Audencia
BUSINESS SCHOOL

PROFESSIONAL THESIS REPORT

"TO WHAT EXTENT CAN LEAN MANAGEMENT BE IMPROVED BY INTEGRATING AGILE APPROACHES?"

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" No one who achieves success does so without acknowledging the help of others. The wise and confident acknowledge this help with gratitude." (Alfred North Whitehead)

I would like in this occasion to express with all gratefulness my sincere signs of gratitude to everyone who expressed supports to me through all the journey of achieving this goal, I am really thankful for them.

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Thanking you,
Shadi RIZKALLAH
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1 Summary

This professional thesis focuses on determining how to improve a lean process by implementing agile approaches after defining lean methodology and agile mindset in terms of their advantages, the commonly known practices and challenges.

The problematic of this thesis is: “To what extent can lean management be improved by integrating agile approaches?”

The combination of the literature review, the semi structured interviews and the questionnaires allows us to answer this problematic and to propose some new reflective axes.

The literature review will present a historical view of the project management evolution and focus equally on lean and agile, in order to explore both concepts, highlight their values and see the points of resemblance and contradiction as well as their famous techniques and challenges.

The research methodology is a quali-quantitative study, based on 9 semi structured interviews conducted with people in decision making positions, and an online survey of 316 participants.

The survey responses highlight the level of knowledge and maturity of lean and agile approaches in the current and future work force, as well as the ability to work in lean or agile environments. In addition, the semi structured interviews consist as a valid resource from people who are active and in decision making position to help identifying if it is feasible to implement some agile approaches in lean process, and what are the conditions and the obstacles of such implementation. Their views enrich this research and help understand their needs in order to make adequate improvements to ensure a better experience and efficient results.

The fruit of this thesis is defining which agile approaches can be integrated into lean and justify the main reasons behind its integration by exploring the added values of such actions and illustrate which recommended actions should be taken to resolve any obstacles on human and technical levels.

2 Introduction

With the developing tendencies to drop regular and rigid project management techniques in the business word today and leaning toward more practical tools such as agile in the software development and lean in industry and manufacturing instead of the waterfall technique, and after the safe framework was able to integrate lean practices into agile project management and came up with the SAFe method, a debate took place in the industry world today whether it is feasible to integrate agile practices into a lean process.

On one hand, and according to (Lombardi, 2018) lean is used among large enterprises from different sectors such as Toyota, Intel, Nike and John Deere. In addition, companies are continuously adopting lean methodologies for example Soditel in construction (NIEDERCORN, 2019).

Lean is also an important subject for startups with the lean startup approach and reached as well the farming sector (Navarra, 2019). Lean is spreading in all sectors, and companies are increasing the adoption of lean in their processes in small and mega projects. For example, Bechtel integrated a lean six sigma department into its organization, part of BACS consortium in the construction of the Riad metro project.

On the other hand, The (Versionone, 2019) 13th annual state of agile survey shows that agile is spreading worldwide, the survey includes respondents from the five continents with a 47% dominance to North America. In addition, it shows that agile is spreading among industries like financial services, professional services, insurance and even energy. The main reasons for adopting agile are accelerating delivery and enhancing ability to manage changing priorities. The most used agile method is scrum with 54 % while stand ups is the most practiced agile technique with 86%. While the organizations are not pure agile, 97 % of the respondents acknowledge practicing agile development methods.

Similarly, press is writing several articles treating the agile framework and its principles and giving advices and guidance on its proper application. For example (Cartalas, 2019) and his multiple weekly publication in itforbusiness.fr

My name is Shadi RIZKALLAH, a civil engineer who previously worked in lean environments - yellow belt six sigma certified- and curious for the agile project management world. I invite you, dear readers, to walk with me through this thesis to briefly explore both lean and agile methodologies, extract their advantages and disadvantages, and illustrate their

commonalities and differences, to be able to answer the problematic : “To what extent can lean management be improved by integrating agile approaches?”

The main objective of this research is to verify to which extent it is feasible to integrate agile approaches in lean which results in a project structure relying on both agile and lean principles that leads to continuous improvement, faster productivity and is adaptable to changes. This target will be achieved through the secondary objectives of this research: identifying the core principles of both lean and agile methodologies and the advantages of adopting each of them through a literature review elaborated based on scientific articles. Once identified, the focus will be on filtering the best agile practices and values that fit the most into lean structure and extracting the advantages, the limitations and obstacles of integrating them in lean. Throughout the literature review, the human factor was emphasized and thus the investigation will also focus on determining the level of maturity of the human factor and their capacities to work in these environments.

Before starting, let us give a quick definition to the two terms according to their use in project management:

Lean methodology, developed originally after WWII in japan, focuses on defining, then creating value from the point of view of the customer and eliminating waste throughout the process, the people and the tools in order to reduce cost, while improving efficiency, quality and productivity. Agile methodology, originally introduced by software developers who were looking to break from traditional product development, focuses on better management by being adaptive and able to change directions at any circumstance.

The literature review illustrates the available information at this stage and elaborates a clear definition of both concepts and explore their values and advantages from a scientific point of view. The research is divided into different angles of investigation: the first angle is project management in general, the second angle is lean methodology, the third angle is agile methodology and the fourth is implementing agile in lean. The first subject illustrates the history and the evolution of project management, while the second and the third elaborate on the origin, applications, advantages and disadvantages of lean and agile, and the fourth subject is a synthesis on implementing agile in lean. The information resources are varied and are sourced from a wide collection of books and articles that are all listed in the bibliographic reference. In particular, the two books listed below have guided the reflection that revolves around this professional thesis, since they are the books of foundation of lean and agile respectively:

- Ohno, T. (1988). *Toyota Production System (1988), by Taiichi Ohno*

- *Manifesto for Agile Software Development*. (2001)

In order to deny or confirm the various approaches mentioned in the literature review and to answer the research question, a field investigation is needed after clearly defining the research framework. This investigation consists of a methodological research that captures reality and is based on questions and testimonies. It is framed by the thesis problematic and the research questions. This research allows us to have better understanding and a wider-angle vision. The adapted methodology for data collection and analysis is oriented toward both quantitative and qualitative methods:

The method of qualitative data collection and analysis is semi-structured interviews held with managers since it is very essential to communicate with them and understand their reasons, motivations, and opinions. In addition, it is indispensable to see what problems they face and how they tend to solve it. The quantitative method is an online survey targeting students and employees who are not in a decision-making level and consist the current and future skilled workforce that will be subjects to the implementation of whether lean or agile methods.

The phase of data collection will be followed by a data analysis phase that will allow us to extract conclusions and provide recommendations and answer the research questions.

This work is successfully completed thanks to the collaboration of a large number of people (students, engineers, researchers, employees and managers) who agreed by phone, email, direct interviews, LinkedIn conversations or through the questionnaire to answer a number of questions related to this subject as well as sharing their experiences.

3 Literature review

3.1 Project management

"Project management is the application of knowledge, skills, tools, and techniques to project activities to meet the project requirements" (pmi). It is the way to organize and manage resources, plan and execute activities in order to achieve a certain well-defined objective while meeting specifications and criteria.

While some claims that project management first appeared in the early history with the construction of the pyramids of Giza and the great wall of china (two projects that required high levels of accuracy and management), project management in the modern sense first began with Henry Gantt in 1917 with the creation of the Gantt diagram and is under improvement since that date.

Chronologically, the major developments in project management can be summarized as followed:

- The Gantt chart Developed by Henry Gantt in 1917

Henry Gantt is best-known for creating his scheduling diagram, the Gantt chart. It was a radical idea and an innovation of worldwide importance in the 1920s. One of its first uses was on the Hoover Dam project that started in 1931.

- The Critical Path Method (CPM) Invented by the Dupont Corporation in 1957

Developed by Dupont, CPM is a technique used to predict project duration by analyzing which sequence of activities has the least amount of scheduling flexibility.

- United States Department of Defense Mandate the Work Breakdown Structure (WBS) in 1962

WBS is a hierarchical tree structure of deliverables and tasks that need to be performed to complete a project.

- Project Management Institute (PMI) in 1969

Five volunteers founded PMI as a non-profit professional organisation dedicated to advance the practice, science and profession of project management. The PMI offers two levels of project management certification, Certified Associate in Project Management (CAPM) and Project Management Professional (PMP).

- The Ohno method-lean in 1988

Taiichi Ohno, a Japanese industrial engineer and businessman, created the Toyota Production System, which inspired Lean Manufacturing.

- PRINCE2 Published by CCTA in 1996

PRINCE2 is an upgraded version of PRINCE that aims to reduce cost and time overruns. It is a process-based approach that focuses on organization and control over the entire project, from start to finish.

- The Agile Manifesto Written in 2001

In February 2001, 17 software developers developed a lightweight software development method, and published the Manifesto for Agile Software Development.

With the increase of the global competition in the market, and the continuous innovation and technologies, companies are in a never-ending search for the best project management methodologies to adopt in their processes. The continuous need of faster production, higher profitability while maintaining a good product quality that ensures customer satisfaction drives the industry today to seek for the best practices in their production cycle. “The two criteria used to measure success which are common to most of the organizations today are: “Planned vs. actual release dates” and Product Quality” (Lishner & Shtub, 2019).

Lean management derived from the Ohno method and agile approaches derived from the agile manifesto are often considered to be two different methodologies in management, while they may seem contradictory to some, the others find that the two approaches focuses

on achieving more by working less. Therefore, if we keep on separating agile and lean, we might miss great opportunities. The purpose of this review is not to merge the two terms together but to explore both terms separately and retrieve the advantage of each practice in order to see in conclusion whether combining some agile practices in lean can achieve better results or not.

3.2 Lean methodology

Lean methodology, developed originally after WWII in japan, focuses on defining, then creating value from the point of view of the customer and eliminating waste throughout the process, the people and the tools in order to reduce cost, while improving efficiency, quality and productivity. " Lean methodology relays on the continuous elimination of waste and continuous improvement " (Niewiadomski et al., 2018). In other words, the lean mindset encourages the enterprise to find ways to eliminate wastes in the entire value stream or all the necessary actions required to deliver a valuable product to the customer.

(Womack et al., 1990) defined the five principles of lean that are considered as a recipe for improving workplace efficiency and include: defining value, mapping the value stream, creating flow, using a pull system, and pursuing perfection.

Muda or any process that does not add value, is anything other than the minimum amount of inputs, materials, processing, space or time needed that are important to add value to the product and are at the number of seven : Overproduction, unnecessary transportation, waiting, extra processing, motion, inventory and defects (Ohno, 1988). By improving efficiency and eliminating waste, resources are freed to be used on another level of the production cycle which leads to reducing the total cost.

Mura is the inconsistency in your workload that causes waste (Ohno, 1988).It is recommended that you work in a consistent way during the whole period of the process and not create waste by the fluctuation of the effort put into the activity.

Muri is all the unreasonable loads that are imposed on the workforce that cause stress and reduce manpower productivity (Ohno, 1988).

- ❖ Lean Techniques and Tools

Several techniques can be used in order to implement the lean methodology, (Goel & Kleiner, 2018) list and describe some of the most known lean techniques: Just-in-time

production that consist on productivity improvement, *Poka-yoke* Japanese for mistake proofing, Value stream mapping, lean six sigma, Kaizen and others.

- Value stream mapping

"Without a clear, long term vision of what management wants to get out of the company, workers can quickly feel demotivated. You cannot feel empowered to reach your and the company's goals if you don't know what those goals are."(Mocan, 2020)

The roadmap, or the value stream mapping is a lean tool that allows management to communicate a clear vision to the team members of the project from end to end.

"The benefit is that now we visualize the end-to-end view of the work, we can identify the value-added and non-value-added steps as well as the waste states."(Moreira, 2015)

- Kaizen

Kaizen is a compound of two Japanese words that together translate as "good change" or "improvement," but Kaizen has come to mean "continuous improvement" through its association with lean methodology. The Kaizen cycle consists of ten major steps: Get employees involved, find problems, create a solution, test the solution, analyze the results, standardize, repeat. ((Margaret, 2018)

- Lean six Sigma

Six Sigma strategies seek to improve the quality of a defined process by determining and eliminating the root causes of defects and minimizing defect's impact on the final product. The implementation of such process is supported by using quality management tools such as root cause analysis, which consist of searching the root causes of waste, analyzing them and optimizing the ones with the most impact, the fishbone diagram or the ishikawa diagram, a tool used for brainstorming on solutions, the 5 whys, and others.

❖ Lean challenges

It is established by now that implementing lean can be translated in many gains to the organization in terms of reducing cost, improving quality and increasing customer

satisfaction. But applying lean comes with great challenges that, if not faced, might result in the failure of the lean application.

Improving efficiency and reducing cost should be achieved by eliminating wasteful steps and not by eliminating job opportunities or creating continuous stress on the employees by considering breaks, vacations, …. as waste to be eliminated: (Stewart et al., 2016) interviewed and surveyed workers at four auto plants in the UK and Poland, and concluded that significant groups of workers are clearly experiencing deleterious working conditions in specific ways for long periods of time. In parallel to lean implementation in a company system, a lean training department should be integrated, where " lean educators should incorporate a deeper understanding of the impact of variability on flow and an explicit recognition of the impact of job characteristics on worker satisfaction and motivation "(Hopp, 2018).

It is highly recommended to make everyone involved in the cycle aware of the lean and its advantages. This involvement helps inspiring a shared vision, especially with effective participation of the top-level management, and leads to increasing the discretionary effort of the employees.

In addition, getting carried into lean process might reduce communication and collaboration between team members and consequently reduce their creativity and their capacity to improve. The value of a team as an entity and the contribution of teamwork in waste elimination will decrease to shallow surfaces, and the team members will become applicants instead of contributors. Lean manufacturing processes require a complete overhaul of manufacturing systems that may cause stress and rejection by employees.(lang wood, 2019).

The challenges surpass the human factor and reaches the company's performance and the customer satisfaction, on two levels: Since lean are highly dependent on suppliers, machines and schedule efficiency, any delay in supply, machine deficiency or even slight modification required from the customer might cause perturbation in the production and eventually customer unsatisfaction.

3.3 Agile methodology

While lean methodology focuses on improving the process, the agile framework, originally introduced by software developers who were looking to break from traditional product development, focuses on better management by being adaptive and able to change

directions at any circumstance. “Agile processes help project teams manage unpredictability through a focus on adaptive planning and rapid, flexible response to change”(Tilk, 2016). In addition, agile seeks shorter planning, commitment cycles, and encourages more interaction between collaborators which helps improving efficiency through dynamic and fast deliveries.

According to (*Manifesto for Agile Software Development*, 2001), the twelve agile development values are : customer satisfaction, welcome changing requirements, deliver software frequently, prioritize daily cooperation, build projects around motivated individuals, face-to-face conversations, use working software as the primary measure of success, sustainable development, technical excellence, simplicity, self-organizing teams and efficiency.

