Key issues and strategies for implementing the Lean Methodology in organizations

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Abstract:

The media landscape today is shifting towards the digital and business is highly competitive. This has forced companies to look for new solutions to produce faster and innovate with less waste, and the lean methodology, originated from the Toyota Production System (TPS), has been identified as a potential solution to guide companies towards sustainable economic growth. Even though the philosophy is easy to grasp, studies have proven that implementation may be challenging due to a lack of understanding and measuring performance incorrectly. This study is based on a theoretical framework that looks into what lean is and what approaches there are towards implementing lean principles in organizations. It also explains how this methodology can benefit various companies and impact revenue positively, through genuine feedback from experts who have a personal experience of lean in practice (n = 71). To conduct this study, an online survey was shared in a selection of channels on social media to involve lean experts in both different industries and geographical areas. Even though most of the study participants say they have noticed a proven significant business growth thanks to lean, there is still hostility and resistance towards the principle. This may be a result of an organizational culture and strategy that is not very suitable for implementing lean.

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FOREWORD

Back in 2015, I joined Schibsted Media Group (Finland) in the position as a *Lean UX Designer* under mentorship of Mr. Esa Övermark and Mr. Juha-Antti Huusko. During my time in the company, I got introduced to lean principles utilized in software development, which has inspired me to look at the topic from different angles. I would therefore like to thank both Esa and Juha-Antti, who ignited my interest towards lean.

The process of writing has been challenging at times, but thanks to close guidance by Dr. Owen Kelly, at *Arcada, University of Applied Sciences*, I have managed to proceed in the research through determination and clear milestones. I can truly say I have enjoyed every bit of my studies.

I would also like to show my greatest gratitude to my spouse, family and friends for all support and understanding.

Finally, I would like to gratefully acknowledge my father, Stefan Djupsjö, who helped me with proofreading the text with excelling precision.

Helsinki, November 2019

Thomas Djupsjö

1 INTRODUCTION

1.1 Problem statement and questions

This study will examine what lean is and what approaches there are towards utilizing lean principles in different organizations. It will look at challenges and key issues with measuring success, and how the lean methodology can benefit teams in different industries and with different organizational cultures. It also studies how lean has been perceived by members in teams by critically looking at genuine feedback and analyzing performance, tools and implementation strategies.

The study will be based on the following research questions:

- What is the lean methodology?
- What are the main issues when implementing lean?
- How have employees perceived lean in organizations?

1.2 Aim and rationale

The world is shifting towards digital and business is highly competitive. Therefore, organizations are looking for new potential solutions to produce faster and innovate with less waste. (Karim & Arif-Uz-Zaman, 2013). The lean methodology, originated from the Toyota Production System *(TPS),* has been identified as a potential solution (Pakdil & Leonard, 2015) and is researched from different angles throughout this report.

The purpose of this study is to analyze different aspects of organizations, such as knowledge work, culture and the office environment, and address key issues to consider when applying lean. The research will also summarize insights from previous studies, looking at implementation strategies, leadership and history of the methodology to give the study a wide view on lean principles.

This research is based on a literature review and quantitative research, conducted with experts that have experienced lean principles in organizations.

2 CONCEPT DEFINITIONS

2.1 Lean thinking

Lean thinking is a concept introduced in 1996 as a principle to administer business, manage systems to create value (d.A. et al., 2017), minimize waste and to achieve more with less efforts in organizations. These principles have proven to benefit learning processes in teams and have a direct impact on how employees act (Stone, 2012). It also entails tracking the correlation between the production of services and the pull of the customer (demand) (Kropsu-Vehkapera & Isoherranen, 2018).

2.2 Lean manufacturing

Lean manufacturing describes utilizing lean thinking in a manufacturing setting, with a focus on avoiding manufacturing waste, managing with less workforce and optimizing product development and operations (Utku et al., 2018).

It also offers benefits such as reduced inventory levels, higher product quality, safer work environments, reduced lead times and cost reduction that may offer performance superiority to manufacturers (Ghobakhloo & Azar, 2018).

2.3 Lean leadership

Lean leadership is very like transformational leadership, where employee wellbeing and satisfaction is in focus through a human-centric approach. Lean leadership also puts effort on self-development, knowledge sharing and continuous learning that supports workflows in the organization (Håkansson et al., 2017).

2.4 Organizational culture

Organizational culture is a system that unites team members through ways of working, traditions and stories. It develops cumulatively over time, where employees adapt to new social environments, and is socially constructed on the unconscious level. (Pakdil & Leonard, 2015).

3 CONTEXT AND BACKGROUND

The global environment and industries are rapidly changing, as technology allows new opportunities to provide customers with value online. Content is consumed anytime, anywhere and anyhow, and content is fighting for attention, as a dramatic increase in products and channels is occurring. This makes the market unpredictable, and it is becoming more expensive and resource-dependent for companies to differentiate and make sustainable economic growth. Therefore, organizations are rethinking and optimizing their value chains and some companies are experimenting with new business models. Business models, such as the *freemium* model, are good examples on how companies are changing their revenue streams to match the landscape better. (Küng, 2017)

This converging competitive market means that different channels need to work close together. Industry borders are also becoming more porous, as new agile firms are entering the market. Enormous companies such as Google, Apple, Facebook and Amazon are therefore expanding their services away from their core business to strategically answer to the changes in the industry. These companies are also using sophisticated use of data to create personalized experiences that boosts attraction, increases differentiation and feeds user stickiness. (Küng, 2017)

Well-established companies have noticed that they need to be on the edge and follow trends to be able to provide customers with value. These experiences are mobile, on-demand and customers are expecting to be provided with free content when and where they want (Küng, 2017). At the same time firms are looking into solutions to make production more effective and reduce an excess waste of resources (Stone, 2012).

Teams in organizations are also changing, where flexible, multidisciplinary teams are established, that combine knowledge, experimentation and innovation in agile ways (Küng, 2017). A focus on the office environment, employee health, well-being and job satisfaction is highly important as full-time employees spend around 40% of their waking hours at work. Studies prove that poor working conditions can create suffering in form of illness and stress, which results in extra costs for societies and organizations. Therefore, there is a growing interesting in lean office design that tries to free up time and give flexibility (Bodin Danielsson, 2013).

In the following chapter lean principles are analyzed in a literature review to better understand organizational challenges and customer needs that support the current rapid changes in the industry.

4 LITERATURE REVIEW

4.1 Context of lean

As stated in the introduction, global competition, technological change and selective customers are forcing companies to optimize manufacturing processes (Karim & Arif-Uz-Zaman, 2013) and put efforts on iterative learning (Mansoori, 2017). Therefore, principles such as the lean methodology, originated from the Toyota production system (*TPS*), have been used in organizations to be able to deliver faster, give flexibility and eliminate waste to gain competitive advantage (Karim & Arif-Uz-Zaman, 2013). Lean also offers suitable tools and philosophies on all organizational levels (Håkansson et al., 2017; d.A. et al., 2017).

The Toyota production system includes determining value given to the end user, value flows for products, continuous flow, pulled production and continuous improvement towards perfection (d.A. et al., 2017). There is, however, a contrast in lean processes where the continuous improvement and respect for people combine, which can also discourage employees to participate (Pakdil & Leonard, 2015).

Companies are changing parts of their supply chain to deliver high-quality products faster, at the speed of the customer demand (Karim & Arif-Uz-Zaman, 2013). Therefore, it is crucial for managers to know how to convince, motivate and involve employees when transforming into lean principles (Taherimashhadi & Ribas, 2018).

Lean principles, considered a system of combined ideas (Taherimashhadi & Ribas, 2018), includes doing purposeful experimentation (Mansoori, 2017) and was naturally grown among workers at Toyota for five decades, which is a reason to why it has been hard to document. It is important to know that Lean Manufacturing not only applies to manufacturing (Taherimashhadi & Ribas, 2018), but can also be utilized in e.g. customer relations and product design (Karim & Arif-Uz-Zaman, 2013).

Lean ideas are also used in the public sector, giving value to the citizen and enhancing management practices. In public organizations it has been beneficial especially since public organizations are working close with the citizen and with a need to be flexible. There are, however, political influences that affect the application of lean and planning and implementation may need adjustments to suit the administrative sector (d.A. et al., 2017).

Even though the philosophy is rather easy to grasp, it has been proven hard to successfully implement in organizations (Taherimashhadi & Ribas, 2018). A reason to unsuccessful execution of the principles is a lack of implementation understanding and measuring performance incorrectly. It is therefore crucial to measure the right thing at the right time for effective decision-making (Karim & Arif-Uz-Zaman, 2013) and to acknowledge that different implementations of lean can result in different outcomes in the company (Håkansson et al., 2017).

4.2 Lean thinking

The lean thinking principle, which is a philosophy based on avoiding waste and giving value (Stone, 2012), can benefit from using *Value Stream Mapping* (*VSM*), a tool that identifies excess waste, and find solutions to gain performance and agility (de C.F. et al., 2018). Value Stream Mapping also tries to make intangible work more concrete and standardized, and many times, this is the first thing applied in a knowledge worker setting when applying lean. (Kropsu-Vehkapera & Isoherranen, 2018).

The *Lean thinking* concept was introduced in 1996 as a principle to administer business, manage systems to create value (d.A. et al., 2017), minimize waste and achieve more with less efforts in organizations. The principles have proven to benefit learning processes in teams and organizations and have a direct impact on changing how employees of an organization act (Stone, 2012). It also entails tracking the correlation between the production of the services and the pull of the customer (demand). All these aspects must include continuous improvement that supports the operations towards perfection (Kropsu-Vehkapera & Isoherranen, 2018).

Waste can be defined as human activities that consume resources but create no value (Stone, 2012). Another study refers to waste in two types: surface and leadership waste.

Surface waste can be defined as waste identified in how the company operates and leadership waste as something concerning administrative strategy and management (d.A. et al., 2017).

Value on the other hand, can be explained as a capability to provide a customer at the right time at an appropriate price, defined individually by each customer (Stone, 2012).

Lean thinking also provides employees tools at all organizational levels (d.A. et al., 2017), such as lean boards for visualization and continuous learning monitoring to help with employee engagement (Håkansson et al., 2017).

The principle has a diverse range of definitions, which can cause dilution and difficulties when using process improving methods. It also results in numerous ways of implementation, and some companies are incorrectly using the lean toolbox without understanding the underlying philosophy (Stone, 2012).

