster and with good quality. The article goes in-depth and builds a case study trying to prove this matter. Lean implementation at more influential organizations such as the BBC Worldwide and Timberline Software shows the improvements of agile and lean. (Kasims, 2018.)

For the article, a study of how lean methods achieved such results was built along with observational studies of teams inside organizations shifting to lean and how they managed with it for a year. The results concluded with showcasing the quality and speed of the products created, but the biggest problem was the shift to lean and agile. Causing problems and making the overall results suffer for it. As the teams got more motivated and understood the methods, productivity also came with it. Showcasing similar results as Womack and Jones discovered in their works related to lean. (Kasims, 2018.)

Advances in Using Agile and Lean Processes for Software Development (Pilar Rodríguez, Mika Mäntylä, Markku Oivo, Lucy Ellen Lwakatare, Pertti Seppänen, Pasi Kuvaja) focuses on the same principles as this thesis. How agile and lean have become such a stable part of software development through the years. The trends of agile methodologies have become more used in today's start-ups and organizations. (Rodríguez et al., 2019.) The article goes into an in-depth review and analysis of the different agile methods and metrics behind the shift to agile and lean.

The article concludes with the clear distinction and benefits of agile and lean with the similar principles of the previous article from Kasims and the literature piece Lean UX from Gothelf and Seiden. The use of lean and agile is more of a stable structure because organizations used older methods such as waterfall

before. With time it is possible for lean and agile just being a regular part of any organization without understanding the origin of the methods and mindsets.

The article highlights the possibility of focusing the learning of agile and lean into teaching and allowing companies to adapt, experiment, and explore management methods. Showing the value of this may better give understanding towards agile and lean. (Rodríguez et al., 2019.)

These two articles show the variety of different agile methodologies but still linking the common points of each of the methods and mindsets together. The connection between agile and lean is there. However, people achieve it and conclude and see the actual benefits come from using it themselves over theoretical studies.

4.3 The connection between agile and lean

The final section of this literature review will focus on the connections between agile and lean with the reviewed pieces of literature. As the literature review was split into different sections, this section will focus on both together — the focus on highlighting the different connections between the methods and mindsets.

Agile as a project management method has always had a focus on the product and not the documentation. The people and organizations who have found benefits from lean have used the mindset in their work and not simply thought of implementing it to their smaller-scale projects. These works of literature are mostly guidelines to agile and lean for start-ups or larger organizations making the shift to modern solutions.

Whereas the organizations and start-ups adapt and use these methods. It is intriguing to see the different approach to project management. Every organization has differences and ways management is done. Identifying the precise reason and connection to why start-ups and organizations pick agile, and lean is difficult. The fundamental principles of lesser waste and higher

quality products in a smaller timeframe is something every organization strives for. Experimenting with the possible changes to achieve that is daunting and risky unless properly coordinated, such as the example from the case studies of Adzic.

The connection between agile and lean is, at times, apparent and sometimes very blurry. All depending on the use of the selected mindset and method. Gothelf and Seiden highlight the use of design thinking through the process of lean UX and agile methods. Being the possible key to understanding agile and lean is to focus on design thinking as a mindset.

As agile frameworks and methods adapt and shift people's needs, possible hybrid techniques are feasible. As time passes, lean and agile might be classified the same way as the waterfall technique is of being outdated and merely something to build upon, depending on the human-centred approach of organizations in the future. As people iterate and explain their techniques and mindsets, it may cause confusing results for people trying to understand the key elements of agile and lean.

5 Conclusions & discussion

The final part of this thesis will focus on the conclusions and how the literature review went, what could have been changed and possible future research topics, but also explaining some gathered essential points from the conducted literature review.

The literature review shows the adapting nature of both agile and lean. The value it brings and the way it is turning into the new norm of project management, as a topic of a literature review and the vast amount of research done on the subject. The difficulties highlighting the reason for the review are challenging to find. However, simultaneously proving the nature of agile and lean and the viability of the methods and mindsets with the literature review. As

the works throughout the literature review all have differences and ways, they have used lean and agile with different reasoning behind it.

From the book *Lean UX: Applying Lean Principles to Improve User Experience* by Jeff Gothelf, Josh Seiden focuses on the aspect of design thinking briefly. Therefore, giving the possibility of future research on how design thinking connects as a mindset to lean. The term lean is possibility fading or transitioning to design thinking to better suit the age of information and digitalization (Gothelf & Seiden, 2013). This could also be acknowledged through the different case studies from *Specification by Example: How Successful Teams Deliver the Right Software* by Gojko Adzic and research papers of the review. Organizations and start-ups have used the adaptive and iterative agile and lean methods but have not categorized the term simply using it as their own way of thinking (Adzic, 2011).

The mix of results collected from the literature review is broad and daunting. Not being a bad thing, but an opportunity to set the scene of future frameworks and mindsets to suit and not be restricted by already coined terms and methodologies. All the different pieces of literature had the common goal of explaining the already understood method but allowing the reader to use only a tiny portion of that knowledge while combining it with other methods they have research to fully come a capable part of their own development or management workflow.

Overall, the review did not come with expectations and possible conclusions built before the review. Opening the methods one by one in future research to only focus on, for example, kanban or scrum to better understand them might be beneficial for anyone who wants to learn more about agile project management and lean thinking. But giving more focus on the umbrella term of agile and the broad mindset as lean thinking has its difficulties in specifying and building expectations for this review and thesis.