Unlike the traditional project management methods, Agile focuses on operating flexibly and iteratively, avoid multi-tasking and drops the concept of rigid planning. In other words, the added value relies in achieving small steps, executing it quickly and evaluate to improve on small scales. Therefore, the agile project is divided into small sections called iterations and each iteration is treated separately. Iteration is defined as being one cycle within a project, in scrum for example, one of the most famous agile methods, this cycle is 30 sequential days, or a sprint. (ken schwaber, 2004). Agile considers the output of each iteration as an increment of the product. The iterations consist of three following events:

1. The start of the iteration where the team reviews the scope left to be completed in the project, it then choses what it will be done within the iteration.
2. The heart of the iteration where the team is left alone to self-organize and to make its best effort to deliver. During this event the team conduct daily meetings.
3. The end of the iteration where the team delivers a part of the product to the client and conduct a retrospective meeting to evaluate and assess the iteration.

Within these three events, several agile techniques were highlighted such as self-organized teams, retrospective meetings and daily meetings:

The daily meeting occurs in the morning of each day during an iteration, usually its duration is fixed, and members limit their meeting to the fixed duration. In each daily meeting, the team members inspect each other’s activities and make appropriate adaptations. Similar to daily meetings, retrospective meetings have fixed duration but they occur once in each sprint, at the end of it: the purpose of retrospective meeting is to see how the process worked during the last iteration and adjust it to improve the next iteration. Self-organized team are not unmanaged teams, they are teams that are managed and supervised by themselves. Beside its

importance on an organizational level, where team members are responsible of developing functionalities and deliver incremental product, this practice can also foster creativity and increase workers satisfaction. (ken schwaber, 2004)

Another main fundamental of using agile is accepting uncertainty as a given and the capacity to rapidly find solutions due to adaptability. This allows the company to quickly respond to problems, and to adapt to changing needs which gives companies using agile framework an advantage to satisfy today's changing needs of the customer.

The best illustration of uncertainty on an agile project is probably the uncertainty cone. This diagram originally created by the American association of cost engineers and developed by (McConnell, 2006) to adapt to software development state that that the accuracy of delivery the final product increases while the variables are more known with time. Software development use the uncertainty cone shown in the figure below to guide estimates and illustrate how uncertainty decrease with incremental delivery.

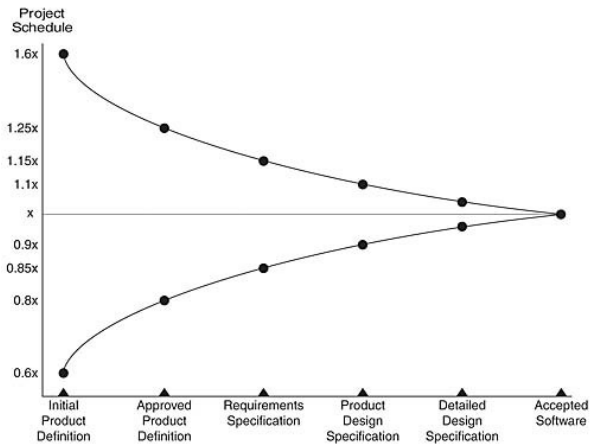


Figure 1. Uncertainty Cone

- ❖ Popular Agile Frameworks

- ➢ Kanban

Kanban means "board" in Chinese and Japanese, and the Kanban board is used to visually design, manage and improve processes. The visualization should include the team commitment point, the delivery point and the work in progress limits. A Kanban board is a swim lane diagram with four more columns. These columns typically have the labels Stories, To Do, Doing, and Done.

Kanban is structured to address the human tendency to resist change and adopt the change management principles by starting with what is known, understanding current processes, agree to pursue improvement through evolutionary change, encourage acts of leadership at every level. (Anderson & Reinertsen, 2010)

Kanban is a scheduling system that was used in lean manufacturing. Many Agile teams like to display their work on a Kanban board, but Kanban's influence on the Agile mindset goes well beyond just the board. The Kanban system is a popular way to apply lean thinking (focusing on what's valuable to the customer, and then continuously improving the product over time) to software development

- Scrum

Agile is a mindset and Scrum is a framework to help embrace that mindset. Scrum describes itself as an empirical process control framework. The empirical side means that Scrum runs experiments to improve the product by inspecting and adapting. Once the product is inspected and if needed some adaptation is quickly done. Scrum is the most used Agile framework.

Scrum breaks down a product into smaller tasks, and places them on a list called a backlog. These tasks are given an order of realization and are completed in a set timeframe called sprint. The sprint duration is 30 days approximately.

There are three different roles in a scrum team: the product owner or the person responsible for managing the Product Backlog to maximize the value of the project. The Product Owner represents all stakeholders in the project. The second role is the scrum master or the person responsible for the Scrum process, its correct implementation, and the maximization of its benefits. The third role is the members of a team or a cross-functional group of people that is responsible for managing itself to develop software every Sprint.(ken schwaber, 2004)

There are several benefits from using Scrum for managing projects:
Team members have a simplified and clear image of their responsibilities, customer feedbacks are received after every iteration and can be integrated smoothly into the process, big projects are divided into smaller parts which are easier to manage and complete.

- Agile Challenges

There are a lot of challenges that come with embracing an agile mindset. But the biggest challenge in large organizations is underestimating how radical this transformation can be. The organization will need to step away from long term detailed plans, instead they need to inspect and adapt. If enterprises want to embrace a more agile mindset, then they must change their whole relationship with uncertainty. Instead of trying to stamp it out, they need to see it as a competitive advantage. An agile team doesn't communicate with reports, instead the team communicates with working software. That means attending frequent sprint reviews and giving direct feedback about the product. For most organizations, these changes will all be very difficult and different from the status quo. In conclusion, agile is a radical change in the organizational mindset. If you're not thinking about the product differently, then you're probably not going to get that much benefit from many small changes.

The two leading causes of Agile project failures are lack of experience with Agile and a company culture that is at odds with Agile values,(VersionOne, 2014) considering that Agile values responding to change over following a plan. Therefore, and since the failure is due to people factor, a proper preparation of the team is required before implementing new agile method along with an analysis of the team motivation, structure and its capacity to adapt agile roles.

3.4 Implementing agile in lean

After briefly exploring both lean and agile methodologies, we can conclude that the two methodologies have more commonalities than differences, for example both target to improve quality and emphasis on learning, continuous improvement and customer satisfaction. Most importantly, people are the center of both mindsets where they rely on people to achieve goals, the human factor is clearly emphasized on in each of the above methods developments. But to what extent can agile practices be implemented into lean? And how can we make the best use out of both together? Especially that lean is sometimes considered as an old-school methodology that’s not relevant for most teams working digitally these days in an agile business world.

Lean thinking can be summarized into two values: respect for people and continuous improvement. Lean emphasizes on people over process. It encourages companies to have respect for people and trust them to deliver high-quality work. Agile teams don’t only focus on continuous delivery of valuable software, but it also values the importance of the human

factor. This is clearly stated in the first value in the Agile Manifesto, and principle five says that organizations should build projects around motivated individuals and trust them to get the job done.

In conclusion, a lot of the Agile mindset is just a restatement of lean thinking. Self-organized teams are just a way to have greater respect for people. Retrospectives and software refactoring are just another way to continuously improve.

4 Research Framework

We have discovered throughout the literature review the core principles of the lean methodology and the main advantages of adopting the lean practices as well as the challenges of applying lean practices. We have also highlighted some of the most famous lean techniques. The same informative sequence was adapted for the agile mindset.

Based on the information of the literature review, and the commonalities that was discovered between both mindsets, we are encouraged to investigate furtherer and throughout a methodological research two essential elements:

1. On one hand the possibility of integrating some of the agile techniques mentioned in the literature review into a lean structure. The agile techniques extracted from the literature review that will take part of the investigations are iterations, self-organized team, daily briefing, and retrospective meetings. Kanban and uncertainty cone were eliminated from the investigation since, and according to the literature, Kanban was already applied in lean and starting a lean production with a relatively big amount of uncertainty is very hard to be accomplished. Eliminating uncertainty cone from investigation doesn't eliminating reflecting on how to face uncertainty when occurred.
2. On the other hand, the importance of the human factor was clearly highlighted as a determining factor and one of the reasons of success or failure. The challenges of agile and lean were both consisted of human factors resistance. In addition, The Muri factor mentioned in the literature review, which one of the three axes of the Ohno method, along with the agile manifesto principles urge to respect, value and motivate the human factor therefore the second part of the investigation will be dedicated to this factor and it will be complementary and support the findings of the first part. Considering that the human factor is the subject of implementation of every change. The focus will be on determining the maturity level and the awareness level of lean as well as the capacity of the young workforce today to work in a lean or agile environment and which tendencies they prefer.

❖ Thesis general statement, research questions and hypothesis

This research general title expressing its problematic is: “To what extent can lean management be improved by implementing agile approaches”.

Consequently, and in order to have a wider vision to be able to answer the general statement, the research will focus on finding adequate answers to the following questions:

Primary questions:

- Can self-organized teams, working in iterations, retrospective meetings and daily briefings be implemented into lean structure? Focus on industrial and construction fields
- What is the maturity level of lean and agile methodologies and how much is the workforce aware of their practices?

Secondary questions:

- How can each agile approach be implemented? And what are the advantages, conditions, and obstacles of implementing each approach?
- Does the future workforce prefer working in lean or agile environment? How to optimize the contribution of the human factor? Is the level of maturity linked to the education level?

Hypothesis

- The most compatible agile approaches to be implemented in lean are retrospective meetings, daily briefing, working in iterations and self-organized team
- The human factor is the foundation in both lean and agile mindsets
- Lean and agile have more commonalities than differences

5 Methodological Orientation

5.1 Empirical investigation object

The human factor is the foundation in both lean and agile mindsets, therefore the human factor is the source of all methodological search. As previously mentioned, some sectors tend to work with agile structures such as information technology, web development, software development, while other sectors prefer using lean in their process management such as manufacturing, industry and construction. Therefore, it is essential to widen the investigation object and to limit the investigation to one specific sector.

The investigation strategy consists of the following points:

- Extract agile related information from people working in management consultancy
- Orient lean investigation toward the industry and construction sectors
- Address the questionnaire to students and workforce belonging to both sectors

This investigation strategy was chosen for the below reasons:

1. The orientation toward agile environment will allow us to confirm the core principles of agile illustrated in the literature review especially the ones related to the four approaches in question (retrospective meeting, daily briefing, iterations and self-organized team) and see the advantages and limitations from a practical point of view.
2. The orientation toward the industry and the construction fields is a must in the investigation, especially that any recommended modifications to lean will be implemented first in such sectors where lean is applied the most to their repetitive process. Testing if lean is improved by implementing the four agile approaches should be validated by the people working in these fields. This justifies why most of the interviewees work in these sectors.
3. The questionnaire is addressed to the future workforce and is a solid podium to test the level of maturity of lean and agile and allow us to answer the research questions related to this field of study. In addition, the questionnaire will allow us to know if the workforce prefers working in lean or agile environment.

5.2 Methodology

The adapted methodology for data collection and analysis will be oriented toward both quantitative and qualitative methods.

On one hand, the quantitative method will be a survey targeting students and employees who are not in a decision-making level at the hierarchy of the company, that will be subjects to the implementation of whether lean or agile methods.

On the other hand, it is very essential to communicate with managers on a decision-making level, adapting lean or agile methods and understand their reasons, motivations, and opinions. In addition, it is indispensable to see what problems they face and how they tend to solve it. Moreover, it is critical to listen to their point of views about implementing agile approaches into lean. In conclusion, and for explanatory and exploratory means the method of qualitative data collection will be semi-structured interviews.

The methodology is summarized in 5 phases:

- Search for contacts
- Contacting and interviewing defined contacts
- Collecting information
- Analyzing the results
- Suggest recommendations based on the collection and analysis phases and personal reflections.

The reflection of this study is based on the following 5 axes:

- Understanding the existing
- Asking and Observing throughout the data collection period
- Discovering the actual state
- Analyzing the data collected
- Confirming what is possible and denying what is impossible.

5.3 Qualitative Method

The adapted qualitative research method is a semi structured interview with managers and employees at a decision-making level, the corresponding process for conducting such interviews is summarized in the steps below:

1. Get informed about the subject, mainly from readings and the literature review

2. Designing an interview guide that will be approved by my tutor and will focus on answering the research questions of this thesis related to the interview's objectives
3. Determining the target interviewees that will be in the majority managers working in lean oriented sectors and some management consultants aware of the agile framework, which will make their interventions reliable and adequate source.
4. Interviewing and follow up after the interview

❖ Sampling criteria

A semi structured interview will be held with nine persons that are in a decision-making level, the sample is consisted of the following:

- One head of department in the construction field
- Two project engineers in the mechanical production lines and construction fields
- Three construction managers in the construction fields
- Two senior management consultants
- One learning and development consultant

❖ Expected Outcome

The expected outcome of the semi structured interview is to answer from a practical point of view the research questions related to implementing agile approaches in lean. More specifically, implementing retrospective meetings, daily briefing, self-organized team, and working in iterations into lean. The interview question will not neglect the human factor and will rapidly discuss it from a decision-making point of view.

Thus, the interview question will focus on five different objectives summarized in the figure below:

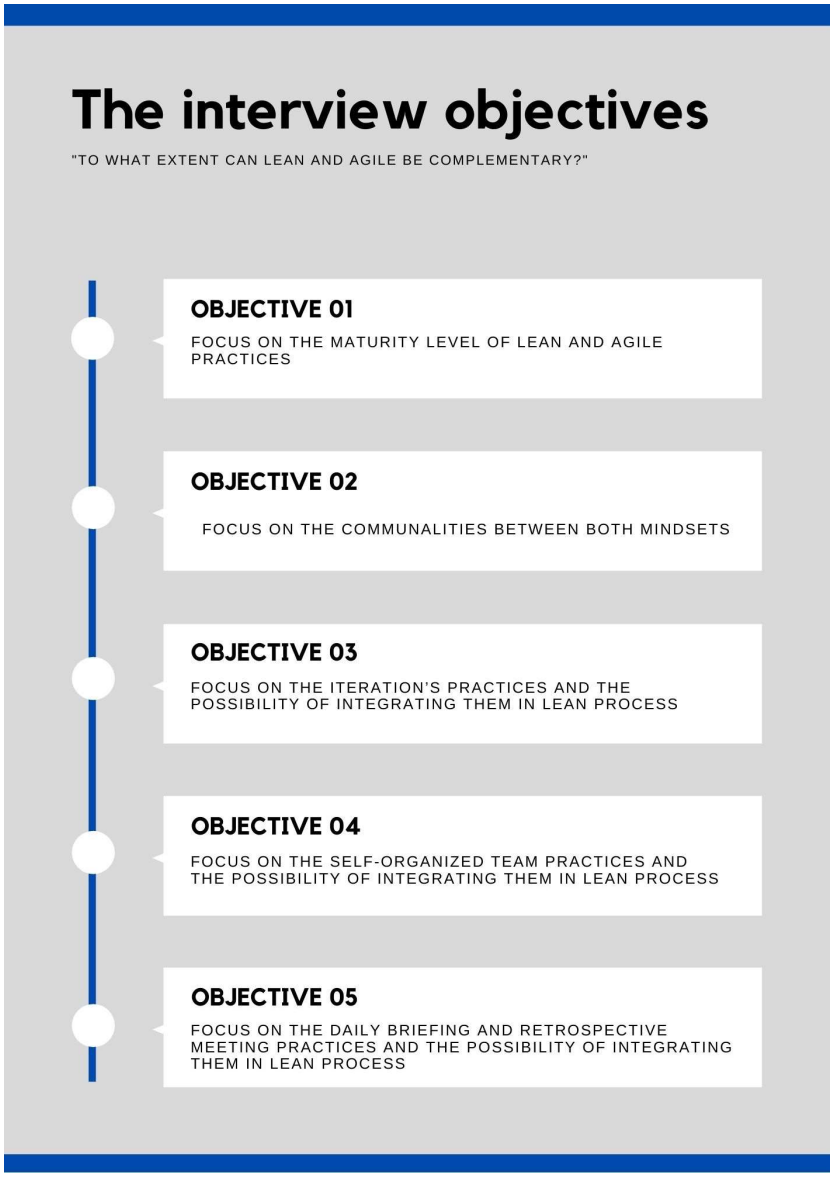


Figure 2. Interview objectives

The interviewees sample was chosen in accordance with the above objectives. In other words, the management consultants will give a clear vision of the agile and lean practices, the project engineers, construction managers and department head will clarify the possibility of the implementation and the level of maturity, the learning and development consultant intervention is expected to add value from coaching and training perspective.