To successfully implement lean, eight steps have been defined to support the process:

1. Committing to change through communication, experimentation and flexible tool application supported by the top management
2. Defining and understanding the value flow and creating improvement plan processes
3. Learning about lean, arranging lean thinking trainings and creating a learning plan
4. Mapping current status, by exposing current workflow and information units for analysis
5. Defining principle performance measurables to be able to follow objectives
6. Mapping the future status by determining where lean tools needs to be used, understanding customer needs, the implementation phase and how to distribute work equally
7. Creating a continuous improvement (*Kaizen*) plan
8. Implementing the *Kaizen* plan and following it up

(de C.F. et al., 2018)

In order to be able to track current and future status it is necessary to use process modeling that transparently shows the results of lean, including goals, costs and performance (d.A. et al., 2017).

4.3 Lean in knowledge work

Knowledge work has been defined as managing information and is considered invisible and more dynamic than regular factory work. Knowledge work is also more complex and includes strategic thinking and problem solving through utilizing abstract sets of data. (Kropsu-Vehkapera & Isoherranen, 2018)

Sometimes the terms *knowledge work* and *services* are used inaccurately synonymously, e.g. in call center work, where the tasks resemble more the typical manufacturing process. It is considered a big difference when someone is applying given information compared to innovatively using information to develop new products or strategies.

For collaboration in knowledge work, a group of individuals need to be involved with their individual expertise and work in a mobile, collaborative way. When applying lean principles in knowledge work, all its peculiarities need to be understood (Kropsu-Vehkapera & Isoherranen, 2018) as there is a tendency to use loosely defined jargon that results in confusion in the context of lean (Stone, 2012). Therefore, lean should be thought and trained through philosophy rather than implementing tools that might be unsuitable for knowledge workers (Kropsu-Vehkapera & Isoherranen, 2018).

Lean has also been linked to more intensive work and many studies have revealed worse social conditions (Håkansson et al., 2017), perhaps as knowledge work is increasingly diverse and, in some areas, only part of the operations (Kropsu-Vehkapera & Isoherranen, 2018). Many times, only benefits and experiences are documented and learnings are left out (de C.F. et al., 2018), which contributes to difficulties implementing the principles (Kropsu-Vehkapera & Isoherranen, 2018).

Two types of knowledge have been recognized; *tacit* and *explicit*. *Tacit* knowledge is relative to the abilities of team members or practices in the team. It can indirectly be shared through examples and this knowledge is considered vital for learning and innovation. *Explicit* knowledge is documented and can be shared among members of a team in the form of rules or guidelines. (d.A. et al., 2017)

The workplace landscape is highly competitive and knowledge workers are required more than ever before. There are many areas to improve and challenges, like the slow economic growth in Europe, from where jobs are moving to China and East Asia, put pressure on

making knowledge work more productive. This means that work is done at a lower cost than in foreign companies. Productivity is typically measured as output divided by input. Measuring is however difficult, as the produced knowledge work many times is intangible and is based on an individual's knowledge and experiences and how they are applied in work (Kropsu-Vehkapera & Isoherranen, 2018).

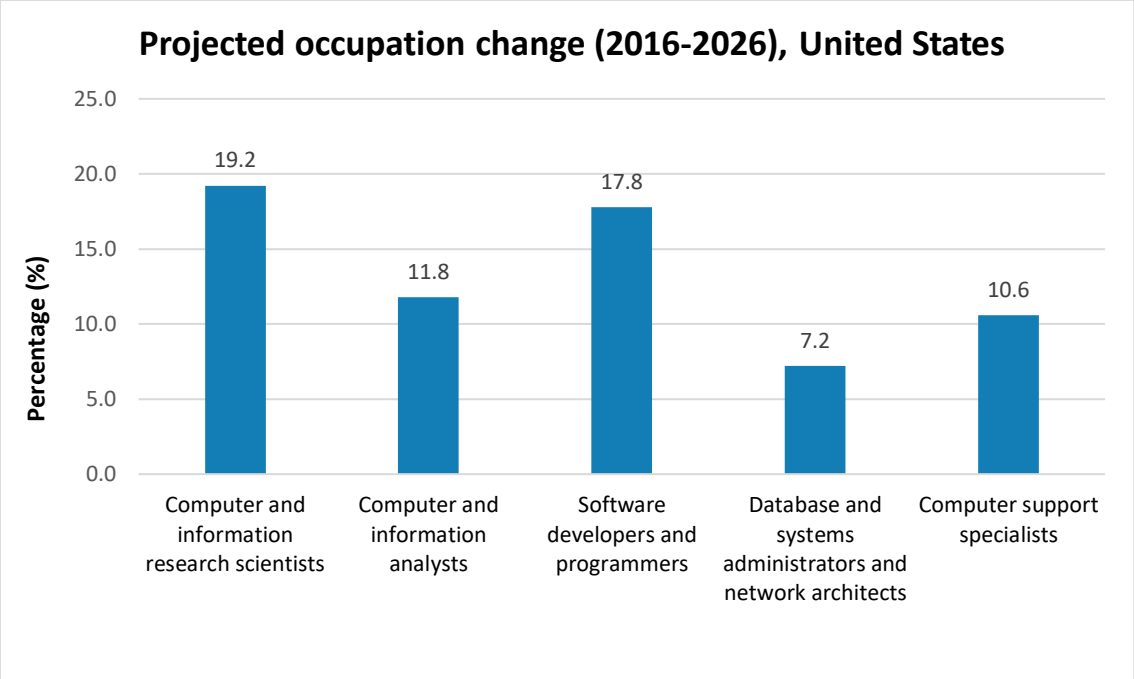


Figure 1. Projected occupation changes in knowledge work in the U.S. (U.S. Bureau of Labor Statistics, 2019)

4.4 The lean office

Lean has been used in organizational changes and is referred to as *lean office* in an office setting. It can be utilized in administrative areas such as removing waste in processes and information flow (de C.F. et al., 2018) to respond quicker to market changes (d.A. et al., 2017) and free up time to give flexibility (Bodin Danielsson, 2013). The lean office principle also tries to avoid overproduction, extra inventory, defective products, waiting time and extra logistics (de C.F. et al., 2018).

Other typical ways of applying these methods are by cutting down printed documents, minimizing underused human resource as well as reducing hierarchical levels and document storage costs (d.A. et al., 2017).

The lean office can be divided into two; the *Neo-Tayloristic Lean Office* and the *Team-Based Lean Office*. The *Neo-Tayloristic Lean Office* includes standardizing work processes and administrative areas to make whole companies more productive. The *Team-Based Lean Office* focuses on solving problems in teams and learning. To increase efficiency within the team, creativity, team dynamics and autonomy is considered a key area (d.A. et al., 2017). Therefore, autonomous cross-functional teams are established that combine knowledge, experimentation and innovation in agile ways (Küng, 2017).

Although lean has been increasingly popular in many sectors, it has also been associated with high stress levels, tension and anxiety in teams (van Dun & Wilderom, 2016). There are also examples on authoritarian hierarchies, work with too high intensity and humiliation. Therefore, socially sustainable working conditions, *SSWC*, are crucial to give enough resources that support employee growth, health and meaningful work (Håkansson et al., 2017) when applying lean.

4.5 Lean leadership

Management is considered a system to implement organizational goals as leadership embraces a role to engage and inspire employees to achieve the goals. In lean management leaders need to include employees and empower them (Håkansson et al., 2017), as team leaders managing a lean team have a big role in how the workers behave (van Dun & Wilderom, 2016). Management style, cultural differences and implementation approach all have an impact on working conditions in organizations (Håkansson et al., 2017).

Studies say that a human centric approach to lean implementation has better outcomes and that there is an important relationship between management practices and employee engagement in change. Work in a lean environment is considered of value when it supports workflows. Therefore, managers may want to promote activities that help the company towards business goals. (Håkansson et al., 2017)

A top example from Toyota in Japan on a lean organization is an office without rooms, where the employees sit together in rows of desks (Pakdil & Leonard, 2015) and where working progresses can be developed to bring customer value (van Dun & Wilderom,

2016). Leadership culture plays an important role at Toyota, and four main aspects of leadership have been defined:

1. Managers need to enable self-development and encourage learning at work
2. The culture needs to embrace coaching and give possibilities to learn, but also to teach others
3. Daily continuous learning *(Kaizen)* should be supported throughout the organization
4. Goals should be linked to problem solving

(Håkansson et al., 2017).

Leaders coaching lean, measuring maturity and how employees cope with change, can be considered crucial for a successful implementation (Håkansson et al., 2017). Therefore, it is important for managers to understand that a collision in cultures may slow down adaption and performance (Pakdil & Leonard, 2015).

4.6 Organizational culture and lean

Organizational culture is a system that unites team members through ways of working, traditions and stories. The culture develops cumulatively over time, where employees adapt to new social environments. Culture is also socially constructed on the unconscious level and shared values are necessary to give certainty on how the company should operate and what is accepted. (Pakdil & Leonard, 2015)

Socialization refers to explaining to new employees what expectations there are towards working performance and is necessary to use, to avoid *outsiders* (someone outside the social circle). As a certain company culture can block new improvement programs from being implemented, an assessment of the culture needs to be done to verify that the improvement program is suitable. If the culture is not suitable towards lean, the culture must be altered towards success. The key is finding out what processes are possible to implement with minimum change. (Pakdil & Leonard, 2015)

Organizational culture needs to be examined thoroughly to be able to create sustainable lean processes, as lean values might contradict the cultural values of the company. Although cultural aspects are considered an important factor when implementing lean

(Pakdil & Leonard, 2015), many organizations are leaving these out (Taherimashhadi & Ribas, 2018). Employees also need proper training when implementing the principles (Pakdil & Leonard, 2015) and, established personal development programs (d.A. et al., 2017) and leaders at all levels need to change their mindset (van Dun & Wilderom, 2016).

The maturity of the organization needs to be considered, as well as its ability to adapt and learn. The application of the principles will be slowed down if change resistance is not considered (Kropsu-Vehkapera & Isoherranen, 2018). Internal resistance towards new methods mean that also top managers and leaders need to be involved in developing the attitudes of employees, as it directly affects employees' behavior (d.A. et al., 2017).

Multiple organizational cultures have been defined that adapt lean in different ways:

- Group culture is an organizational culture that consists of teamwork and employee involvement and works well with lean implementation.
- Development culture is flexible and creative and has an external focus. There are high ambitions on individuals taking risks and preparing for the future. This works well in a lean process as managers are responsible for employee and business performance. The processes are effective in creativity and problem solving.
- Hierarchical culture is identified by hierarchy, rules, strict training and low flexibility. This means that the output will be consistent and that the process is efficient, predictable and eliminates waste. The lean process will be effective as processes are standardized and controlled.
- Rational culture (market culture), is recognized by its low flexibility and its focus on a hostile external environment such as regulators and customers. The rational culture tries to improve its competitive position. The core values are competitiveness and profitability. In a lean implementation the focus is on increasing efficiency, quality control and productivity to be able to compete in the industry.
- Balanced culture. In a balanced culture internal and external aspects are considered. Toyota promotes this and has successfully implemented this within their organization. This culture has a positive effect when implementing lean principles.