For future research on finding the connection between agile and lean, possible expectations and wished conclusions should be formed through the literature

review. As for this thesis, it was left quite open for the opportunity to find these answers in a more precise sense. After conducting the literature review, the line between agile and lean might still be blurry and not give straight answers to the methodologies and mindsets besides building an understanding of the adaptive and iterative nature of agile and lean while also highlighting the coined term design thinking.

References

- Adzic, G. (2011). *Specification by Example: How Successful Teams Deliver the Right Software* (1st ed.). Manning Publications.
- Beck, K., Beedle, M., van Bennekum, A., Cockburn, A., Cunningha, W., Fowler, M., Grenning, J., Highsmith, J., Hunt, A., Jeffries, R., Kern, J., Marick, B., Martin, R. C., Mellor, S., Schwaber, K., Sutherland, J., & Thomas, D. (2001). *Manifesto for Agile Software Development*. <http://www.agilemanifesto.org/>
- Boer, G. (2017, April 4). *The Scrum lifecycle* [Illustration]. What Is Scrum. <https://docs.microsoft.com/en-us/azure/devops/learn/agile/what-is-scrum>
- Bolderston, A. (2008). Writing an Effective Literature Review. *Journal of Medical Imaging and Radiation Sciences*, 39(2), 86–92. <https://doi.org/10.1016/j.jmir.2008.04.009>
- Brechner, E. (2015). *Agile Project Management with Kanban (Developer Best Practices)* (1st ed.). Microsoft Press.
- Denning, S. (2018). *The Age of Agile: How Smart Companies Are Transforming the Way Work Gets Done*. Amaryllis.
- Gothelf, J., & Seiden, J. (2013). *Lean UX: Applying Lean Principles to Improve User Experience* (1st ed.). O'Reilly Media.
- Julião, J., & Gaspar, M. C. (2021). Lean thinking in service digital transformation. *International Journal of Lean Six Sigma*, ahead-of(ahead-of-print), emerald.com. <https://doi.org/10.1108/ijlss-11-2020-0192>
- Kasims, G. (2018). Applying Lean to Improve Quality in Software Development Projects. *Proceedings of the 2nd International Conference on Business and Information Management*, <https://dl.acm.org/>. <https://doi.org/10.1145/3278252.3278254>
- Laloux, F., & Wilber, K. (2014). *Reinventing Organizations: A Guide to Creating Organizations Inspired by the Next Stage in Human Consciousness* (1st ed.). Nelson Parker.
- Nokes, S., & Kelly, S. (2008). *The Definitive Guide to Project Management: The Fast Track to Getting the Job Done on Time and on Budget* (2nd ed.). Ft Pr.
- Oxford University Press. (1948). Iterate. In *Oxford Advanced Learner's Dictionary*. <https://www.oxfordlearnersdictionaries.com/>
- Project Management Institute. (n.d.). What is Project Management? Www.Pmi.Org. Retrieved March 9, 2021, from <https://www.pmi.org/about/learn-about-pmi/what-is-project-management>

Rodríguez, P., Mäntylä, M., Oivo, M., Lwakatere, L. E., Seppänen, P., & Kuvaja, P. (2019). Advances in Using Agile and Lean Processes for Software Development. *Advances in Computers*, 135–224.

<https://doi.org/10.1016/bs.adcom.2018.03.014>

Romero, D., Flores, M., Herrera, M., & Resendez, H. (2019). Five Management Pillars for Digital Transformation Integrating the Lean Thinking Philosophy. 2019 IEEE International Conference on Engineering, Technology and Innovation (ICE/ITMC), researchgate.net. <https://doi.org/10.1109/ice.2019.8792650>

Saleh, S. M., Huq, S. M., & Rahman, M. A. (2019). Comparative Study within Scrum, Kanban, XP Focused on Their Practices. *2019 International Conference on Electrical, Computer and Communication Engineering (ECCE)*, <https://www.researchgate.net/>. <https://doi.org/10.1109/ecace.2019.8679334>

Schwaber, K., & Beedle, M. (2001). *Agile Software Development with Scrum* (Series in Agile Software Development) (1st ed.). Pearson.

Shah, R., & Ward, P. T. (2007). Defining and developing measures of lean production. *Journal of Operations Management*, 25(4), 785–805.

<https://doi.org/10.1016/j.jom.2007.01.019>

Snyder, H. (2019). Literature review as a research methodology: An overview and guidelines. *Journal of Business Research*, 104, 333–339.

<https://doi.org/10.1016/j.jbusres.2019.07.039>

Stanford, N. (2011). *Corporate Culture: Getting It Right*. Wiley.

Stellman, A., & Greene, J. (2013). *Learning Agile: Understanding Scrum, XP, Lean, and Kanban* (1st ed.). O'Reilly Media.

Steward, B. (2004). Writing a Literature Review. *British Journal of Occupational Therapy*, 67(11), 495–500. <https://doi.org/10.1177/030802260406701105>

Womack, J. P., & Jones, D. T. (2003). *Lean Thinking: Banish Waste and Create Wealth in Your Corporation, Revised and Updated* (2nd ed.). Free Press.