❖ Interview Guide

The estimated time per interview is 25 mins and the interviews will be held in both English and French depending on the interviewee, the semi structured interview guide aiming to reach the objectives mentioned in section 5.4.1 consists of the eleven questions displayed below:

1. What sector do you work in? what is your current position and how many years of experience do you have?
2. Does your work environment include any lean or agile practices? What are they and how are they practiced?
3. Is it possible for your team members to understand both mindsets? If no what are the obstacles?
4. Can you identify any communalities between the lean and agile mindsets? What are they? And do you think they are exclusive to your work sector?
5. Some consider lean is strictly used in manufacturing and agile is strictly used in software development, do you agree?
6. Dividing process into iterations is usually applied in agile to deliver incremental value to an uncertain final product. Is it feasible to apply the same concept in a rigidly planned project?
7. Do you think dividing the process in smaller iterations make waste detection easier?
8. Is it possible for a self-managed team to identify waste in its working process? Or the intervention of a second party is required?
9. What are the boundaries and limitations of a self-managed team?
10. Do you do a daily briefing with your team members? What are the cons and pros of such practice?
11. Do you practice retrospective sprint with your team? If yes, how often? And what are the advantages of such practice? if no, why? and what are the alternatives?

5.4 Quantitative Method

The adapted quantitative method is a self-administrated survey research questionnaire. This questionnaire was developed using survey hero platform and will target a minimum response rate of 250 internet users. For the purpose of reaching more audience and drive traffic to answer the survey, it will be broadcasted on the below online platforms:

- Facebook: on the Facebook pages of student communities and the groups of university students and through private messagings.
- Youtube: By sharing the link on trending videos discussing lean and agile subjects.
- Linkedin: By posting the link and identifying contacts who are sensitive to this topic and through direct messaging.
- On my website on the following link: https://www.shadirizkallah.tk/survey.html

❖ Objectives and Sampling criteria

This survey targets are to cover a high range of employees and future employees that might be subject to lean or agile implementations, the criteria of participation to this survey are:

1. Equal focus on agile and lean fields
2. Actively working or studying
3. Level of education Baccalaureus and above

The objectives of this survey are:

1. Identify a wide range of samples in accordance to their experience, their education and specialization and determine if the level of maturity is linked to the level of education.
2. Identify their familiarity with both lean and agile tools and methodologies and the level of maturity of these terms to them.
3. Determine which environment they prefer working in and to what extent they can work in a lean environment with agile implementations.

❖ Survey Structure

A small introduction will inaugurate the survey that will introduce the participant to the subject. Twelve questions will follow the introduction and will be divided into three different sections:

- Three questions in the personal information section
- Four questions in the technical information section
- Five questions in the technical opinion section.

Each section is dedicated to respectively fulfilll one of the three objectives listed above. The question types used are open list, multiple choices, rating and category questions.

Below is a list of the twelve questions:

1. What is your highest level of study?
2. What is your field of specialization?
3. How many years of experience do you have?
4. How much are you familiar with Lean management Tools and Methodologies?
5. How do you rate your knowledge on the below?
   "Fishbone diagram, Kaizen, root cause analysis, value stream mapping, waste determination, waste elimination"
6. How much are you familiar with Agile Mindset Tools and Methodologies?
7. How do you rate your knowledge on the below?
   " Kanban, Scrum, Self-organized teams, Uncertainty cone, Working in iterations, Retrospective meetings, daily briefings"
8. In general, do you find yourself at ease working in which environment?
9. Are you capable of working in a self-managed team?
10. Are you capable to identify waste in your work process?
11. What do you think identifying/eliminating waste in a self-managed team leads to?
12. Do you think dividing the process in smaller iterations makes waste detection easier?

The tools tested in questions 5 and 7 and listed above are all developed and explained in the literature review.

N.B: Appendix A and to the following link https://surveyhero.com/c/c32c0d35 provides access to the full survey and allows the readers to have a clearer image of the survey especially the multiple choice questions and the proposed answers.

❖ Analyzing process and expected outcome

Once the data is collected for this survey and the minimum amount of participant fixed at 250 is reached, the data analysis process will start. Several data visualization tools such as excel and survey hero platform will be used to convert numerical data into charts, and graphs as follows:

- Range standard deviation charts, with the mean as the centered variable, will be used to illustrate the answers of questions 5 and 7, since there are several variables that needs to be illustrated and the final purpose is to determine the level of knowledge varying between not familiar and mastering.
- Column charts, bar charts and pie charts, if needed, will be used to illustrate the results of the remaining questions.

❖ Expected outcome

The expected outcome is to identify:

- How much the current and the future workforce are familiar with lean and agile tools and techniques
- Which environment they prefer to work in
- Whether there is a link between the level of education or experience and the level of familiarity with both lean and agile management
- To determine the necessity or not to include lean and agile trainings within the learning and development departments

In parallel, the aim is to determine what proportion of the tested sample can work in a self-organized team and feel that has the enough skills, ability and will to identify waste while working in a self-organized team.

6 RESEARCH ANALYSIS

6.1 Semi-structured Interviews

The previously set objective of the qualitative investigation were the following:

- Focus on the maturity level of lean and agile practices
- Focus on the Communalities between both mindsets
- Focus on the iteration's practices and the possibility of integrating them in lean process
- Focus on the self-organized team practices and the possibility of integrating them in lean process
- Focus on the daily briefing and retrospective meeting practices and the possibility of integrating them in lean process

In order to achieve these objectives, nine interviews were held according to the interview guide shared in section 5.4.2 with nine persons working in the fields below:

- One head of department in the construction field
- Two project engineers in the mechanical production lines and construction fields
- Three construction managers in the construction fields
- Two senior management consultants
- One learning and development consultant

In the next section, an analysis of the answers of the participants will take place. This analysis will project my reflections and observations toward the participants answers, and it will be function of the five objectives previously set in order to determine concrete results on each axe. The Appendix C illustrates a synthesized summary of each interview and the answers received to each question.

In parallel, each of the five objectives is covered in 2-3 questions in the interview guide, therefore, the appendix C is divided in five sections and each section illustrate the answers to the questions corresponding to a certain objective. In the following analysis, participants citations will be quoted where needed, these citations are referred in Appendix C.

❖ Interview Interpretation

The intended variation between the participants profiles, years of experience and sectors makes them a reliable source of information that allows us to hear several points of views and get informed from various sources coming from different backgrounds.

- Determining the maturity level of lean and agile practices

According to the participants answers the level of maturity of lean and agile practices vary widely between sectors and it also varies between companies in the same sector, while Mr. A confirmed that lean dates more than 10 years in his company "Lean was introduced into the process twelve years ago/people are more familiar with lean/ Lean trainings done by a consultant/No explicit Agile practices", Engineer D stated that there are no practical lean tools in his work process. Despite the variation in the level of maturity, almost all the participants established a direct link between the capacity to understand both mindsets and the change resistance, the efficient trainings and the correct practice, Project engineer D states these arguments in his testimony "Understanding both mindsets will dictate cross training team members to perform different tasks, this might lead to wasting of time especially when it is faced with resistance" If these obstacles are faced, identified and resolved, team members will have the ability to understand both mindsets.

- Focus on the Communalities between both mindsets

When asked if it possible to integrate agile practices into the lean manufacturing process the answers fluctuated between Project engineer D who totally disagree and others who linked it with testing and analysing periods, keep production moving and integrating some agile practices to improve lean without compromising the core lean principles as Consultant F confirmed: "You might be able to integrate some practices that improve the lean without compromising the core lean principles". Participants supported the integrating idea by confirming the communalities between both mindsets such as the value added to the quality of the final product, and targeting customer satisfaction, and that both mindsets' foundations is the human factor, Consultant E and F had different approaches to the question and answered them based on lean and agile tools: Consultant E confirmed that many teams use both Kanban and kaizen while consultant F assimilated between iterations and work flow and I quote:

"Iterations in agile are quite similar to each step in the production line, the challenge in lean is to improve repetitive iterations".

What increases the necessity of integrating agile practices is that the whole business word is converting toward agile according to head of Department A "This is how it started, but the whole business word is converting toward agile environment, thus the necessity of change and evolution in lean". Most of the participants agree that agile is spreading very fast and it has proven its efficiency in many fields other than product development, while lean is a necessity considering that eliminating waste can be translated into cost reduction and time saving. Consultant E confirm the spread of lean and agile out of the comfort zone of manufacturing and product development respectively, "SAFE framework is a proof that lean can be introduced to software development" as he said. Some participants considered the implementation of lean in agile is easier than agile in lean especially that one of the agile foundations is uncertainty that isn't present in lean manufacturing where everything is planned in a workflow. Project engineer B considered that "So far, there are no serious attempts to implement agile into manufacturing, this might be due to lack of trying, competencies, or avoiding risk".

The second part of the interview focused on some agile approaches, their practice routines and their advantages in the participants companies. More specifically, 4 main agile approaches were the subject of the second part of the conversation: iterations, self-organized team, retrospective meetings and daily briefings. As previously mentioned, those four subjects were specifically chosen because it seemed after the literature review research and reflections that there are the most feasible to be implemented in lean since they are independent of uncertainty and they can create value to the workflow.

- Focus on the iteration's practices

Participants had a consensus about integrating iterations in lean, but this integration is conditioned by different aspects, for example: defining the scale of iteration whether it is function of time, cost or the product itself. It was considered that contrarily to agile iterations, lean iterations should be well defined and in a specific order that allows the production to keep going as Project engineer B stated: "Iterations works in a rigid planned project if the project has a continuous flow, so the iterations will resemble to a specific step of the flow that we target to achieve". If these conditions applied, it is believed that dividing the lean process

into iterations can contribute to a better waste detection and elimination. Project Engineer B statement supports this idea “Dividing in iteration can be translated in waste detection on a smaller scale, which might be easier to achieve”. In addition, and to have optimised results, it should be combined with subject awareness, subject mastering and standardisation. In parallel, applying iterations in lean manufacturing and construction is limited: In agile for example, the team decide at the start of the sprint which part of the product to work on during an iteration. While in manufacturing and construction and since the work steps are highly dependent of the chronological order, the iteration scope, if applied, is predefined function of the previous iteration. Construction manager H support this idea:” If the final product is a building. You cannot cast a slab before columns and consequently if casting slab is an iteration, it will be dependant of casting the column and cannot come first”

- Focus on the self-organized team practices

The self-organized team is another essential principle of the agile practices, the importance of self-organized team is expressed by the freedom of decision that the team possesses and the open space of creativity, in addition self-organized team works faster and are more eligible of dividing tasks between team members. It is very critical to identify whether a self-organized team is or can identify waste in his process since if those two concepts are successfully combined (self-organized team and waste identification), there would be a huge impact on the team productivity and may allow the team to achieve excellence.

The participants expressed their beliefs that self-organized team can identify waste in their process considering that they actual own the process by managing it. In addition, the success of such implementation is conditioned by the collaboration between team members, the skills, experience and training. On the other hand, Consultant C evoked the idea of accountability by saying: “The challenge in a self-managed team is the lack of accountability and it can go sideways! If no one is accountable for mistakes a team might be relieved and seek optimisation or tend to accept the status-quo as long as it gives acceptable results!”. Despite the importance of applying the self-organized team principle, there are many obstacles and limitations that needs to be resolved before such action, For example: setting the correct context and framework, define responsibilities and adaptation skills as Consultant E included: “I would say the lack of capacity to adapt: It would be easier to apply a self-organised team to newly graduate rather than experienced members” people tend to resist

change and find hard time adapting to it". Moreover, it is important to highlight the statement of consultant C that aroused the importance of a third-party supervision: "A third party added value might be the objective view, a self-organised team get carried on too much in the process to a point they can't troubleshoot". Another factor to be taken into consideration is the authority level given to a self-organised team in lean sectors and determine whether the self-organisation is limited to executing the task only or planning deciding and executing? Construction manager I would try the self-organised team concept on execution level but won't risk giving his team the authority to decide whether to pour concrete before him checking the work. "Even though I might consider giving my team the authority to execute the task however they see best. I am not ready to allow concrete casting without checking their work at fist" , In parallel, Construction manager H stated the limitations of a self-organised team as the following: "The limitation of a self-managed team that may be imposed by the higher hierarchy are mainly related to the budgeting, choice of suppliers and contractors, hiring/firing people. Internally, power conflicts may occur between team members, too many team members may slow down decision-making, new ideas may be refused in favour of group thinking and the conformity of team norms"

- Focus on the daily briefing and retrospective meeting practices

The last two subjects discussed in the interviews were the daily meeting and retrospective meetings. While the importance of daily briefing is keeping team, members focused and target-oriented throughout the sprint and raising any issues or obstacles faced by team members, The retrospective meeting held at the end of each sprint is considered as a time for evaluation and improvement. During the interviews, the participants mentioned other advantages to the daily briefing such as increasing the feeling of involvement, discussing the goals of the day, identifying shortcomings, sharing ideas, avoiding obstacles and as Consultant F specified "During the daily briefing team members gets the opportunity to express any difficulties that prevent them to reach the sprint target, and thus ensures the sprint productivity and the workflow persistence."

When asked about retrospective meetings, almost all participants agreed on its added value. Each of the participants explained how retrospective meetings create value for the team. For example: facilitating communication, evaluate performance, and increasing the lesson learnt as Consultant F added : "The retrospective meetings increase the lesson learnt awareness, where every member can share what issues he resolved and what issues he is

facing which facilitate preventing the same issues by other members through lesson learnt". Even though these two practices create value, some companies get to carried away by eliminating waste that they considered the time dedicated to these meetings as waste to be eliminated: When asked why they don't practice these meetings, construction manager G stated: " I do not imagine asking the whole team to start working 10 to 15 minutes later each day just to chat and discuss ideas". Retrospective meetings in lean can play a reminder role to check inventory and store requirements and needs in terms of materials sufficiency as also highlighted construction manager G: "We run a weekly retrospective sprint, in which we inspect the process to identify and order the major items…"

6.2 Online Survey

As previously mentioned, the expected outcome of this Survey is to identify the below:

- How much the current and future workforce are familiar with lean and agile tools and techniques
- Which environment they prefer to work in
- Whether there is a link between the level of education or experience and the level of familiarity with both lean and agile management
- To determine the necessity or not to include lean and agile trainings within the learning and development departments.