(Pakdil & Leonard, 2015)

4.7 Lean startup

Lean startup is a framework that combines ideas from lean manufacturing and entrepreneurship as a philosophy (Ries, 2011), where long-term planning is rejected to focus on experimentation and iterative learning as a cyclic process (Mansoori, 2017). It has gained substantial attention among entrepreneurs (Mansoori, 2017) as it can reduce extreme uncertainty by involving customers in product development and testing of new services (Bieraugel, 2015). Lean startup is also prominently visible in University entrepreneurship programs and accelerators where it has been favored over business planning (Mansoori, 2017).

Lean startup as a principle was developed by Eric Ries in 2011 (Bieraugel, 2015). Ries explains lean startup as an application of lean thinking to innovation that measures progress through validated learning (Ries, 2011), but also as a set of processes that reduces time, risk and investments when starting a company (Bieraugel, 2015). It also focuses on customer feedback, vision and ambition. Ries states that the goal of a startup, a new company that aims to develop an innovative service, is coping under extreme uncertainty. Therefore, it must build products that consumers want as fast as possible through unproven, even radical services (Ries, 2011).

The lean startup methodology utilizes tools from other principles, such as the customer development framework, rapid prototyping and agile software principles to execute purposeful experimentation (Mansoori, 2017). Therefore, lean startup promotes determining key features in a product and measuring assumptions through customer feedback to reduce risk to organizations (Bieraugel, 2015). To test assumptions, organizations can create an MVP (minimum viable product) that works as a version of a product with the smallest number of features to provide entrepreneurs with insightful feedback (Mansoori, 2017). The minimum viable product is developed for the customer and is measured through an assessment on how well it functions (Bieraugel, 2015).

Testing with an organization’s target customers is done in a scientific manner, utilizing assumptions the organization has about its audiences. Hypotheses, which require rich, comprehensive and continuous acts with potential or current customers, are used

throughout the launch of a new service (Bieraugel, 2015), which results in reliable empirical data to be analyzed (Mansoori, 2017).

Another core area of lean startup, that differs from traditional management, is *pivoting*, which means changing parts of a tested hypothesis. This could mean introducing new features, shifting to another customer audience or even lead to completely new concepts. Through learning from these changes, the company should decide if the concept development should persevere or pivot (Bieraugel, 2015).

There are five main principles included in the lean startup methodology (Ries, 2011):

1. **Entrepreneurs are everywhere**
   Anyone who works with product development under extreme uncertainty can utilize lean startup, regardless of company size, industry or sector.
2. **Entrepreneurship is management**
   A specific type of managerial approach is needed to cope with extreme context (landscape).
3. **Validated learning**
   Continuous systematic tests can give valuable insights on how to run sustainable business.
4. **Build-measure-learn**
   The build-measure-learn loop gives accelerated insights turning ideas into products. It informs the organization on whether to pivot or persevere.
5. **Innovation accounting**
   All involved innovators are accountable for measuring progress, prioritize tasks and set planned actions. This may need an organizational change.

(Ries, 2011)

4.8 Lean in software development

In the following chapter a few frameworks (agile, scrum and lean six sigma) are explained, as examples on how lean has been formed in different industries.

4.8.1 Agile

In the digital landscape today, it is important for firms to collaborate closely with suppliers to be able to understand and develop a company's supply chain. When constantly creating new products, for example in the software industry, utilizing agile tools has seen a great increase. (Emerald Publishing Limited, 2017)

Lean and agile share many basic ideas and characteristics and both seek to eliminate waste from processes that generate value to customers (Krehbiel & Miller, 2018). From a performance perspective, lean manufacturing is a predecessor to agile, and there is a considerable overlap in practices between lean and agile (Ghobakhloo & Azar, 2018).

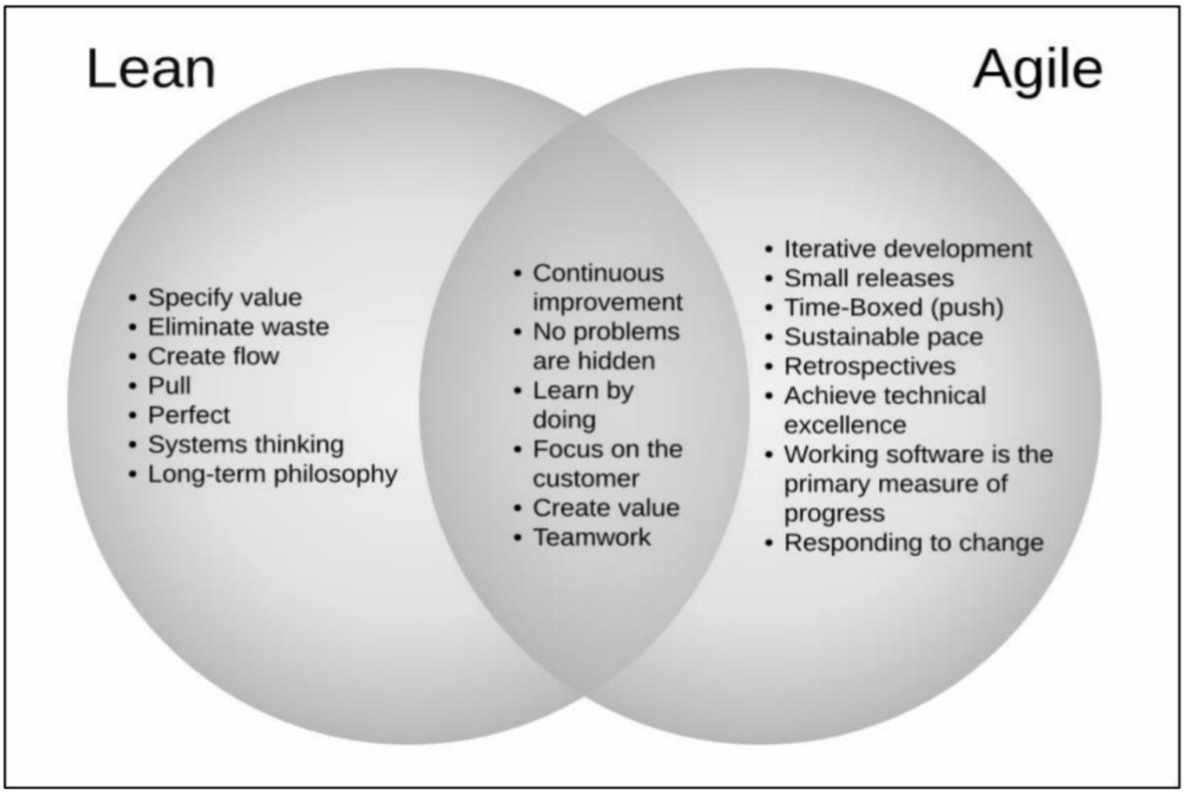


Figure 2. Lean and agile philosophies overlap in certain focus areas (Krehbiel & Miller, 2018).

Both systems have commonalities, though there are differences in adoption. In lean manufacturing, safety, delivery and risk is prioritized, while agile manufacturers focus on

technology, services, research development and production capability when selecting suppliers (Emerald Publishing Limited, 2017).

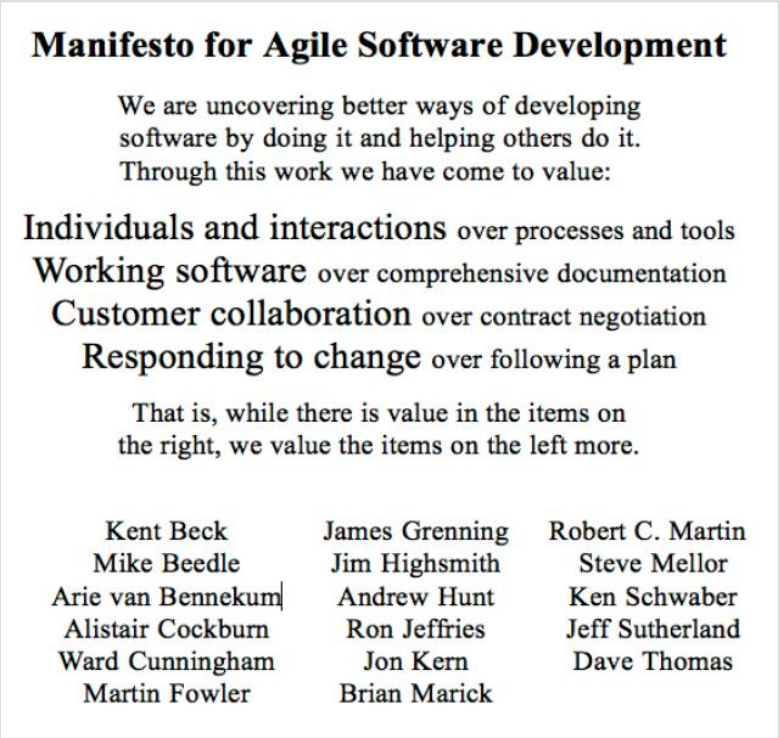
Lean has been considered a slow process that prevents innovation and only associates with manufacturing, with no relevance to software or technology (Krehbiel & Miller, 2018). Nevertheless, studies show that lean and agile co-exist and offer high performance gains, and some scholars propose that neither philosophy is better or worse than the other, thus working complementary (Ghobakhloo & Azar, 2018).

A common definition of agile manufacturing is a capability to operate with profit in a competitive landscape by continuously adjusting to customer demand through an effective control of costs and quality (Ghobakhloo & Azar, 2018). Following an agile strategy requires that the firm functions with reliability and rapidity, with an ability to release a minimum viable product (MVP), to be able to test the market for customer insights (Emerald Publishing Limited, 2017).

To measure the success of agile, organizations look at customer satisfaction, product quality, on-time delivery and growth in business value (Krehbiel & Miller, 2018).

New companies and start-ups usually adopt agile principles easier than older organizations, as old organizations often are siloed in separate departments as well as risk adverse and resistant to change (Krehbiel & Miller, 2018). Firms also have different business goals impacting the adoption strategy. Lean strategies strive towards competitiveness and profitability, where agile strategies focus on coping with a fluctuating market, which has an impact on what strategy is taken into use (Ghobakhloo & Azar, 2018).