In addition, the aim is to determine what proportion of the tested sample can work in a self-organized team and feel that has the enough skills, ability and will to identify waste while working in a self-organized team.

In parallel, it is important to indicate that the interviews resulted in highlighting more and more the importance of the human factor through the testimonies of the participants and thus stresses on the importance of this survey as a complementary research investigation.

A questionnaire consisting of 12 questions was distributed online on several media platforms of social networks: Facebook, LinkedIn, etc. The results were analyzed using excel and the survey hero platform.

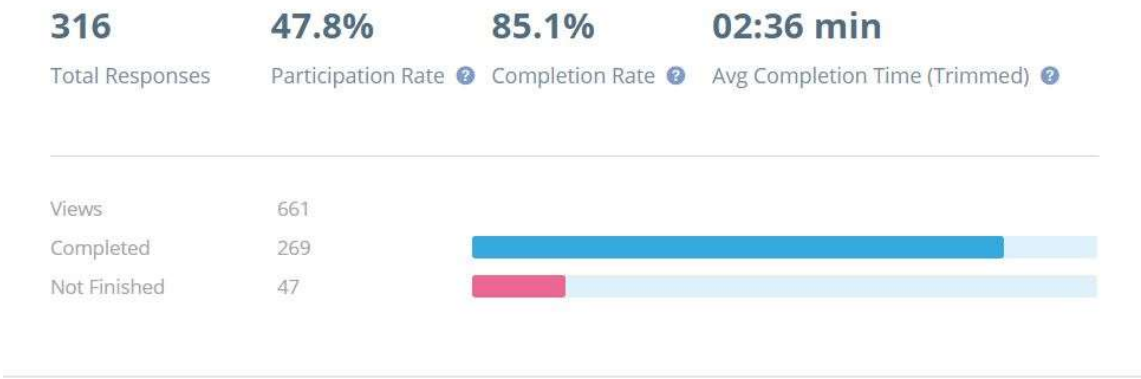


Figure 3. Participation and completion rates

This survey received 661 views, 316 total responses achieving a participation rate of 47.8 %. The low participation rate can be explained by the sensitivity of the subject and the unfamiliarity that some responders might face.

Out of the 316 responses, 269 participants completed the survey, reaching the initial target of 250 participants that was fixed when the methodological orientation was chosen, and achieving a completion rate of 85.1%.

The average completion time of the 316 responses was 02:36 minutes.

- Section 1: Personal information

Most of the respondents have a level of education equal to 5 years after baccalaureus (52.53%) and (22.15%) of the respondents have a level of education equal to “Mastère spécialisé”.

(79.43%) of the respondents have a level of education higher or equal to 5 years after baccalaureus while (20.57%) of the respondents have a level of education that is lower than 5 years after baccalaureus.

These numbers indicate that the sample of the participants have a very good level of education and is a reliable source of analysis, especially when it comes to answering the research questions in direct connection with the level of maturity for example whether there is a link between the level of education and the level of awareness in the lean and agile fields, and vice versa.

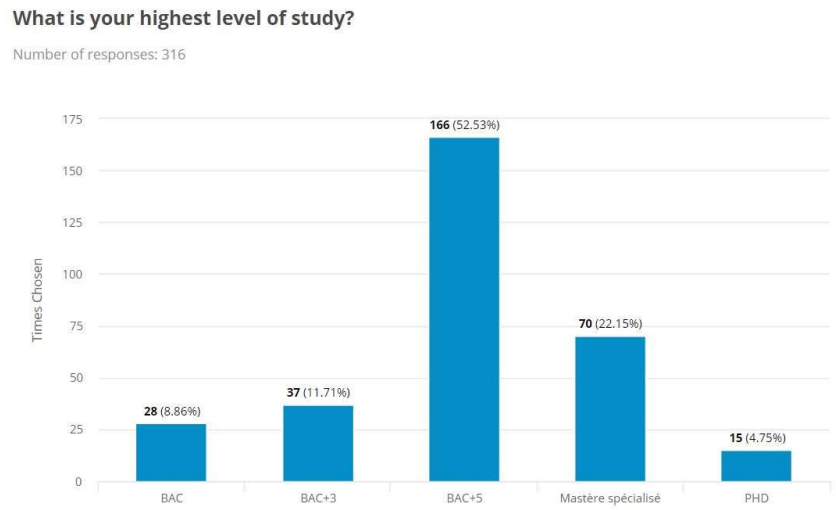


Figure 4. The level of education of the participants

The field of specialization of the participants shows a remarkable variation between fields related to IT and digital with a percentage of 20.89% where agile methods are used the most and manufacturing, production and construction with a percentage of 18.99 % where the lean methods are proven most effective. Business and management hold a good share of the sampling criteria with a percentage of 19.62 %.

The variation shown in the sampling criteria regarding the field of specialization proves its reliability. Especially that agile fields and lean fields hold almost equal shares, People who chose other specializations with a percentage of 20.25% are divided between pharmaceuticals, socioeconomics, chemistry and others.

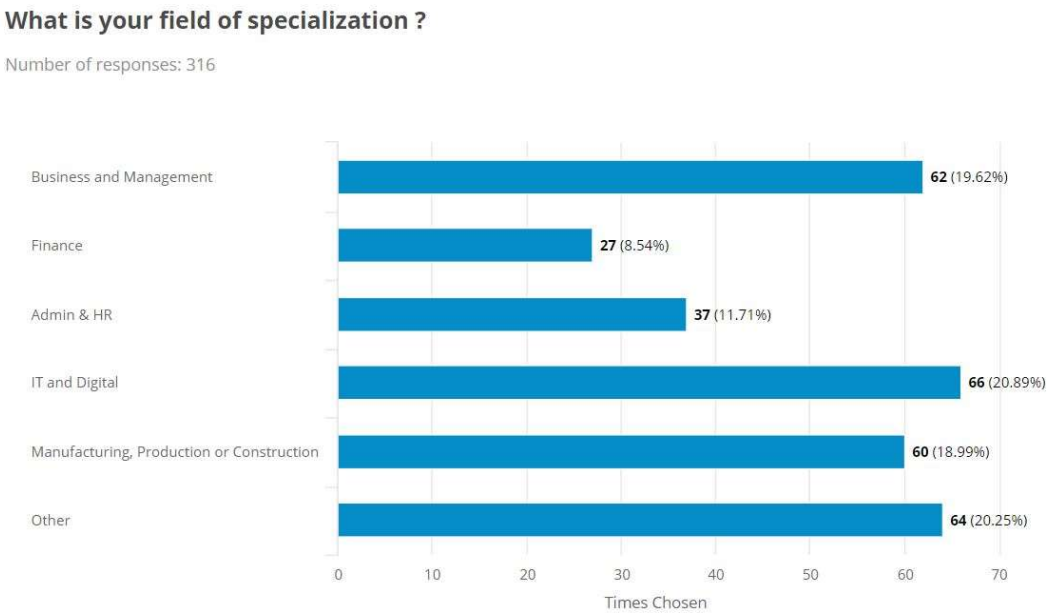


Figure 5. Field of specialization of the participants

(31.21%) of the participants are student, (21.97%) have less than 2 years of experience. A total of 53.18% of the participants are either students or have recently joined the workforce. This high percentage is very important to determine the necessity of including courses and training teaching lean and agile approaches in the company's learning and development departments.

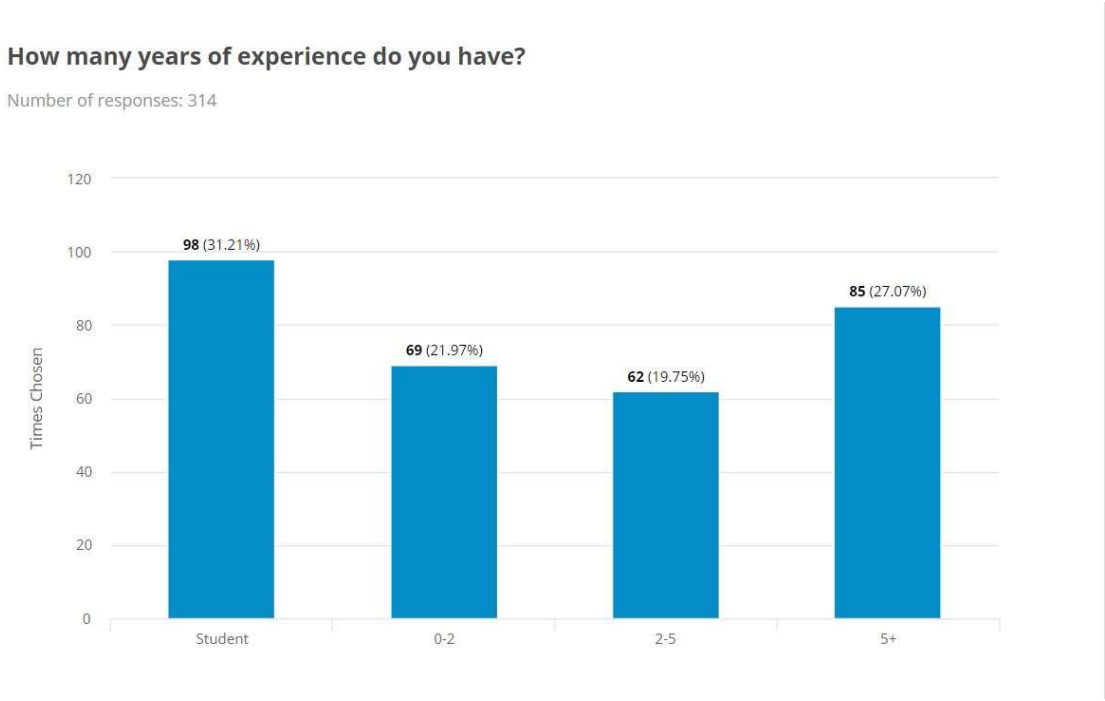


Figure 6. The level of experience of the participants

❖ Section 2: Technical knowledge

The analysis of the outcome of the first section revealed the following information:

- Most of the participants have a level of education equal or higher to five years after baccalaureus
- Most of the participants were students or recently joined the workforce
- The participants come from various backgrounds and the percentage of participants working in lean and agile fields is almost equal

The purpose of this section is to determine the technical knowledge of the participants and the level of awareness they possess of both lean and agile practices.

At first participants are asked how much they are familiar with lean or agile practices in general, then they were asked to specify their specific knowledge in the most famous techniques in lean and agile.

The tested lean and agile techniques were both extracted from the literature review and are listed as shown below :

The lean techniques:

- Fishbone diagram
- Kaizen
- Root cause analysis
- Value stream Mapping
- Waste determination
- Waste elimination

The agile techniques:

- Kanban
- Scrum
- Self-organized team
- Uncertainty cone
- Working in iterations

When asked how much you are familiar with lean management tools and methodologies and agile tools and methodologies on a scale from 0 to 10 (0 being not at all and 10 being masters), a shocking (16,04%) majority answered not at all for lean and a (15.77%) majority answered with not at all for agile.

A total of (51%) answered with less than 5 over 10 for lean and a total of (55%) answered with less than 5 over 10 for agile. The figures below show the full repartition of the participants level of knowledge.

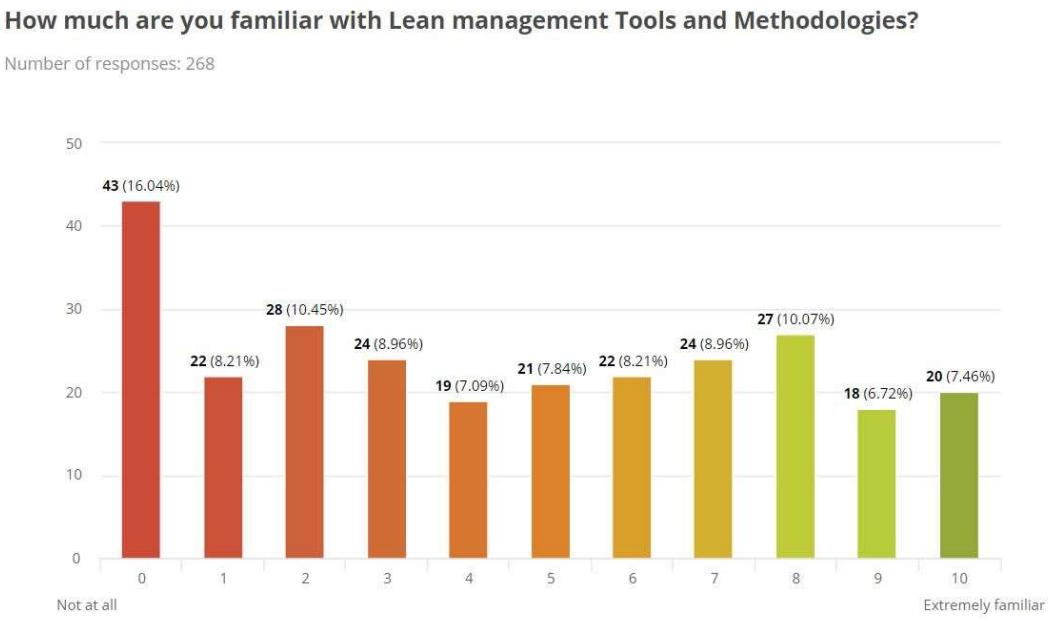


Figure 7. Level of familiarity with lean management Tools and Methodologies.

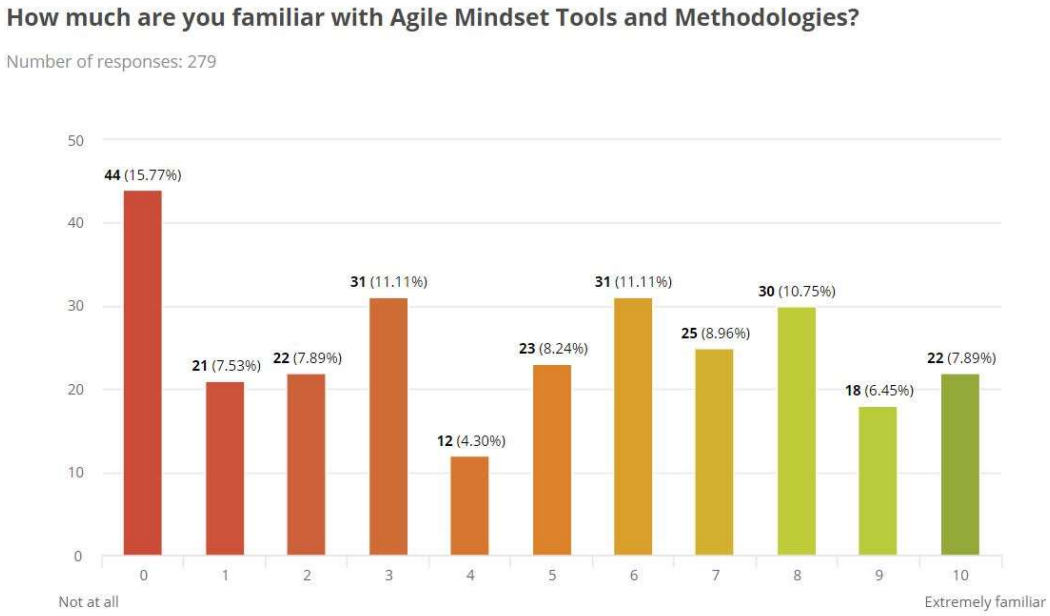


Figure 8. Level of familiarity with Agile Tools and Methodologies.

When it comes to asking the level of awareness of the participants with specific tools and techniques the participants were asked to choose between four options: Not familiar, Familiar never practiced, Familiar-practiced, Masters. The standard variation method of

analysis was chosen to give the best illustration of the respondent's answers to the techniques. In addition to standard variation, the below figures illustrate the mean of the variation.

For lean management, the standard variation of the responses varied between Not familiar and familiar-practiced and the mean was mostly on the familiar never practiced for most of the techniques except the root cause analysis and the waste elimination techniques.

Figure 9. Knowledge on specific lean techniques

For agile, the answers were quite similar with the mean almost centered on the familiar never practiced except for the self-organized team and the working in iterations were participants showed a higher level with familiarities with those two techniques.

Figure 10. Knowledge on specific agile techniques

❖ Section 3: Technical Opinion

The analysis of the outcome of the second section revealed the following information:

- Most of the participants have slight knowledge in lean management and are familiar but never practiced the lean techniques
- Most of the participants have slight knowledge in lean management and are familiar but never practiced the lean techniques
- The participants have some additional knowledge in specific techniques in lean and agile such as: working in iterations, self-organized team, root cause analysis and waste elimination

The purpose of this section is to find out whether the participants prefer working in lean or agile environments, reveal their capacity to work in a self-organized team and identifying waste in their work process, and to take the participants technical opinion in regards to what identifying and eliminating waste in a self-organized team leads to, and if dividing the process in smaller iterations makes waste detection easier.

Even though, as seen in section 1, the participants profiles come from both lean and agile working environment sectors, most of the participants confirmed that they prefer working in an agile environment as seen in the picture below:

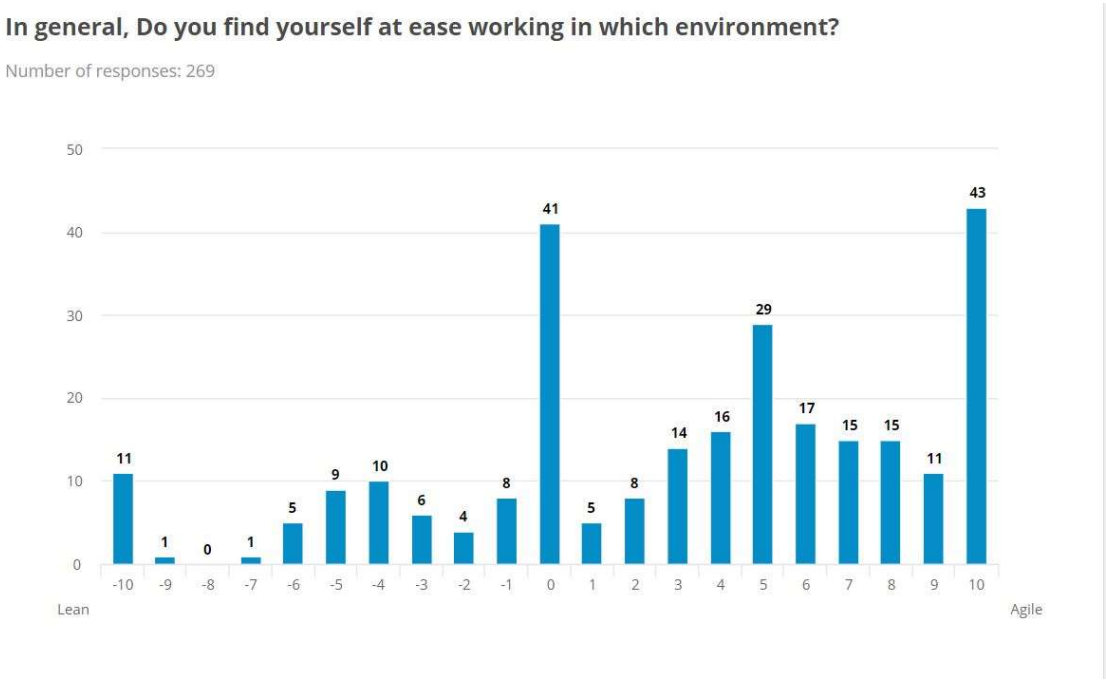


Figure 11. Lean vs Agile environment

When the participants were asked if they are capable to identify waste in their process, (62.45%) of the participants answered yes while (37.55%) answered no. These percentages show that most of the participants, who previously answered that they are more familiar with the waste elimination process showed their capacity of identifying waste in their work process. The (37.55%) percentage is a relatively high percentage, the reasons behind this high percentage could be due to complicated

processes or a lack of knowledge of the process and the optimization tools.

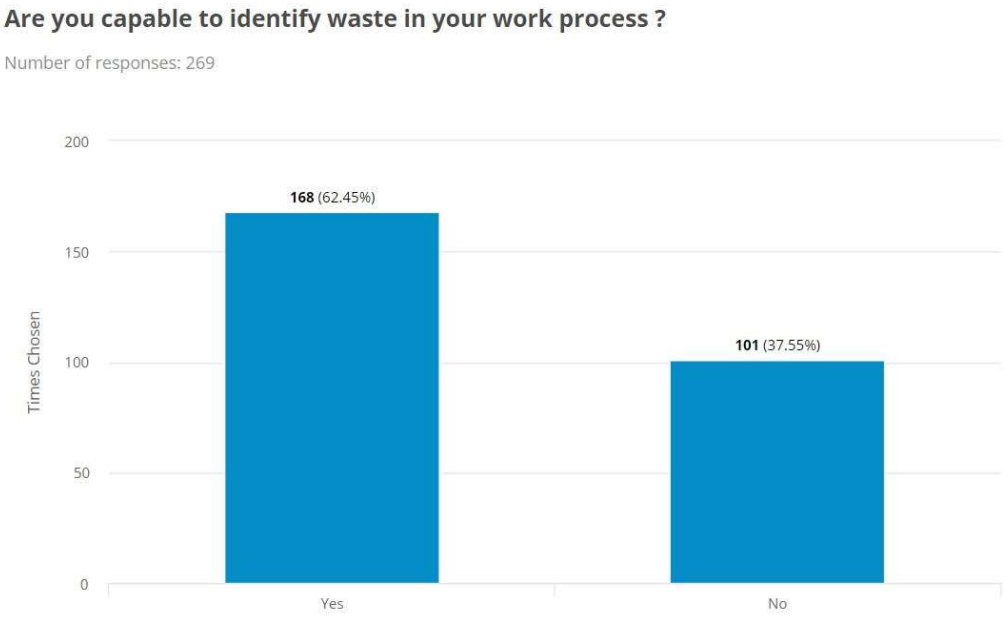
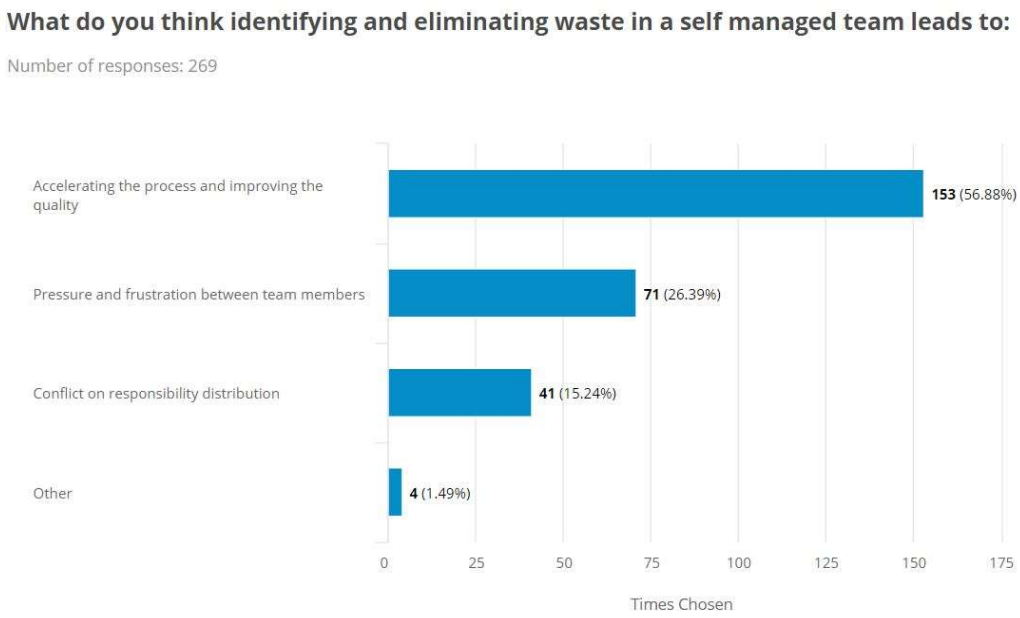


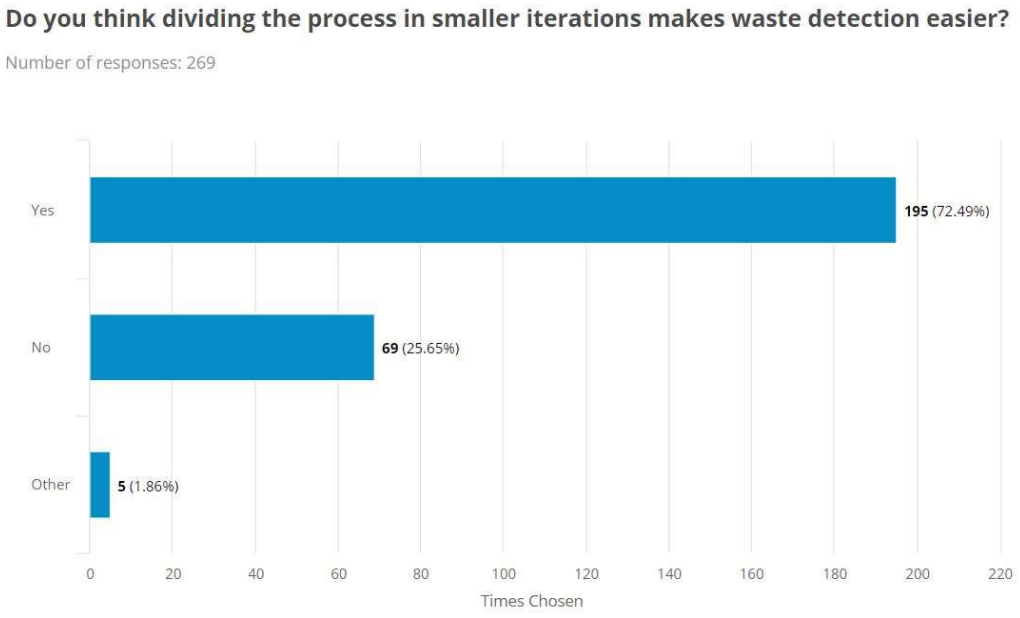
Figure 12. Waste identifying capacity

(56.88%) of the participants answered the question "what do you think identifying and eliminating waste in a self-managed team leads to?" with: accelerating the process and improving the quality.

(26.39%) answered pressure and frustration between team members. This percentage reflect a demotivation of the participants to identify waste and consider this task as a pressure source in a self-managed team. The demotivation element should be eliminated to optimize this concept.



The majority (72.49%) of the participants answered yes to the question "do you think dividing the process in smaller iterations make waste detection easier. This percentage might be due to the fact that people consider that searching and identifying the waste and optimizing the process on a smaller scale might be a lot easier than a higher scale.



In Summary, the most important findings extracted from the interpretation of the online survey are the below:

- Most of the participants have a level of education equal or higher to five years after baccalaureus
- Most of the participants were students or recently joined the workforce
- The participants come from various backgrounds and the percentage of participants working in lean and agile fields is almost equal
- Most of the participants have slight knowledge in lean management and are familiar but never practiced the lean techniques
- Most of the participants have slight knowledge in agile management and are familiar but never practiced the agile techniques
- The participants have some additional knowledge in specific techniques in lean and agile such as: working in iterations, self-organized team, root cause analysis and waste elimination
- Most of the participants prefers working in an agile environment
- Most of the participants consider themselves able to work in a self-managed team and identifying waste in the process
- Most of the participants think that identifying and eliminating waste in a self-managed team leads to accelerating the process and improving the quality
- The majority of the participants think that dividing the process in smaller iterations make waste detection easier
- An importanat percentage think identifying and eliminating waste in a self-managed team leads to frustration
- An important percentage think that they are not capable to identify waste in the process

7 RESULTS SYNTHESIS

The findings that emerged from the field investigation and the research results illustrated in section 6 allow us to answer the thesis problematic "To what extent can lean management be improved by integrating agile approaches?"

Answering the thesis problematic is based on answering the research questions illustrated in section 4.

Below on this section, we will display a detailed analysis of the research findings and a synthesis of the results and consequently and according to the logic above answer the thesis problematic.

Today, and even though the concept of agility is spreading widely in the business word and evolving among different sectors, this concept is still quite weak in the manufacturing and construction sectors. This issue was clearly addressed by the interviewees where it was clear that any agile knowledge and practices emerged from personal effort and agility is not yet incarnated in the structure of the enterprises. The main reason behind this fact are risk avoiding, cost cutting, time saving on a short term and others.

The fact that there isn't any serious effort, doesn't deny the big opportunity that integrating agile can provide to these sectors while respecting certain conditions and removing predefined obstacles:

- Self-Organized team

The self-organized team approach has heavy contribution in optimizing the lean process considering that the self-organized team owns the process and is most qualified to identify waste in it and optimize it. In addition, applying self-organized team concept increase creativity and allow team members to work faster, in complete freedom and innovative space without direct supervision.

Integrating this practice in lean faces many limitations and obstacles such as the amount of collaboration between team members, the skills, the experience, the training, the problematic of who is held accountable in case of production failure, change resistance and teams capacity to adapt and the most important factor is the amount of authority given to the team during self-organization. In other words, the team will self-organized to execute a task

predefined and planned by management or the team will self-organize in the whole process: planning, budgeting, recruiting, supplying, and executing?

- Working in iterations

Originally, working in iterations in agile is used to deliver an incremental product at the end of each sprint. The advantages of such practice is delivering quickly, allowing the client to see a part of the product, easier to test and debug and optimize during a smaller iteration and avoid risk considering that it is always easier to fix a small part of the product rather than the product as a whole.

Delivering independent parts of the product is not applicable in lean sectors, due to the dependency between the product elements, Consequently it is hard to import working in iterations into lean process but it is possible to integrate some of its practices to improve the lean process especially that even in construction manufacturing and industry, the client is asking today for modification during the production phase and thus the necessity to adapt and change occurs. Working in iterations in a lean process, in other words dividing the full workflow into smaller iterations that are planned and achieved independently can results in a better waste detection and consequently better optimization considering that the optimization is done on a smaller scope scale.