In software development, the term a*gile* comes from the *Agile Manifesto,* written in Utah in 2001, by a group of software developers looking to build software more efficiently. The incentive to the meeting was a reaction to the *waterfall model*, which many times ends in disappointment because of limitations in customer interaction and requirement gathering when launching a new product or service. (Krehbiel & Miller, 2018)



Manifesto for Agile Software Development

We are uncovering better ways of developing
software by doing it and helping others do it.
Through this work we have come to value:

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

That is, while there is value in the items on
the right, we value the items on the left more.

Kent Beck	James Grenning	Robert C. Martin
Mike Beedle	Jim Highsmith	Steve Mellor
Arie van Bennekum	Andrew Hunt	Ken Schwaber
Alistair Cockburn	Ron Jeffries	Jeff Sutherland
Ward Cunningham	Jon Kern	Dave Thomas
Martin Fowler	Brian Marick	

Figure 3. The Agile Manifesto is a reaction to the waterfall model (Krehbiel & Miller, 2018).

The collection of agile principles attempts to flexibly create customer value in small but frequent intervals, react to changes through collaboration and solve problems in teams through reflection. It also adopts self-managed teams that use human-centric methods to give a personal accountability to the team.

During recent years, agile has moved into the mainstream and there is an increased amount of academic research and other literature available. At the same time, successful stories are distributed from companies using agile, which corresponds to the technological development in our society. There are also active communities with professionals interested in agile. (Krehbiel & Miller, 2018)

4.8.2 Scrum

Scrum is an iterative and incremental agile working method (Naz, et al., 2016) with a focus on technical skills, communication and teamwork. It has been widely used by IT professionals to deliver higher quality software (Magana, et al., 2018), but also to manage and develop software in general (Naz, et al., 2016). Recent research, based on thousands of survey respondents, shows that scrum is the most commonly used agile methodology with 58% of companies using it (Magana, et al., 2018).

The definition of scrum was first formulated by Hirotaka Takeuchi and Ikujiro Nonaka in 1986 as guidelines to flexibly manage product development (Naz, et al., 2016) and with an initial purpose to be able to create tested and usable results in manufacturing within just a few weeks (Magana, et al., 2018). In the 1990's the principles were applied to software development through organizational knowledge creation, focusing on continuous and incremental innovation. The flexibility in scrum entails that customers can change their requirements and ask for additional features. These unexpected occurrences are changes that could not easily be solved in traditional software development principles (Naz, et al., 2016).

Scrum, which is considered a holistic methodology, is facilitated by self-organized teams (Naz, et al., 2016). These teams possess both technical knowledge and soft skills, which include communication, problem solving, teamwork (Magana, et al., 2018) and working together as an entity towards a common goal (Naz, et al., 2016). Scrum also encourages working with technically oriented peers and interacting with the end user (Magana, et al., 2018). Teamwork and communication in scrum are encouraged by physical colocation (or close online association) (Naz, et al., 2016) and collaboration is promoted by implementing specific roles. The most important roles in a scrum approach are *product owners*, *development teams* and *scrum masters*. (Magana, et al., 2018)

The *product owner* represents the stakeholders and is the bridge between the scrum team and the clients (end-customers). Among some of the product owners' duties are to write customer-centric user stories (Naz, et al., 2016) and a responsibility for keeping product tasks (backlog) up to date (Magana, et al., 2018).

The *development team*, usually consisting of three to nine members, is self-organized (Naz, et al., 2016) and functions as one unit (Magana, et al., 2018). It is accountable for producing a deliverable product by the end of every sprint. The role of the team is to analyze, design and develop a project, but also to make sure it is tested and documented properly (Naz, et al., 2016).

A *scrum master* is responsible for supporting the development team, enable communication, solve conflicts (Magana, et al., 2018) and remove impediments when developing a product. The scrum master also ensures that scrum principle rules are

followed, that meetings are held accordingly and that every distraction is minimized to make the team work as efficient as possible. (Naz, et al., 2016)

Scrum principles include three events; *sprints, meetings* and *extensions*.

Sprints, usually lasting from a week to a month, are fixed time-boxed efforts that are the fundamental in scrum development. During a sprint, scrum facilitates a set of *meetings* that are held at particular stages. Every sprint starts with a planning meeting where all details of the sprint are documented on a backlog. This meeting aims to plan a strategy to finish and handles estimations for example how much effort is needed to finish all tasks. (Naz, et al., 2016)

In daily scrum meetings, also called *stand-up meetings*, all team members get to show their work and update their status. These daily meetings are usually short, approximately 15 minutes, have a fixed timed and location, and are arranged regardless of whether some members fail to attend. If any hindrances are noticed during the meeting, the scrum master documents and tries to find solutions to solve them. (Naz, et al., 2016)

When a sprint cycle is completed, the development team makes an evaluation, assessment and demonstration, accompanied by analyzing the progress. In so-called end meetings (sprint review and sprint retrospective), analysis is done on how the planned sprint was accomplished, what went well and what specific areas of improvement there are. (Naz, et al., 2016)

As an addition to scrum meetings, extensions are used as continuous procedures, where the backlog is evaluated. Tasks are properly verified, tested and prioritized, and extensions also give team members an opportunity to discuss about specific work tasks. (Naz, et al., 2016)

4.9 Lean Six Sigma

The increased competition in the business industry has led to companies looking for better managerial approaches (Muraliraj, et al., 2018). As a reaction to this, *Six Sigma* was launched by Motorola and further developed by General Electrics in the 1980s. The task of Six Sigma was to identify and eliminate potential defects and variation (Shokri, 2017) and to minimize mistakes and failures that affect business processes (Chugani, et al., 2017). Six Sigma orientates to handle process improvements structurally and data-oriented, but also promotes looking for root causes before making decisions at all stages of a project (Muraliraj, et al., 2018). The principle offers certain tools to improve processes, which in practice can mean visualizing different areas in for example a DMAIC (Define, Measure, Analysis, Improve and Control) roadmap (Shokri, 2017).

Six Sigma is considered a principle to manage global competitiveness through continuous development and business quality, being both a customer-driven and business-driven methodology (Shokri, 2017). It can also function as a principle to improve systems available in industrial layouts (Muraliraj, et al., 2018), aligning quality, statistical thinking and project management. Other purposes of utilizing Six Sigma are to improve product development, service, financial performance and business strategy (Shokri, 2017).

Because of the business environment requiring effective improvised sustainable adaption, Lean and Six Sigma has seen a fusion in *Lean Six Sigma* (Muraliraj, et al., 2018). Both principles are quality management methods and have increasingly been used globally to improve operations and quality (Chugani, et al., 2017), especially in the service industries from around year 2000 (Krehbiel & Miller, 2018). The integration of Lean and Six Sigma has also received attention because of its ability to combine principles in management strategy. This has led to companies investigating various approaches of Lean Six Sigma to effectively improve their competitive advantage (Muraliraj, et al., 2018).

These principles in conjunction, through tools and mindsets (Krehbiel & Miller, 2018), have also gained significant popularity in quality management (Chugani, et al., 2017), working as the most prominent quality management system (QMS) principle today (Krehbiel & Miller, 2018). According to Michael George, the fusion is important for

evolving continuous improvement concepts, and he states three main reasons why combining Lean and Six Sigma is necessary:

1. Lean is unable to maintain a process under statistical control
2. Six Sigma cannot significantly improve process agility or reduce costs alone
3. Lean and Six Sigma facilitate cost of complexity reduction

(Muraliraj, et al., 2018)

Lean Six Sigma jointed as a complementarily principle, can offer small and large service and manufacturing organization numerous benefits. When successfully implemented, it can increase profits by reducing costs, increase customer satisfaction, increase cycle time, reduce amounts of product defects and machine breakdowns, reduce excess inventory, improve quality and raise production capacity. Additionally, it may give organizations quicker processes, responsiveness and general flexibility throughout the business (Muraliraj, et al., 2018).

The combination of Lean and Six Sigma develops an organization to focus on the end-customer and endorses decision-making in collaboration with all employees. This, however, does not compromise flexibility of the organization (Chugani, et al., 2017). Lean Six Sigma also provides companies with a set of tools to get the most out of the philosophy, resulting in a concurrent improvement, which leads to getting things done faster, better, cheaper, safer and greener (Muraliraj, et al., 2018).

Even though Lean Six Sigma as a principle has confirmed positive impacts on business, there are limitations. For example, Lean has proven to reduce waste in processes, but leaves variation unaddressed. At the same time, one should investigate working methods that are most suitable for a certain organization, looking at both the industry and nature of the organization. Some also state that Lean and Six Sigma should not be used simultaneously, as they believe the principles are unable to function properly together. (Chugani, et al., 2017)

4.10 Common lean tools

4.10.1 Kaizen

Kaizen is a tool that offers on-going continuous incremental changes to meet new production goals and sharpening competitive advantages, with a focus on constant improvement. It derives from the Japanese culture and philosophy and can be adapted in company strategy, management philosophy and in process improvement (Ma et. al., 2018).

Continuous improvement is relevant when adapting to lean principles, as it supports operations towards perfection (Kropsu-Vehkapera & Isoherranen, 2018).

4.10.2 Kanban

Kanban (Japanese for *visual sign),* is a visual framework that shows what, when and how much to produce (Stoica et. al., 2016). It encourages incremental changes to an existing system, does not need a specific configuration to apply (Smada et al., 2018) and is suitable when an ongoing activity is to be improved. It also focuses on limiting ongoing tasks, optimizing workflows, developing collaboration and pursuing continuous improvement (Stoica et. al., 2016).

Kanban utilizes a visualization board to show a workflow that tracks priorities and that finds bottlenecks and waste (Denning, 2012). Traditionally, this board was a physical plate with magnets and notes representing work tasks on a white board, but today modern project management software enables online Kanban tools (Smada et al., 2018).

4.10.3 Value stream mapping (VSM)

Value stream mapping is a widely used tool for destroying waste. It documents the current and future state and includes a transition plan to the application (Utku et al., 2018). It ensures that production materials, information and cash flow is transparent and detects bottlenecks. A value stream map also allows creating a detailed plan to implement lean principles (Utku et al., 2018) and tries to concretize and standardize intangible work when applying lean (Kropsu-Vehkapera & Isoherranen, 2018).

5 RESEARCH METHODOLOGY

This research is based on a theoretic framework that encompasses previous academic studies on lean principles. It looks at how lean has been implemented globally in different industries and how it has been embraced as a part of company working processes. Additionally, it tries to capture perceptions of employees and managers experienced with lean.

An online survey was designed and shared in a selection of channels in social media, consisting of professionals with knowledge on utilizing the lean methodology. The reasoning behind selecting a quantitative form of research (online survey) was purposively out of convenience, as the data needed to represent different industries and include various geographical areas. By combining all survey responses, the study will try to give valuable insight aligned with the research goal.