- Daily briefing

Starting each shift with a ten minutes daily stand up or as commonly known as daily briefing is a very powerful tool to remind the team of the day's objective, increase their motivation, share ideas, discuss the progress, assess risk, identify short comes and remind of safety norms. Even though all the listed advantages are applicable in lean, this practice is slowly spreading among manufacturing and construction sectors and has basic use today such as safety reminder and machine checking. The main obstacle of applying it is that managers today still don't believe in its added value and consider it as a waste of time especially that they don't believe in the team commitment level to achieve the intended results of the meeting. This belief is due to the fact that managers get so carried in lean that they don't want to spare even 10 minutes to try something new and explore its benefits, In fact, this tool works the most if management and employees commit to invest in it by dedicating the required time and encouraging communication between team members.

- Retrospective meetings

The Kaizen cycle consists of these major steps: Get employees involved, find problems, create a solution, test the solution, analyze the results, standardize, repeat. ((Margaret, 2018). But how about before standardizing and repeating we evaluate? And re-evaluate and learn from the mistakes that occurred during one cycle?

Retrospective meetings are a window of improvement that allows us to have a look backward, assess and evaluate the cycle, which if added to the lean cycle, results in continuous improvement and give us the opportunity to extract lessons learnt. We have seen through the investigation and the literature review several advantages that retrospective meetings provide such as: facilitating communication, evaluate self-performance, subcontractors and suppliers' performances as well, reminder role to check inventory and store requirement and others. It is important in applying retrospective meetings in a lean production process to determine its occurrence frequency since in an agile process retrospective meeting are held at the end of each sprint.

Ideally, a lean process can be divided into iterations, a team can start each day with a standup, self-organize to achieve the goal and hold a retrospective meeting at the end of each iteration as described above. All these improvements might hit a dead end if the human factor is not optimized as well to deal with it.

We have seen through the literature review and the interviews, that clearly highlighted and emphasized on the change resistance as an obstacle to any implementation, the importance of the human factor especially that employees will be the subject of any integrations and modifications into the structure of an organization. In fact, this factor emerged throughout this research as a defining factor of success or failure of any modification or improvement and a parallel field investigation was required to determine the level of maturity of lean and agile in the workforce of today and the future.

The survey results revealed a low level of maturity of both lean and agile techniques were the highest percentage of participants answered with not knowing at all the lean and agile techniques and when asked about specific tools the result were at its best with a median of familiar but never practiced agile and lean techniques. This low level of awareness, if it stays unresolved, will threat the success of any implementation of agile approaches into lean and thus the importance of optimizing the human factor. This optimization is achieved by

creating motivational environments, inspiring a shared vision, increasing collaboration and communication, and creating spaces for creativity. In fact, these measures are all added value of the previously explained agile tools and can be achieved by integrating them into lean. In conclusion, optimizing the human factor can be achieved by training and coaching about each tool and how to apply it and what are the advantages of its application for the team.

In parallel, the low level of awareness was independent of the level of education since the vast majority of the participants had a level of education that is equal or superior to five years after baccalaureus. Which shows that trainings should be integrated to managers and team members on different levels regardless of their degrees and educational levels.

On the bright side, the survey results show that participants prefer working in an agile environment which reinforce the importance of integrating agile practices into lean especially that most of the participants consider themselves able to work in a self-managed teams and think that identifying and eliminating waste leads to accelerating the process and improving the quality and that dividing the process in smaller iterations make waste detection easier. However, an importanat percentage think that identifying and eliminating waste in a self-managed team leads to frustration and this also proves that, if neglecting the human factor, no matter how brilliant improvements are on papers, they might fail in application.

In general, the reflection on the survey results confirms the importance of investing in the human factor as much as in techniques and procedures where the success of all organization relies on the human factor and whether they are dedicated or not to the procedure.

Finally, and based on all the various reasons, examples, testimonies, investigations, analysis and reflections, lean management can be improved by integrating retrospective meetings, daily briefings, self-organized teams and working in iterations practices to the extents and limitations developed in this thesis. These integrations can improve lean not only on the MUDA level by accelerating the process and helping in waste elimination but also on the MURI level by improving and optimizing the working conditions of the human factor and consequently reducing all the unreasonable loads that are imposed on the workforce that cause stress and reduce manpower productivity.

In the following section after the conclusion, you can find my recommendation on how to apply these integrations.

8 CONCLUSION & RECOMMENDATIONS

❖ Conclusion

The objective of this thesis is to determine which agile approaches can be integrated into a lean process, how they can be integrated? And what are the advantages and the limitations of each integration.

It was determined through the literature review that the most compatible approaches to be implemented in lean were working in iterations, self-organized team, retrospective meeting and daily briefing. The literature review highlighted the core principles of both lean and agile mindsets, the most famous tools and techniques and the challenges facing each approach. The literature review highlighted the importance of the human factor as well, that is the foundation of each success in an organization.

Based on the results of the literature review a field investigation took place on two axes using qualitative and quantitative method: An online survey oriented toward determining the level of maturity of lean and agile with current and future workforces, and semi structured interviews with decision making employees to discuss furthermore each of the four agile approaches in questions.

Following the 316 responses of the online survey and the nine interviews that were held, a deep analysis of the results took place. This analysis was the foundation on which the research questions were answered and consequently the problematic" to what extent can lean management be improved by integrating agile approaches?"

Theoretically speaking, these steps allowed us to prove the importance of integrating agile approaches in a lean process, the advantages of such implementation, which obstacles to eliminate before and while applying it and to what extent each approach can work in a lean process. In addition, it allowed us to determine the level of maturity of both lean and agile approaches on the tested sample.

❖ Recommendations

According to the findings of this thesis the below recommendations are proposed:

Every change should pass with a testing and applying period. It is recommended to apply the change in small doses, analyze the results and adapt according to the results. When it comes to self-organized team in lean sectors such as manufacturing, industry and construction, it is preferable to apply this concept at first on the execution phase. The recommended procedure would be as follow:

- **Define the task for the team** (casting a slab) and provide the required tools and materials
- **Set a target** (finish casting in 3 shifts). Setting the target should be related to the planning and the amount of manhours required according to the plan. It is preferable to set an actual target less than the planned. For example, if according to the plan casting the slab requires 400 manhours set the target to 320 manhours.
- **Couple this target with a motivational factor**. The motivational factor could be finishing the task in 320 and get 30 hours break or finish the task in 320 hours and get paid 350 hours. This will push the team to self-organize better to achieve a task that all members have a common interest to do and will increase the dedication of each member to achieve the goal at the set target.
- **Include a third party to inspect**. The importance of the third party was highlighted during the interviews to ensure maintaining a high-quality product.
- **Test, optimize and standardize**
- **Win-Win situation:** If this method works, it results by both the individual and the organization satisfaction: the team will gain 30 hours and the management will save 50 hours.

N.B: The amount of manhours mentioned in the above paragraph is the sum of all the team hours during the task for example: 3 shifts 10 members 8 hours by shift = 3x8x10=240 man-hours

One of the recommended ways to apply working in iterations practice is dividing at first the whole process into smaller steps and then divide each step into smaller steps. This opportunity emerged from the fact that in a lean process the workflow is a cycle and is repetitive throughout the project with slight modifications. For example, if the whole project is the construction of a building : casting a slab can be considered as an iteration. Within casting the slab (iteration) smaller iterations derive such as formwork, steel reinforcement, casting, and others. It is very important that each iteration starts at the earliest opportunity and doesn't wait the completion of its antecedent to be completed. The advantages of such application are eliminating wastes like waiting time, intellect, processing and inventory.

N.B: Applying this practice is complementary to the self-organized team in lean where each iteration can be considered as a set target where the team will self-organize to achieve.

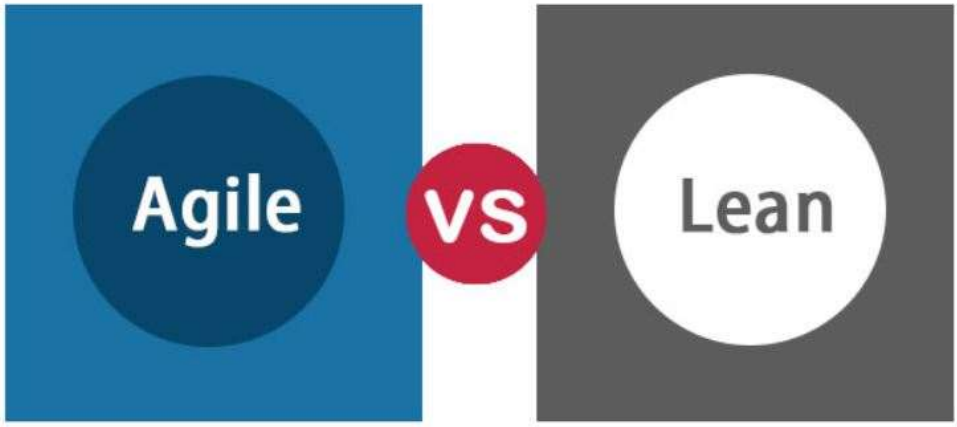
When it comes to retrospective meetings, it is recommended that this practice integrate the lean production process for its importance displayed in the above section in the process improvement. It is also recommended that each team leader adopt the lesson learnt strategy and note every mistake his team made and how they solved it and the possible channels to avoid it. Since the process is repetitive there is a high probability that other teams face the same problem at a different stage of the process. Those lesson learnt should be shared and discuss during the retrospective meetings to increase awareness and improve quality and reduce rework costs. In parallel, it is recommended to set an interval between retrospective meetings (to solve the end of sprint problematic).This interval could be function of time(once every month), working days(every 10 working shift) or reaching set milestones in production (every 5% progress). It is very important as well to insert this mindset between team members and team leaders: so that team members take that extra step and share their lesson learnt with their team leader and eventually so that the team leader note it and share it during the retrospective meeting.

A well-educated and trained employee can achieve excellence. Therefore, it is very important that the integration of any modification in a lean process is coupled with trainings through a learning and development department or external coaches. Another option can be hiring employees that are originally aware of this practice so they can spread the knowledge among team members. In addition, there is a responsibility that lies on the change management department that needs to accompany team members through the change and the fear of the unknown to resolve any resistance issues or power conflict problem. The training

and change resistance measures should include not only team members: team members so they can work and adapt to the changes and managers so that they allow the change to happen.

After displaying the various recommendations that as I believe if put in place will have a great impact on improving the lean process. At the end of this thesis, the question remains if the companies will put the necessary time, budget and effort to realize these improvements? Will they be put in place? And will the actual results meet the theoretical expectations?

APPENDIX A: ONLINE SURVEY



After briefly exploring both lean and agile methodologies, we can conclude that the two methodologies have more commonalities than differences, for example both target to improve quality and emphasis on learning, continuous improvement and customer satisfaction. Most importantly, people are the center of both mindsets where they rely on people to achieve goals, the human factor is clearly emphasized on in each of the above methods developments. But to what extent can agile practices be implemented into lean? Please help me figure out the answer by filling the below survey ! and thank you :)

PERSONAL INFORMATION

What is your highest level of study? *

- ○ BAC
- ○ BAC+3
- ○ BAC+5
- ○ Mastère spécialisé
- ○ PHD

What is your field of specialization ? *

- ○ Business and Management
- ○ Finance
- ○ Admin & HR
- ○ IT and Digital
- ○ Manufacturing, Production or Construction
- ○ Other

How many years of experience do you have?

- ○ Student
- ○ 0-2
- ○ 2-5
- ○ 5+

TECHNICAL KNOWLEDGE

How much are you familiar with Lean management Tools and Methodologies?

Not at all — Extremely familiar

0	1	2	3	4	5	6	7	8	9	10

LEAN - How do you rate your knowledge on the below ?

Select all that apply

	Not Familiar	Familiar-Never Practiced	Familiar-Practiced	Masters
Fishbone diagram	◯	◯	◯	◯
Kaizen	◯	◯	◯	◯
Root cause analysis	◯	◯	◯	◯
Value stream mapping	◯	◯	◯	◯
Waste determination	◯	◯	◯	◯
Waste elimination-optimisation	◯	◯	◯	◯

How much are you familiar with Agile Mindset Tools and Methodologies? *

Not at all — Extremely familiar

0	1	2	3	4	5	6	7	8	9	10

Agile - How do you rate your knowledge on the below ? *

Select all that apply

	Not Familiar	Familiar-Never Practiced	Familiar-Practiced	Masters
Kanban	◯	◯	◯	◯
Scrum	◯	◯	◯	◯
Self-organised Team	◯	◯	◯	◯
Uncertainty Cone	◯	◯	◯	◯
Working in Iterations	◯	◯	◯	◯

TECHNICAL OPINION

In general, Do you find yourself at ease working in which environment? *

Center position is neutral

Lean **Agile**

Are you capable of working in a self-managed team? *

- ◯ Yes
- ◯ No

Are you capable to identify waste in your work process ? *

- ◯ Yes
- ◯ No

What do you think identifying and eliminating waste in a self managed team leads to: *

- ◯ Accelerating the process and improving the quality
- ◯ Pressure and frustration between team members
- ◯ Conflict on responsibility distribution
- ◯ Other

Do you think dividing the process in smaller iterations makes waste detection easier? *

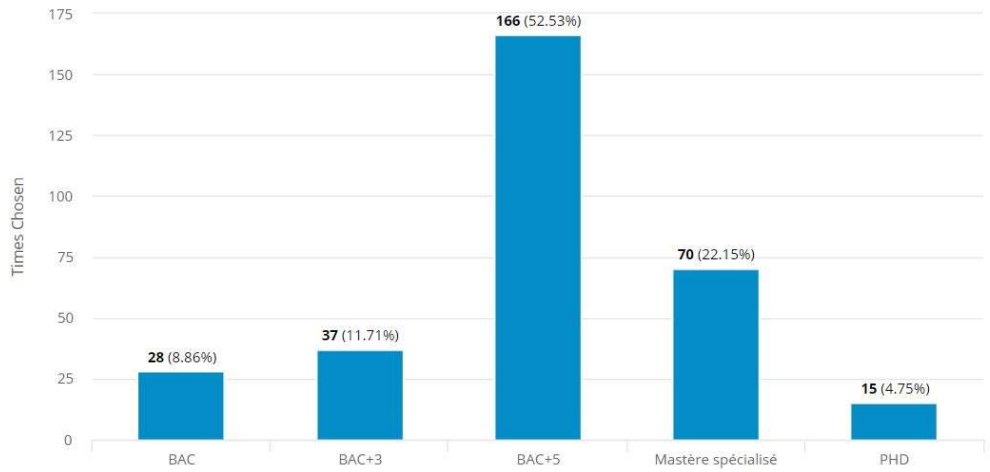
- ◯ Yes
- ◯ No
- ◯ Other

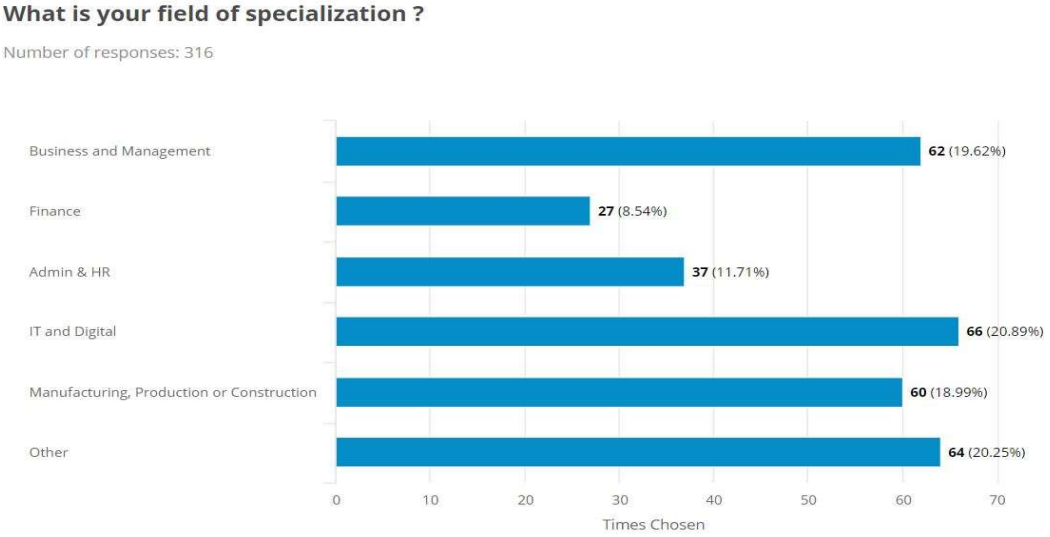
How would you rate this survey?

APPENDIX B: SURVEY RESULTS

316	47.8%	85.1%	02:36 min
Total Responses	Participation Rate	Completion Rate	Avg Completion Time (Trimmed)

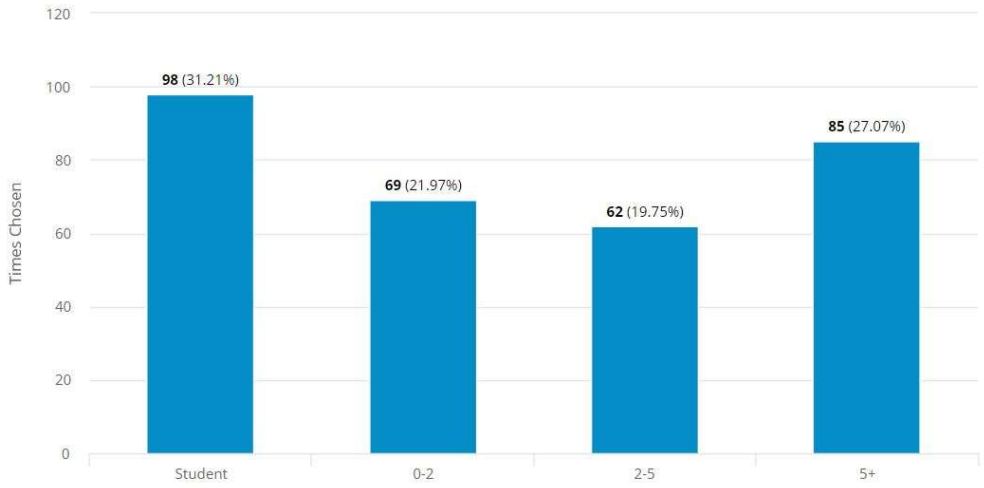
Views	661
Completed	269
Not Finished	47





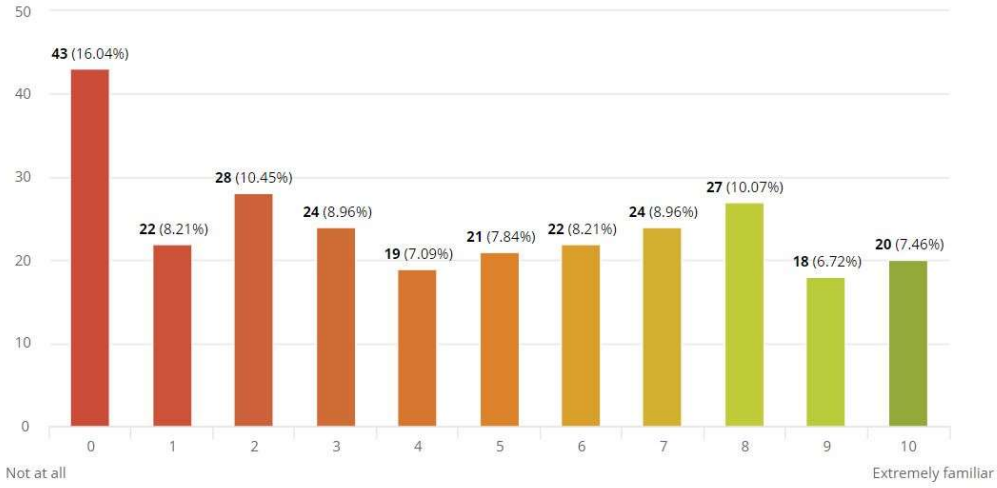
How many years of experience do you have?

Number of responses: 314



How much are you familiar with Lean management Tools and Methodologies?

Number of responses: 268

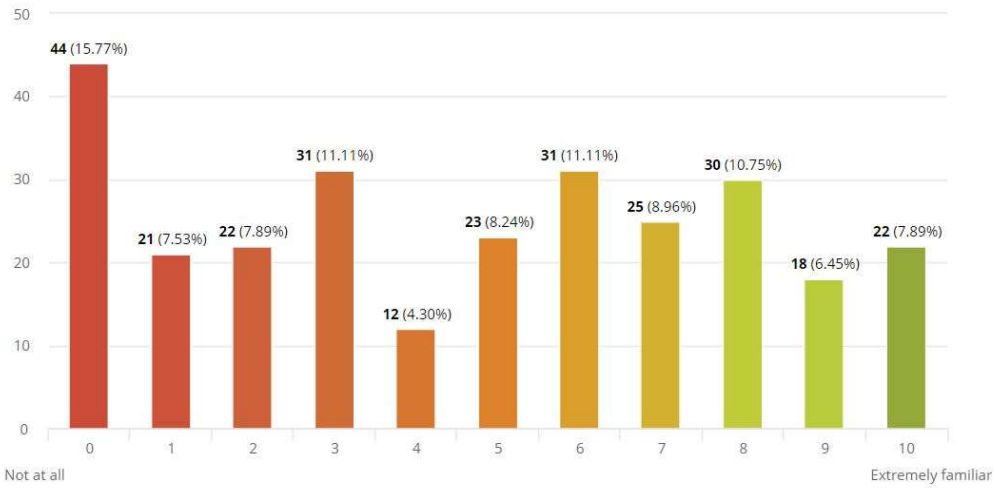


LEAN - How do you rate your knowledge on the below ?

Number of responses: 280

How much are you familiar with Agile Mindset Tools and Methodologies?

Number of responses: 279

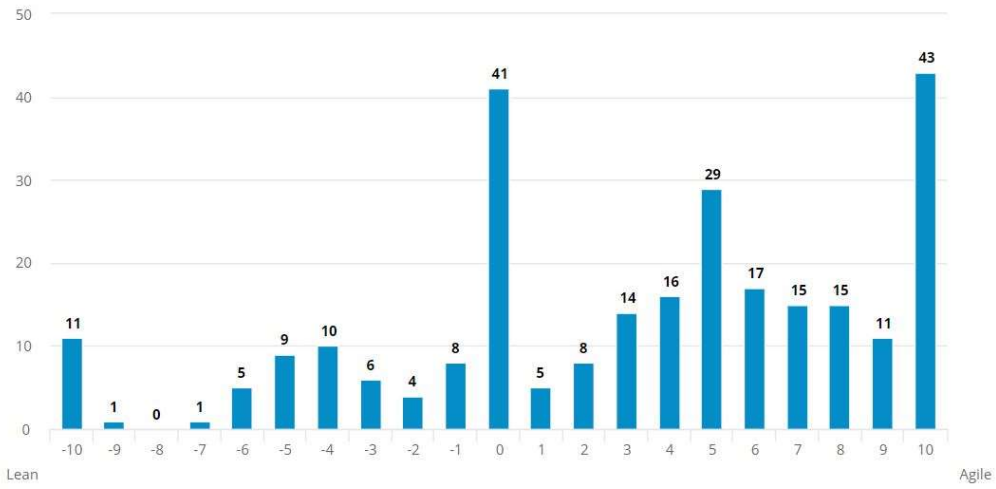


Agile - How do you rate your knowledge on the below ?

Number of responses: 279

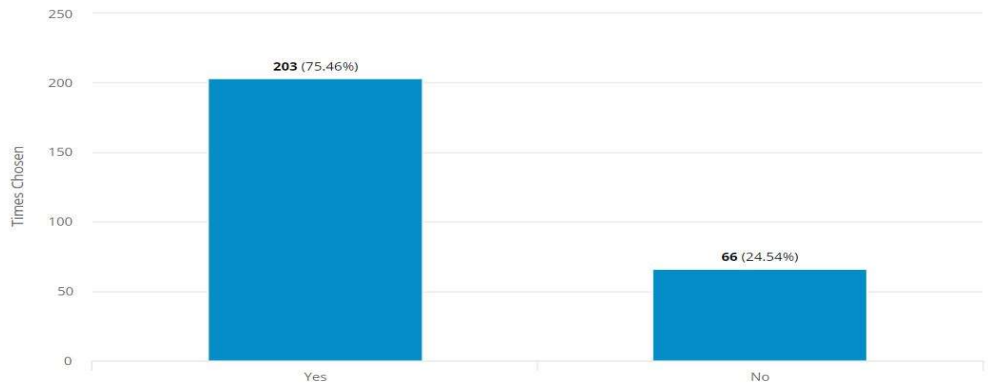
In general, Do you find yourself at ease working in which environment?

Number of responses: 269



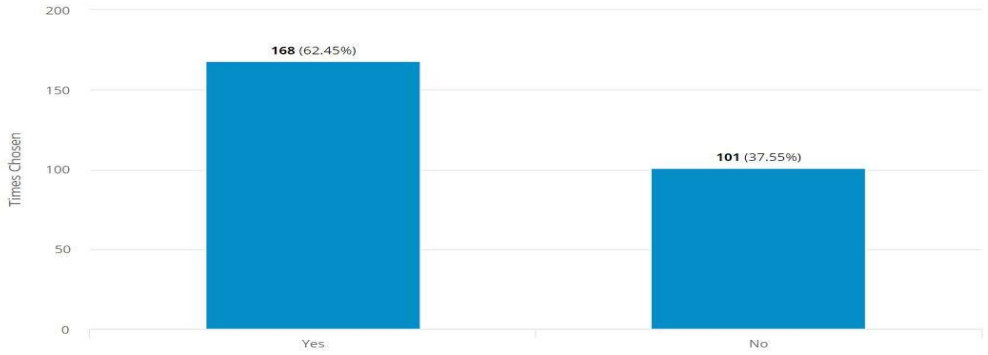
Are you capable of working in a self-managed team?

Number of responses: 269



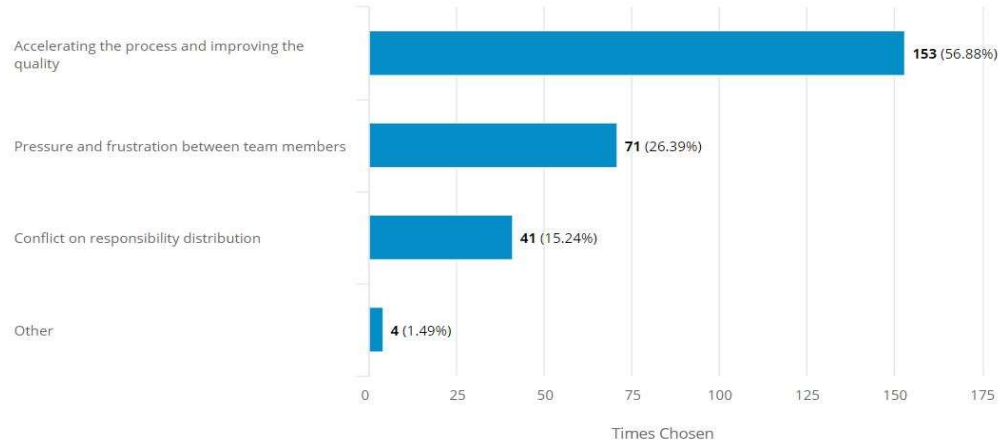
Are you capable to identify waste in your work process ?

Number of responses: 269



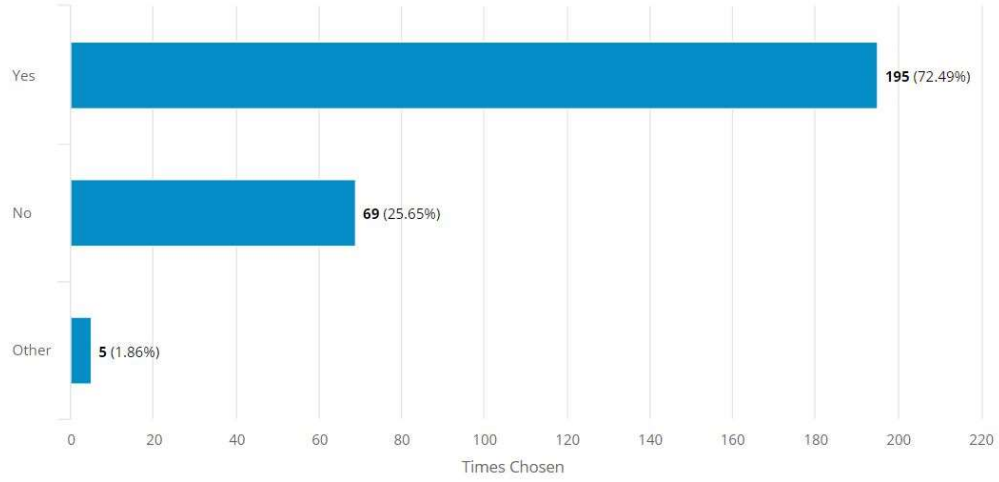
What do you think identifying and eliminating waste in a self managed team leads to:

Number of responses: 269



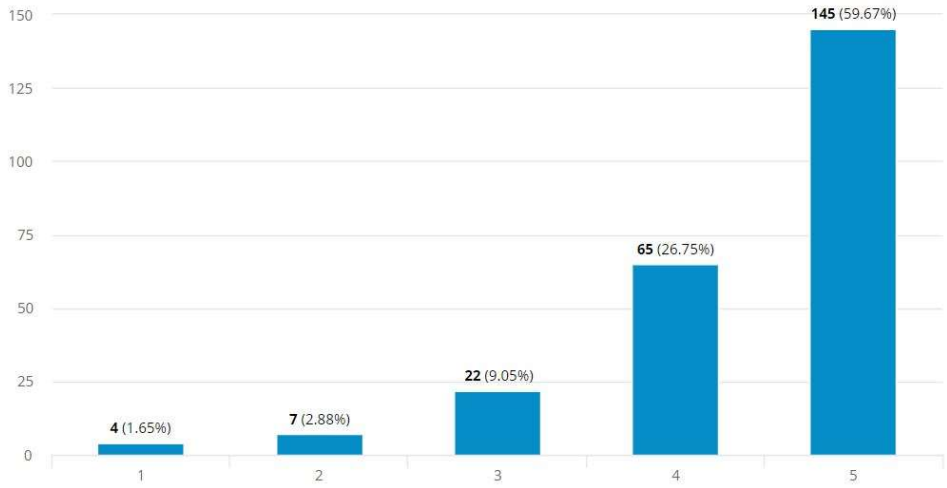
Do you think dividing the process in smaller iterations makes waste detection easier?