5.1 Quantitative online questionnaire

To conduct the study an online survey tool, Google Forms, was chosen. This tool gives customization opportunities, is free of charge and gathers data in an easily manageable format (Google, 2019).

The questionnaire was designed to include basic participant background information, but also to gather insights on companies' eagerness to try out new working methods, how the respondents felt that lean has impacted their business and how easy it felt to implement. In total, a set of 13 questions were asked and included dichotomous, single choice, multiple choice and rating scale questions.

For the single choice questions, a likert scale ranging from 1 to 5 was used, where **1** stands for a negative answer (*No, Not at all, Not suitable etc.)* and **5** for positive response (*Yes, Completely, Very suitable etc.*).

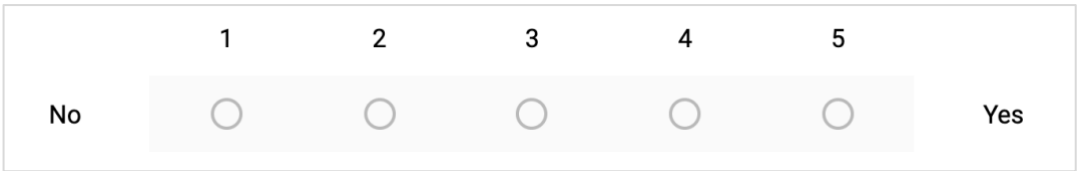


Figure 4. A likert scale ranging from 1 to 5 was used to measure respondents' opinions in single choice questions.

Additionally, an option to give open-ended comments was enabled, to provide the study with a tangible and realistic view on how lean has been approached in practice by the included partakers. This particular option may have contributed with data that otherwise could have been undiscovered. For the full list of survey questions, please view figure 4.

The published survey was active during 2½ weeks (September 18th – October 6th, 2019) and resulted in a total of 71 responses. The study aim and background were thoroughly described to the respondents through a personal note, explaining both who was behind the conducted survey and for what institution (Arcada, University of Applied Science) the study was organized. The questionnaire also contained contact information with an opportunity to give feedback or ask questions, expressing a sort of trustworthiness.

All these factors were outlined to prove that the study is free from bias and to keep the subjectivity of the researcher.

#	Question	Question type
1	In what industry do you work?	Single choice
2	What region are you from?	Single choice
3	My organization functions globally	Dichotomous (Yes/No)
4	How big is your company?	Single choice
5	Are you familiar with the lean methodology (principles)?	Dichotomous (Yes/No)
6	Have you used the lean methodology (principles)?	Dichotomous (Yes/No)
7	How responsible were you in implementing lean in your organization?	Rating scale (1-5)
8	The lean methodology (principles) has been proven beneficial for our business	Rating scale (1-5)
9	Our team has found implementing the lean methodology (principles) easy	Rating scale (1-5)
10	The culture in my organization seems suitable for lean methods (principles)	Rating scale (1-5)
11	Employees in my organization are usually eager to try new ways of working	Rating scale (1-5)
12	I have used the following	Multiple choice
13	Additional comments (feelings, thoughts, questions)	Open-ended

Figure 5. The online survey consisted of 13 well-thought-through questions.

5.2 Data analysis and sampling

Google Forms provides multiple ways of viewing data, and both graphs for visualization and a spreadsheet (.CSV) for analysis in Microsoft Excel was utilized in the study. As the volume of data was quite small, no other data analysis tools were necessary.

To analyze and utilize the open-ended questions in the study, the answers were coded into themes to extract findings. All relevant summarized findings are available in chapter 6.

To reach a potential target audience (experts who have worked with lean) for the study a sampling through interest-based social media channels was seen an adequate strategy.

To explore and select suitable channels for the sample, the researcher actively looked for channels in social media, where lively discussions around lean and other related topics were held. In a few instances, a personal application had to be submitted by the researcher to gain access to discussions and to share information about the study and questionnaire. A set of 11 groups of potential respondents were purposively and strategically selected to give a broad international base, but also to encompass a spread between industries. Additionally, the survey was also shared to the researchers' professional connections on LinkedIn.

Media	Group	Number of members	Date
Facebook	Lean Startup Finland	998	18.9.2019
Facebook	Lean Six Sigma Professionals	12 379	18.9.2019
Facebook	Lean Thinking, Lean Manufacturing, Lean Operations	7 773	18.9.2019
Facebook	UXHel	707	18.9.2019
Facebook	MarkkinointiKollektiivi	12 422	18.9.2019
Facebook	CXL	7 121	18.9.2019
Facebook	IxDA Helsinki	3 150	18.9.2019
Facebook	Verkkokauppiaat	9 548	18.9.2019
LinkedIn	Agile and Lean Software Development	157 571	18.9.2019
LinkedIn	Agile Finland	3 318	18.9.2019
LinkedIn	Lean Six Sigma	589 936	18.9.2019
LinkedIn	Personal LinkedIn channel / feed	1 001	29.9.2019

Figure 6. An online survey was shared on online channels to professionals with experience of lean principles.

5.3 Limitations

Even though the sample only corresponds to a small part of an entirety of experts, it can still be considered statistically valid and representative. This is because the target group was specifically determined with tight requirements, given that the respondents had personal (professional) hands-on experience of lean, either as implementors, managers or team members.

A limitation to the questionnaire data is that it only includes views from partakers active on the given social media groups, and that it only captures personal perceptions of how lean has worked in the respondents' organization.

The researcher has not detected any ethical concerns in the topic, the survey conducted or the conveyed information. It also did not constrain who could participate, in terms of political, financial or personal beliefs and attributes.

6 ANALYSIS AND FINDINGS

The conducted study includes a wide spread of industries, of which the *IT and software* is a clear majority with 42.3% of the respondents. This result comes not unsurprisingly, as lean principles are heavily used within software development (Magana, et al., 2018). At the same time, the research also partly favors the technology industry where half of the utilized mediums for sharing the survey to some extent are related to this industry.

Results show that lean is used in numerous industries, placing *consultancy* in a second place (19.7%) and there are clear indications that consultancy, e.g. *agile coaching,* is on the rise (Google Trends, 2019). The shift can also be seen in a situation that forces individuals to look for new opportunities, and one of the respondents clearly states, "*I have recently started my consulting company"* (respondent No. 36) as a proof that supports this trend.

This study shows slightly unexpectedly a 7% response rate with individuals working in the *Vehicles/Automotive,* even though lean originates from principles in the Toyota Production System (TPS) (Karim & Arif-Uz-Zaman, 2013). Future studies may show that there has been a shift from the vehicle business towards utilizing lean in other industries.

Out of all answers, 12.7% state that they work in an industry not listed in the questionnaire. The reason for this may be not having specified enough industries so that the respondents don't know what to answer or that the organization they work for serves clients in multiple industries, thus making it challenging to answer.

Even though upcoming studies may look deeper into differences between industries and lines of businesses, the data clearly show that there is an interest towards lean in various industries and a suggestion is that "*all the organizations should make Lean Management an essential activity"* (respondent No. 47).

The research presents a good geographic scatter and shows that developed and large economies (*Nordics, Europe, Northern America* and *Asia*), stand for most of the responses (89%). The reason for this may be that the survey was shared on social media with a higher number of representatives from Europe and the Nordics (50%) which leaves a minority of responses (11%) in *the Middle East, Africa. South America, Australia* and *Oceania.* Most of the respondents (66.2%) also state that their organizations function

abroad, which proves that this study on lean has drawn interest both on a local and on a global level.

When asking study participants on their employer, over half (55%) state they work in an organization that has 500+ employees, and one may wonder if these are over-represented in the study. This, however, might be the result as organizations are looking for new potential solutions to produce faster and innovate with less waste (Karim & Arif-Uz-Zaman, 2013), including all sizes of enterprises.

Surprisingly enough only 14.1% of the respondents say the work in a small company (<10 employees), even though lean startup is a common framework that combines ideas from lean manufacturing and entrepreneurship as a philosophy (Ries, 2011).

Out of the 71 respondents, 99% said that lean was familiar to them, even though *"It's easy to understand principles but it's very tough to implement them especially if you don't have a matured and experienced team"* (respondent No. 31). This comment exemplifies findings that other studies has found, where quite many organizations are troubled with implementing lean.

A great majority of 91.5% have used lean to some extent according to the study. This may be the result of purposively sharing the survey on lean specialist channels online and that one may assume not many would participate unless you have personal experience or are familiar with the principle as a concept. This question, however, can be interpreted in different ways and does not solely answer how exactly the respondent has been taking part in using the principles.

When asking how responsible the survey participants were in implementing lean in their organization, a majority of 84% say they were contributing at least to some amount and only 7% state they were not involved at all.

In other words, it seems that most partaking companies successfully have involved the whole organization in the implementation of lean, as it is crucial for managers to know how to convince, motivate and involve employees when transforming into lean principles (Taherimashhadi & Ribas, 2018). The result also proves that a relevant audience was reached in this research, contributing towards answering the goal of the study.

It is easy to say that implementing lean is a team effort, but there are obvious challenges. One participant says that an issue is that *"Leadership doesn't fundamentally understand what lean principles are and how to deal with them as they are implemented"* (respondent No. 13). Another real issue is that there *"seems to be a lack of real commitment from senior management to be able to implement lean principles"* and that "*there might be intent from senior management, the middle and lower levels have no clue on implementation."* (respondent No. 40).

Lean is a proven principle striving to create value (d.A. et al., 2017) and promote activities towards business goals (Håkansson et al., 2017), and unsurprisingly only 10% of the survey respondents say that lean did not have any significant effect on revenue. The rest (90%) say it had a positive impact on their organization's business. This result can be considered helpful in a competitive landscape where new business models continuously are explored and companies are changing their revenue streams (Küng, 2017) to match the competitors.

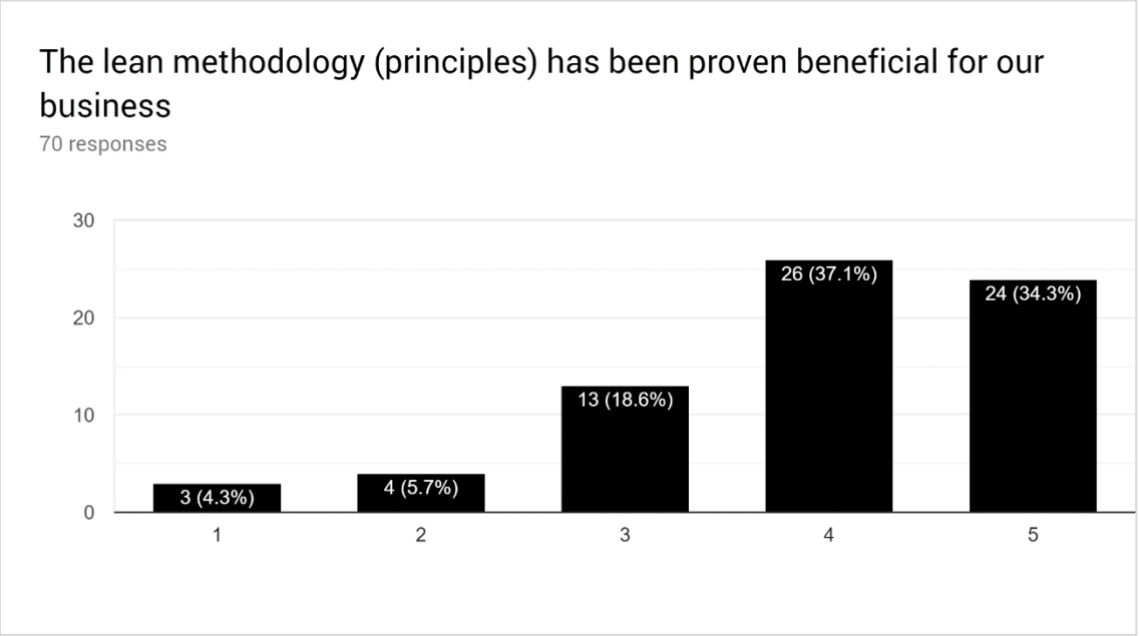


Figure 7. Lean principles have proven a significant business impact.

To be able to implement lean in a proper and effective manner, it seems that these organizations certainly have put effort on measuring success. Many times, organizations look at customer satisfaction and growth in business value (Krehbiel & Miller, 2018), but

equally important is to measure the right thing at the right time for effective decision-making (Karim & Arif-Uz-Zaman, 2013).

Even though this study shows that lean has proven business impact, *"many are suspicious about the impact of lean"* as *"employees challenge the fact that Lean is coming from the automotive space and 'can't work here'"* (respondent No. 13).

The study indicates there are challenges when implementing lean, where a substantial number of respondents say that lean was not at all easy to implement (14.3%) and 63% say not that easy. Previous studies underline this as well, and it has been proven hard to successfully implement lean in organizations (Taherimashhadi & Ribas, 2018). Responses from experts say that issues around "*several sets of lean principles"* (respondent No. 7) and issues with not being able to explain the value "*outside of the engineering and product management teams"* (respondent No. 44) may be reasons for why the principle is many times hard to set up.

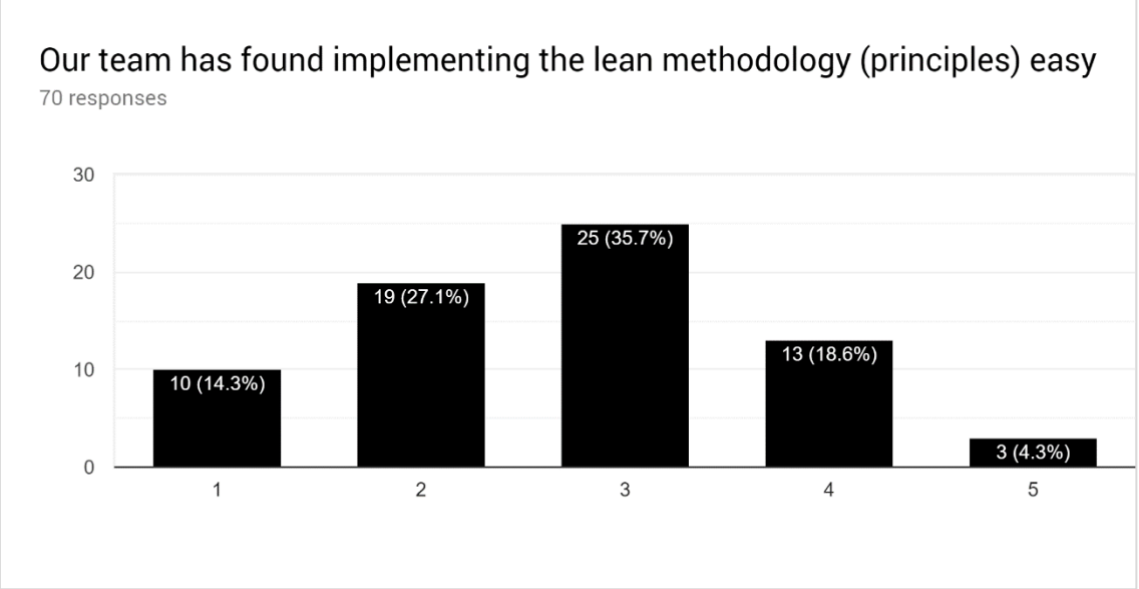


Figure 8. Only a small minority have experienced lean as very easy to implement.

Only 4.3% of the participants indicate that lean was easy to implement, and one reason may be that there is a steep learning curve and initial resistance that may have a big impact on everyday company processes. There are also political influences that affect the application of lean, and planning and implementation may need adjustments to suit certain sectors (d.A. et al., 2017).

Equally important is managing expectations and communicating correctly within the team, as well as explaining how lean "*imbibes value addition to the existing technologies"* (respondent No. 49). It's important to understand that there might be different outcomes in companies (Håkansson et al., 2017) and one survey respondent has experienced that it "*is too hard to implement this methodology in a huge company"* (respondent No. 16).

This study shows that lean has been used across multiple industries, but around 30% say that the culture in their organization is neither suitable nor very suitable for lean. This may be because of attitudinal challenges and that employees might *"have a very negative reaction to lean"* (respondent No. 13). A share of 22.5% state that the culture is very much suitable, whereas 30% say the organization culture is not or little suitable.

The explanation to this phenomenon can change over time, as *"the culture of the organization was initially very resistant to agile"* (respondent No. 44). This validates previous studies that imply that culture can block new improvement programs from being implemented (Pakdil & Leonard, 2015). Another respondent emphasizes the importance on communicating the "*impact and culture benefits"* (respondent No. 20) to the organization. It has also been proven that the key is finding out what processes are possible to implement with minimum change. This combined with an assessment of cultural needs may verify if the proposed lean program is suitable (Pakdil & Leonard, 2015).

Even though studies prove that many companies are trying out new business models, most respondents (32.,4%) stay neutral when asking about their organizations' eagerness to test new working process.

A share of 15.5% say that their organization is very eager to try out new things, which may be caused by the fact that a large majority in the study represent large enterprises (>500 employees) with potentially higher resources. Another reason for the positive approach towards testing out new working methods may be because the environment is changing, and the market is becoming unpredictable and more expensive, which forces companies to differentiate to make sustainable economic growth (Küng, 2017). Only 5.6% say that their organization is not at all eager to try out new things.

Figure 9. A minority say that their organization is not at all eager to try out new ways of working.

Lean offers suitable tools for organizations (Håkansson et al., 2017; d.A. et al., 2017) and this study shows that over 80% have used *Kanban* and almost 60% have used *Scrum* or *Agile* in their company. This result is unsurprising, as most of the survey participants are working in the IT industry, where *Scrum* is used as the most common agile tool (Magana, et al., 2018). Scrum has been used to deliver higher quality software (Magana, et al., 2018) and to manage and develop software in general (Naz, et al., 2016), only 5.6% of the respondents have not used any of the tools listed in the survey. Even though respondents may have used multiple tools, some state that they have not "… *used them all in the same organization."* (respondent No. 7).

7 CONCLUSIONS

This final chapter is based on a theoretical framework and findings from an expert survey and will conclude my thesis.

The media landscape is rapidly changing, and technology has given new opportunities to provide customers with value. This competitive market is unpredictable, becoming more expensive and resource consuming, which is challenging businesses to make a sustainable growth. (Küng, 2017)

As industry borders are becoming more porous, companies are pivoting away from their core business to strategically answer the new needs of customers. For example, conglomerates, such as Google, Amazon, Facebook and Apple, are experimenting with new business models (Küng, 2017). At the same time firms are looking into solutions to make production more effective and reduce excess waste, to save substantial amounts of money (Stone, 2012). Because of this, principles such as the lean methodology have been developed. The principle strives to help companies to deliver swiftly, give flexibility and eliminate waste to gain a competitive advantage (Karim & Arif-Uz-Zaman, 2013).

As the demand of the customers is changing at speed, organizations need to change parts of their supply chains to answer accordingly (Karim & Arif-Uz-Zaman, 2013). Therefore, it is required that managers know how to convince, motivate and participate employees, for example when switching to lean principles (Taherimashhadi & Ribas, 2018).

Even though lean originates from car manufacturing in Japan, it does apply to other industries (Taherimashhadi & Ribas, 2018) and has been utilized in customer relations, product design (Karim & Arif-Uz-Zaman, 2013) and the software industry (Mansoori, 2017) among others.

Although the philosophy in its essence is easily graspable, previous studies prove that lean may be hard to implement in organizations (Taherimashhadi & Ribas, 2018). Some reasons are a lack of proper performance measurement (Karim & Arif-Uz-Zaman, 2013) and not examining the culture of the organization thoroughly (Pakdil & Leonard, 2015). These may result in different outcomes in the company (Håkansson et al., 2017).

This Master's study, consisting of respondents globally, has proven that there is a large interest towards lean principles, both in various industries and in organizations of

different sizes. In the sample, over 50% represent organizations with over 500 employees, and respondents indicate that it is hard to implement lean principles especially in larger companies.

One of the prerequisites for successful implementation of lean is that the organization has a matured and experienced team. Lean implementation is clearly a team effort, which requires that leadership understands the fundaments of these principles, but also knows how to deal with changed business processes. Furthermore, involving all levels of managers and promoting commitment throughout the organization is crucial when applying lean methods. These are aspects that need to be addressed, especially as the study shows that 77% believe there are challenges that make lean hard to implement.

Even though most respondents (over 90%) have noticed a proved significant business growth after implementation of lean, there is hostility and resistance towards the principle. An issue is that 30% say that their organization's culture is neither suitable nor very suitable for lean which may cause problems internally.

This study has together with previous research proven that although lean principles are easy to understand, there are obvious challenges with its implementation, which is dependent on organizational culture and strategy. Future research may investigate dissimilarities in lean in different industries to emphasize and further develop findings from this study.