Number of responses: 269



How would you rate this survey?

Number of responses: 243



APPENDIX C: INTERVIEW ANSWERS

Determining the maturity level of lean and agile practices

Determining the maturity level of lean and agile practices	What sector do you work in? what is your current position and how many years of experience do you have?
	Does your work environment include any lean or agile practices? What are they and how are they practiced?
	Is it possible for your team members to understand both mindsets? If no what are the obstacles?
	According to lean product development, lean and agile are complementary. Is it possible to integrate agile practices into the process of lean manufacturing?

Collected responses:

	What sector do you work in? what is your current position and how many years of experience do you have?	**Does your work environment include any lean or agile practices? What are they and how are they practiced?**
Head of department A	"Construction / head of department/16 years"	"Lean was introduced into the process twelve years ago/people are more familiar with lean/ Lean trainings done by a consultant/No explicit Agile practices"
Project engineer B	"Mechanical/ project engineer/7 years"	"Lean certifications are a plus in recruitment/Specific lean courses in L&D/ Lean practices save money and time/
Consultant C	"Public sector/ senior management consultant/ 5 years"	"All consultants recently had the scrum master training/ Companies are converting toward agile practices/ Lean is old fashion."
Project engineer D	"Civil and construction/ project engineer/11 years"	"Some Engineers are lean trained/ No practical Lean tools/ target to increase production/ weak agile practices such as the Kanban illustration board and post its"
Consultant E	"Digital transformation/ senior management consultant/ 5 years"	"Lean concepts such as waste elimination and road maps are common/ Agile practices such as scrum
Consultant F	"Learning and development/ consultant/ 5 years"	"Recommended training depending on the company: "scrum master, agile project

		manager-pmi/ lean six sigma (yellow, green and black belts)"
Construction Manager G	"The construction field,/civil engineer.Construction manager"	"My work environment include both lean and agile practices it depends on each executed activity, its type and the need of inspecting it"
Construction Manager H	"I am a civil construction manager with 6 years of experience"	" lean practices: Eliminating defects and improving quality by taking into consideration the lessons learnt (even though they are not documented) Avoiding idle time and insuring continuity by assuring all resources (human and material) are present when needed Frequent meetings but not on a daily basis Weekly updates on the schedule Teams work with small to none supervision but are not self-managed. Tasks and priorities are given and checked at the end"
Construction Manager I	"Engineering, Current position: construction manager. 7 years of experience (4 design engineers, 3 construction engineer)"	"No. Not much, mainly some lean practices but not agile"
	Is it possible for your team members to understand both mindsets? If no what are the obstacles?	**According to lean product development, lean and agile are complementary. Is it possible to integrate agile practices into the process of lean manufacturing?**
Head of department A	"It is very hard to introduce change to a routine work process/ sufficient training is required"	"Agile practices might come in handy in dealing with unexpected work events"
Project engineer B	"The team is always capable to learn new skills, but people tend to resist to change in general"	"I believe we need to keep production moving, it is possible, but it should be integrated at the start of the project"
Consultant C	"The challenge is the actual practice/ the obstacles are lack of knowledge, poor training, change resistance"	"It is always possible since they both target better quality and efficient process"
Project engineer D	"it will dictate cross training team members to perform different tasks, this might lead to wasting of time especially when it is faced with resistance"	"I don't see how lean and agile are complementary, I believe they are quite different"
Consultant E	"My team members already understand both mindsets"	"Some testing and analysing period is required before applying any actual changes"
Consultant F	"As I witness from trainings, teams' members are always eager to learn but the real question is whether they practice it correctly"	"You might be able to integrate some practices that improve the lean without compromising the core lean principles"
Construction Manager	"It is possible that the team understands both mindsets"	"It is possible, better it's necessary as stated before the two mindsets complete each other"

G		
Construction Manager H		
Construction Manager I	"I don't believe it will be easy. The team is formed only by engineers, but with the right guidance we can reach there."	"I have very limited experience in this field, but all sectors are trying these days to be more agile"

Focus on Communalities

Focus on Communalities	Can you identify any communalities between the lean and agile mindsets? What are they? And do you think they are exclusive to your work sector?
	Some consider lean is strictly used in manufacturing and agile is strictly used in software development, do you agree?

Collected responses

	Can you identify any communalities between Lean and agile mindsets? What are they?	**Some consider lean is strictly used in manufacturing and agile is strictly used in software development, do you agree?**
Head of department A	"The communalities are in the value added by the final product, they both target quality and customer satisfaction"	"This is how it started, but the whole business word is converting toward agile environment, thus the necessity of change and evolution"
Project engineer B	"Both mindset discard anything that doesn't give value to the customer whether internal or external "	"So far, there are no serious attempts to implement agile into manufacturing, this might be due to lack of trying, competencies, or avoiding risk"
Consultant C	"It all goes back to the same, human factor is the foundation of both mindsets and the customer satisfaction is the ultimate target"	"Software iterations are easier to implement than production iterations and this is why this belief is very common but with the evolution of agile approaches I believe it is a must to integrate it in lean"
Project engineer D	"Both mindsets allow better collaboration between team members and healthy work environment"	Lean suits manufacturing more, it also works for other industries where there is some sort of repetitions of tasks
Consultant E	"Many agile and lean teams use Kanban for illustration and kaizen for waste detection"	"SAFE framework is a proof that lean can be introduced to software development"

Consultant F	"Iterations in agile are quite similar to each step in the production line, the challenge in lean is to improve repetitive iterations"	"It is easier to implement lean in agile and many companies already done it. One of the core principle of agile is uncertainty-not present in a repetitive process"
Construction Manager G	"Both mindsets are intended to keep the client satisfied, and I don't think it's exclusive for our field of work"	"I disagree with this idea; I think that both these mindsets complete each other to provide the perfect product"
Construction Manager H		
Construction Manager I	" I have very limited knowledge in agile"	" as I witnessed from my experience, lean was used almost in every construction project I was in but no actual agile practices were there"

Focus on the iteration's practices

	Focus on the iteration's practices	Dividing process into iterations is usually applied in agile to deliver incremental value to an uncertain final product. Is it feasible to apply the same concept in a rigidly planned project**?**
		Do you think dividing the process in smaller iterations make waste detection easier?

Collected responses

	Dividing process into iterations is usually applied in agile to deliver incremental value to an uncertain final product. Is it feasible to apply the same concept in a rigidly planned project?	**Do you think dividing the process in smaller iterations make waste detection easier?**
Head of department A	"Iterations are in direct connection with planning. You need to plan, define your product and the delivery method and then divide the process in iterations"	"Value stream mapping makes troubleshooting easier, Value stream only illustrate the steps, if you actual divide the process into smaller steps troubleshooting becomes clearer"
Project engineer B	"Iterations works in a rigid planned project if the project has a continuous flow, so the iterations will resemble	"Dividing in iteration can be translated in waste detection on a smaller scale, which might be easier to be achieved"

	to a specific step of the flow that we target to achieve"	
Consultant C	"It requires standardisation and previous definition of the iterations, similar to the backlog in scrum"	"It does if it is combined with modulization and standardisation"
Project engineer D	"It is very hard to determine the scale of the iteration and define it, function of cost? time? product?	If the iteration division is well structured and defined, I believe it can reduce waste.
Consultant E	" I believe a rigid planned project requires a specific final product with a specific time and cost values, which complicates working in iterations."	"It highly depends on the subject, before waste elimination, waste should be identified, to work effectively it should be combined with subject awareness and mastering"
Consultant F	"In Agile, every iteration delivers new part of the product. It would be possible if you divide a repeated process or a production process into iterations"	"Waste detection would be easier if the challenge of dividing the process into iteration works in first place."
Construction Manager G	"It is feasible, but it may seem a loss of time taking into consideration that the project is rigidly planned."	"Dividing process into smaller iterations makes waste detection easier; inspecting any process closely at every stage will prevent several mistakes and improves the whole process."
Construction Manager H	"In my domain, if the final product is a building, you cannot cast a slab before the columns and consequently if casting a slab is an iteration, it will be dependent of casting the column and cannot come first. In a tower, theses iterations are repeated a high number of time, therefore a team would be dedicated for each activity, thus speeding up the process, improving quality and minimizing the defects"	"Sure, having smaller iterations leads to the control of smaller activities and evaluating their impact on the final product thus eliminating waste."
Construction Manager I	"I believe it could. Any project or plan can be modified to have a more convenient schedule divided in a more convenient way. There is a link between every activity that needs to be respected and maintained though"	"It depends on every activity, sometimes waste detection is centralised and you need the big scope so that the eliminated waste becomes significant"

Focus on the self-organized team practices

	Focus on the self-organized team practices	Is it possible for a self-managed team to identify waste in its working

	process? Or the intervention of a second party is required?
	What are the boundaries and limitations of a self-managed team?

Collected responses

	Is it possible for a self-managed team to identify waste in its working process? Or the intervention of a second party is required?	**What are the boundaries and limitations of a self-managed team?**
Head of department A	"I had an experience with a self-managed team in a war room to close NCRs, the team had full authority and they were capable to manage the process and optimize it"	"It is indispensable to set the correct context and framework; a self-organized team should know exactly what he is responsible of and what are his authorities."
Project engineer B	"The intervention of a second party might be useful specially to monitor quality and time, but i believe a self-managed team is capable to identify waste in its working process"	"In a self-organized team, the responsibility is shared between team members, No one specific is held responsible and in case of failure the whole team is held accountable."
Consultant C	"A third party added value might be the objective view, a self-organised team get carried on too much in the process to a point they can't troubleshoot"	"Some companies test this concept while team members don't have the maturity level to succeed, To clarify people in general tend to like having a supervisor and to achieve previously defined tasks"
Project engineer D	"A self-organised team in my field requires skilled and well-trained labours. I believe if a team can achieve self-organising, It can also own the process and optimize it"	"It requires high time and training investment, in addition, it is risky. Companies tend to avoid risk taking and investing in a risky project, without the sufficient skills a self-organized team is meant to fail
Consultant E	"In order to do so the self-organised team must be collaborative which is not the case in most teams, where uncertainty and ambiguity take the place of collaboration and cooperation."	"I would say the lack of capacity to adapt: It would be easier to apply a self-organised team to newly graduate rather than experienced members. People tend to resist change and find hard time adapting to it"
Consultant F	"The challenge in a self-managed team is the lack of accountability and it can go sideways! If no one is accountable for mistakes a team might be relieved and seek optimisation or tend to accept the status-quo as long as it gives acceptable results!"	"The limitation would probably be new regulations and new processes, outside of their fields of expertise, which might lead to the team inability to adapt"

Construction Manager G	It's possible that a self-managed team identifies waste in its working process, but having a second party will push the team to review every point of view closely before taking decisions."	"A self-managed team might create a stress environment between the team members, during the delivery of the process deadlines will push tension levels higher, this is where each member's scope of work should be clear to each and everyone to prevent team member clashes and deliver the process on time."
Construction Manager H	"It is possible but the team should be totally objective, not stubborn with their ideas and flexible which may not always be the case. Therefore, an exterior intervention may be beneficial"	"The limitation of a self-managed team that may be imposed by the higher hierarchy are mainly related to the budgeting, choice of suppliers and contractors, hiring/firing people. Internally, power conflicts may occur between team members, too many team members may slow down decision-making, new ideas may be refused in favor of group thinking and the conformity of team norms, and in case of failure no individual is accountable for the bad result"
Construction Manager I	"believe every team should be able to do that. At least minimizing it to the lowest possible limit. That said, an intervention of a second party can surely identify the voids in the team and uplift the team performance and reducing waste"	"Even though I might consider giving my team the authority to execute the task however they see best. I am not ready to allow concrete casting without checking their work at fistm I believe the given authority is an obstacle and is directly linked to the level of confidance"

Focus on the daily briefing and retrospective meeting practices

	Focus on the daily briefing and retrospective meeting practices	Do you do a daily briefing with your team members? What are the cons and pros of such practice?
		Do you practice retrospective sprint with your team? If yes, how often? And what are the advantages of such practice? if no, why? and what are the alternatives?

Collected responses

	Do you do a daily briefing with your team members? What are the advantages of such practice?	**Do you practice retrospective sprint with your team? If yes, how often? And what are the advantages of such practice? if no, why? and what are the alternatives?**
Head of department A	"The daily briefing enables team members to be updated on how things are going, it increases the feeling of involvement in the process"	"Retrospective meetings are a great way to put all complaints and obstacles on a round table and consequently develop preventing ways to avoid the continuity of such issues"
Project engineer B	A daily briefing is important to discuss the goals of our planned work activities and identify any shortcoming and solve it beforehand.	"yes, we do this on a regular basis may be weekly basis. It is needed to identify possibilities for improvement in quality, time and cost/usually the alternatives are none recurring meeting or digital communication"
Consultant C	"I think the daily briefing is equally important on two axes: discuss the daily objectives and a look ahead to avoid any obstacles"	"The retrospective meeting allows the team to evaluate its performance, identify improvement possibilities and change if needed/I think analysing the KPIs is an alternative for some companies"
Project engineer D	"During daily briefing, we check machine reports. If anything is wrong, we adjust, else we continue producing according to plan."	"We don't practice retrospective meetings in our work process, instead we do an evaluation through planning in comparing what was planned and what was actually completed"
Consultant E	"In a self-organized-team the daily briefing is a podium to share ideas and build trust between team members"	"Similar to daily briefing retrospective facilitate collaboration and communication between team members but it is results oriented rather than objective oriented "
Consultant F	"During the daily briefing team members gets the opportunity to express any difficulties that prevent them to reach the sprint target, and thus ensures that the sprint productivity and the workflow persistence."	"The retrospective meetings increase the lesson learnt awareness, where every member can share what issued he resolved and what issues he is facing which facilitate preventing the same issues by other members through lesson learnt"
Construction Manager G	"We have a daily briefing with the team member; one of its main pros is to follow up the client's planning variations and critical tasks, which will improve the process. But daily briefing can be a loss of time where everyone might be late for a more important task. I do not imagine asking the whole team to start working 10 to 15 minutes later each day just to chat and discuss ideas"	"We run a weekly retrospective sprint, in which we inspect the process identify and order the major items and try to improve it, anything improved will facilitate the team's work and organize its time in a positive way."
Construction Manager	"We have frequent small meetings but not daily. When needed, a 2	

H	minutes phone call may solve the problem without the need for a meeting. Sometimes a fixed daily meeting becomes a waste of time if no change in the plan or priorities, new activity, delay, accident, lesson learnt, … occurs.“	
Construction Manager I	“Yes. As a team leader, missing the briefings can lead the team to waste time and perform badly. The main disadvantage is wasting time, this task takes a lot of my energy and time that can be put to better use.”	“I am not familiar with retrospective meetings as I previously mentioned agile approaches aren’t practiced in my team

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