To shortly summarize, this thesis concludes that:

- Lean can be utilized and implemented in different industries, geographical areas and firms of different sizes
- Only few organizations are not willing to try out new working methods
- It may be hard to implement lean in larger companies
- Most organizations have seen a proved business growth after successfully implementing lean principles
- A majority believe there are or have personally experienced challenges when implementing lean

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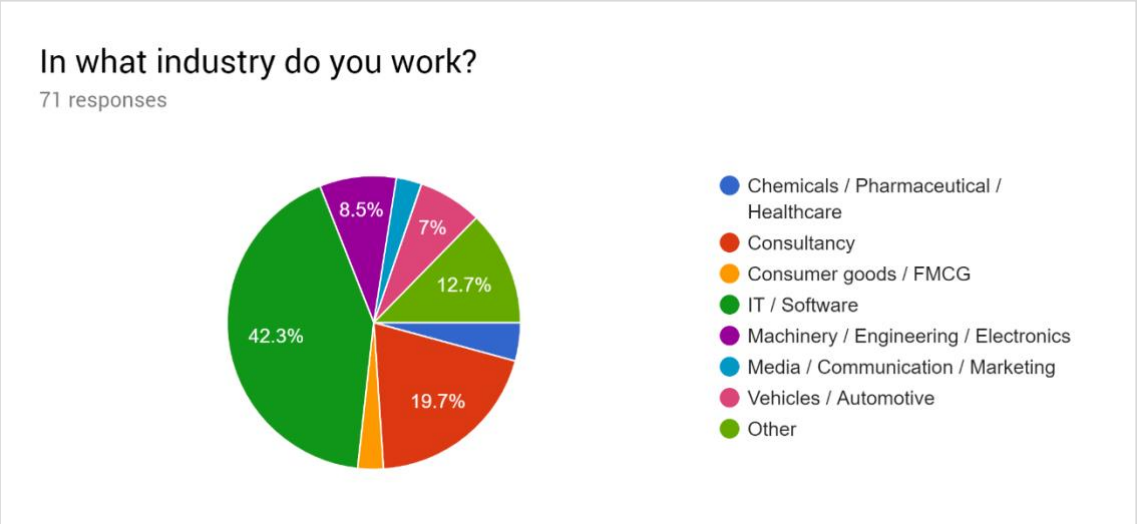
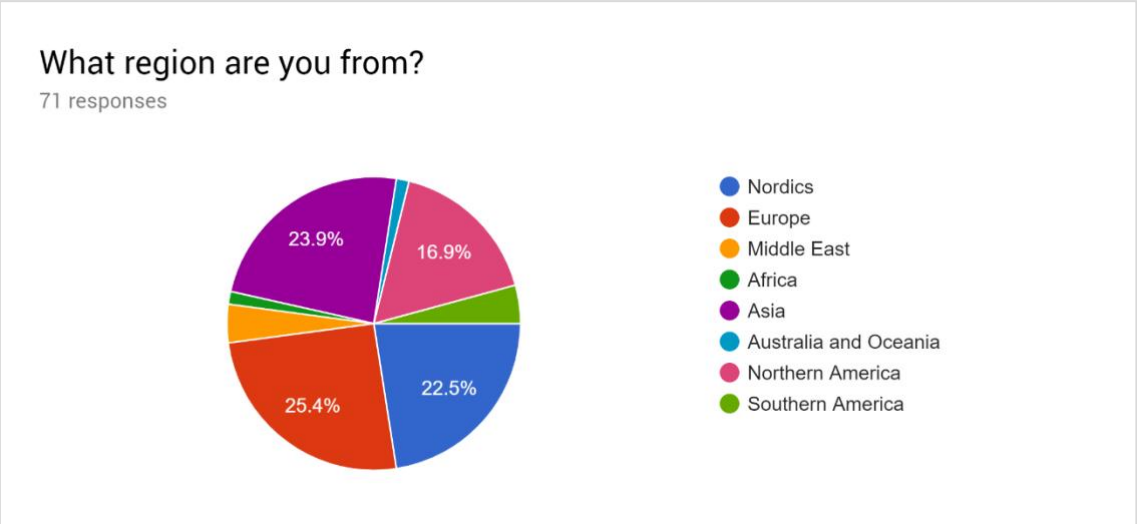
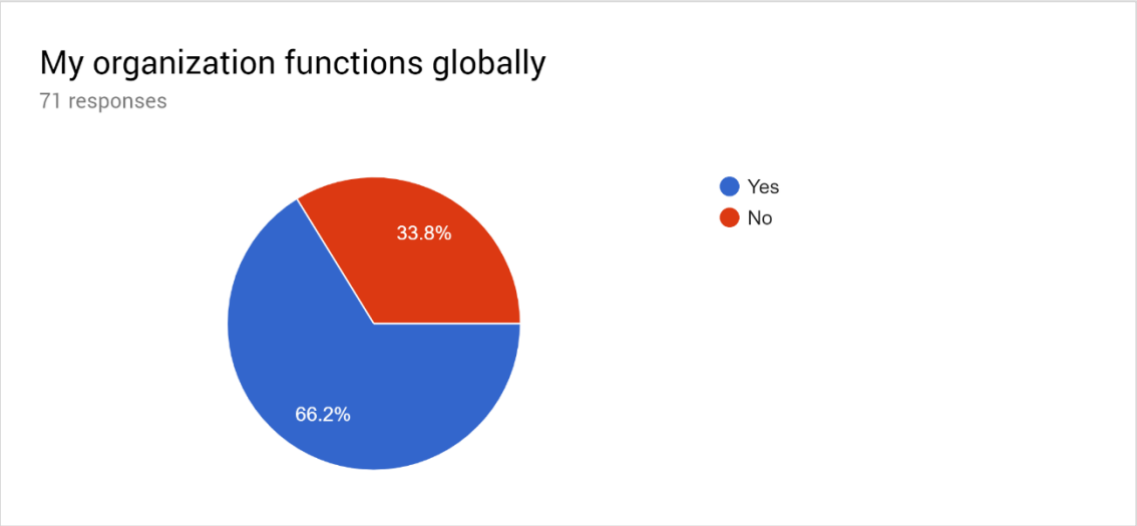
APPENDICES



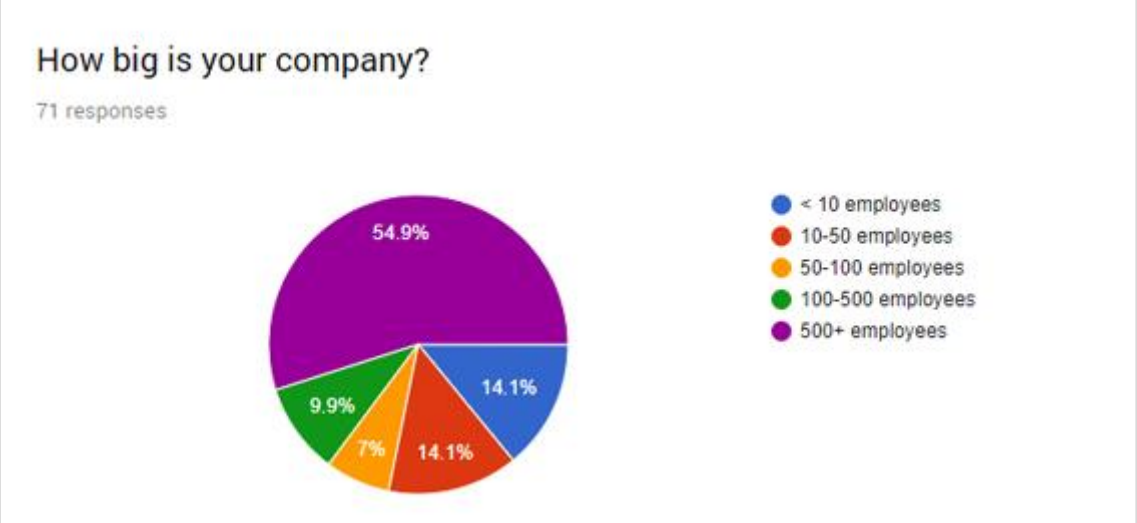
Appendix 1. Survey question: In what industry do you work?



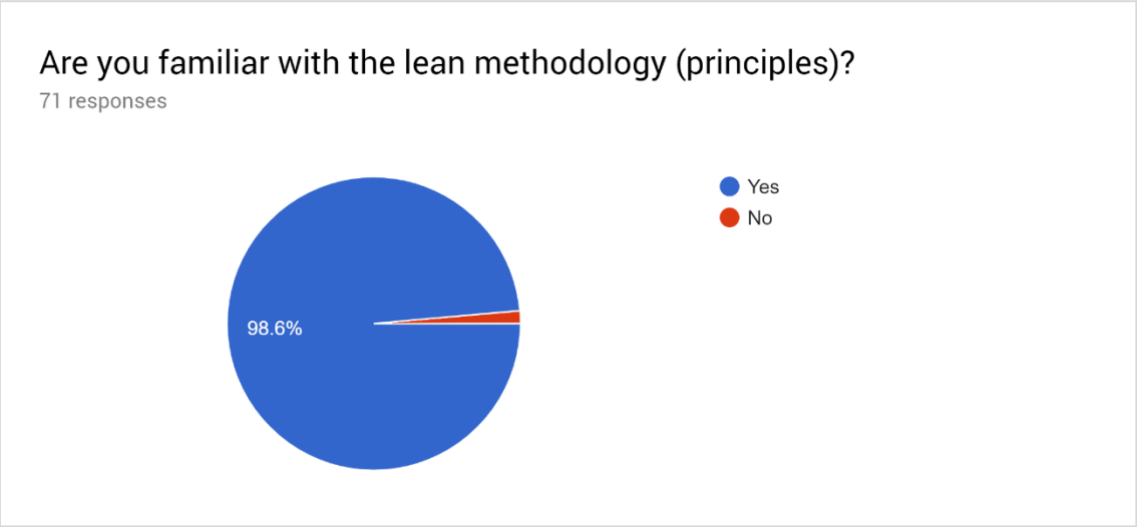
Appendix 2. Survey question: What region are you from?



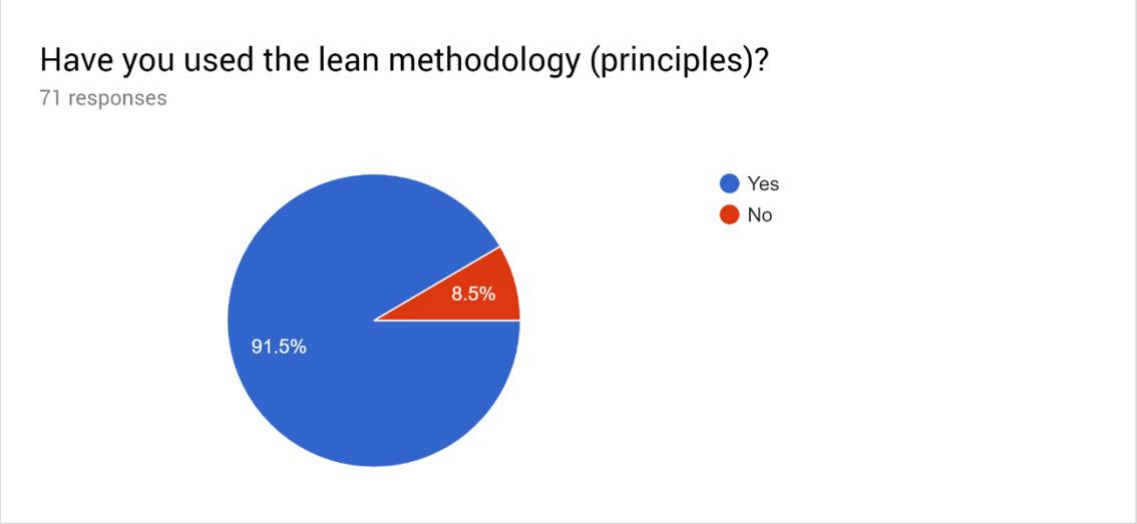
Appendix 3. Survey question: My organization functions globally



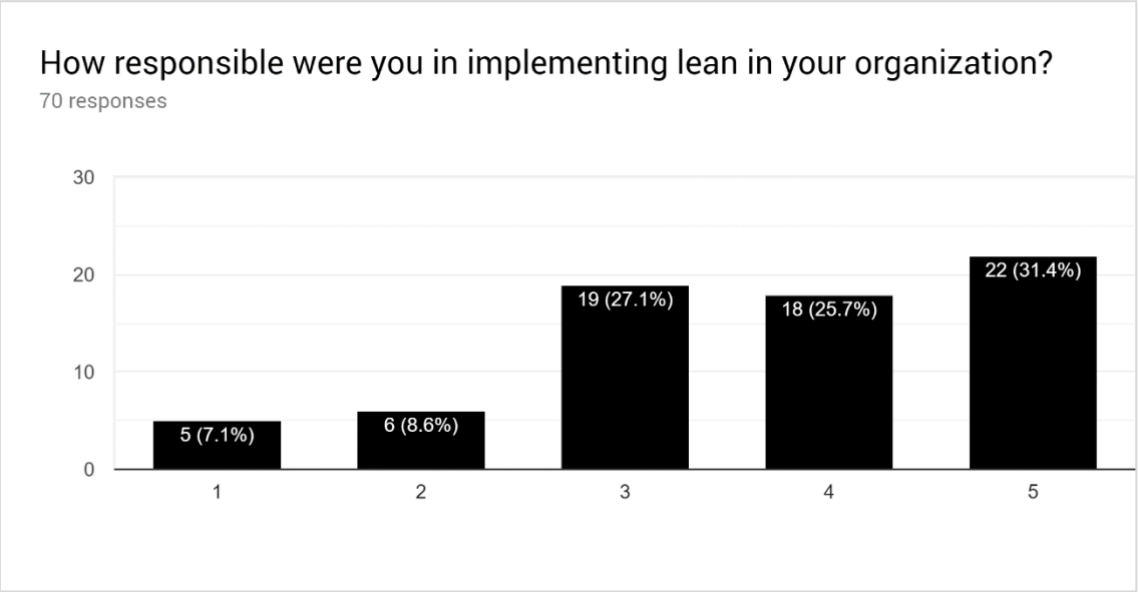
Appendix 4. Survey question: How big is your company?



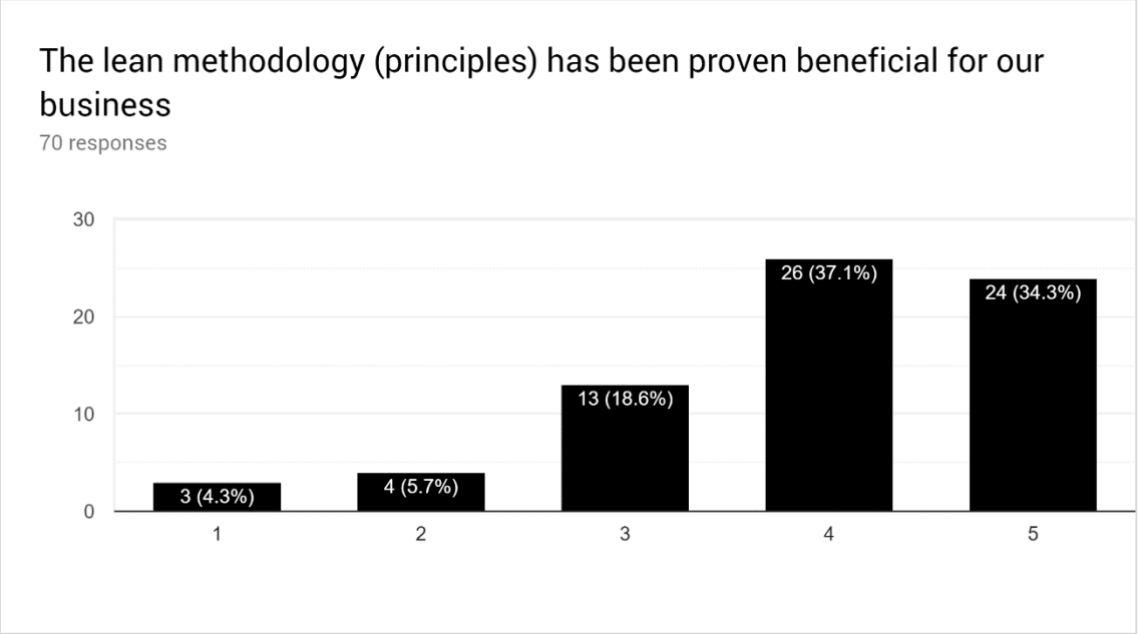
Appendix 5. Survey question: Are you familiar with the lean methodology (principles)?



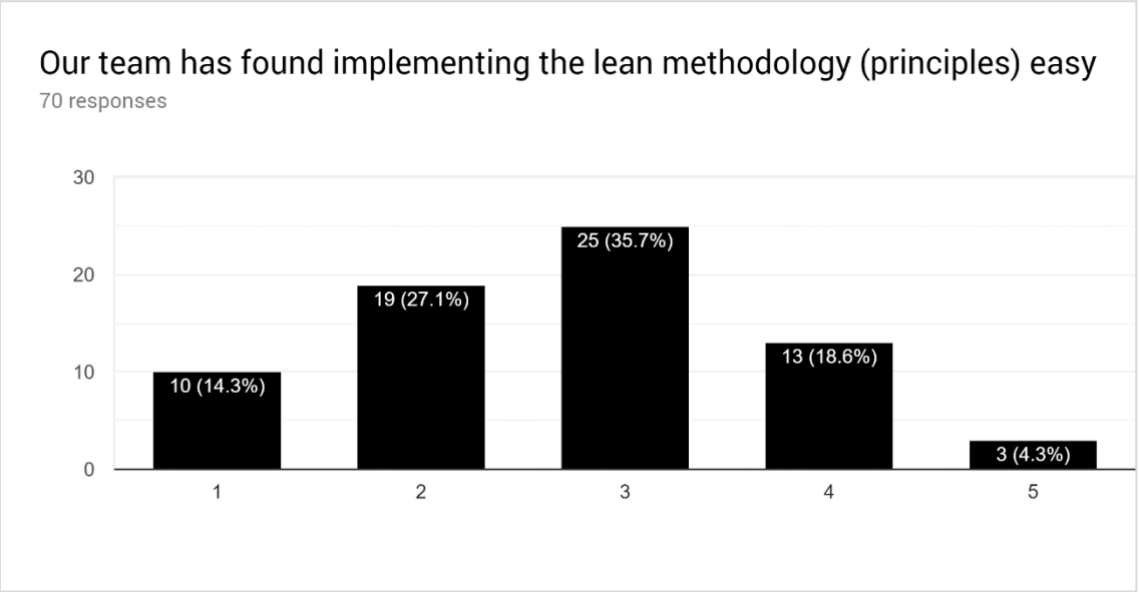
Appendix 6. Survey question: Have you used the lean methodology (principles)?



Appendix 7. Survey question: How responsible were you in implementing lean in your organization?



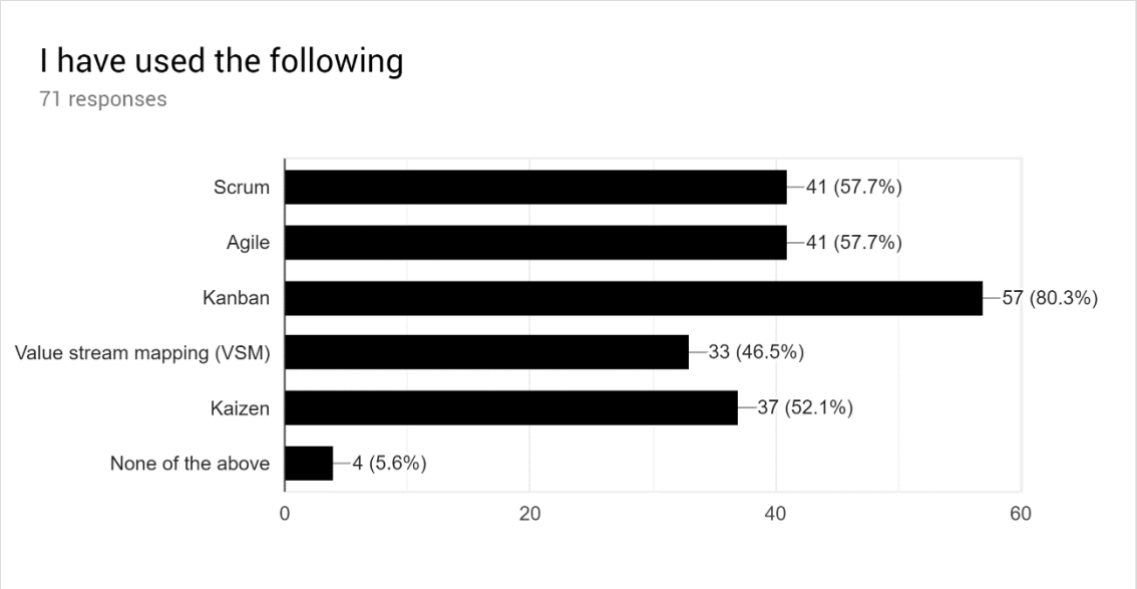
Appendix 8. Survey question: The lean methodology (principles) has been proven beneficial for our business



Appendix 9. Survey question: Our team has found implementing the lean methodology (principles) easy

Appendix 10. Survey question: The culture in my organization seems suitable for lean methods (principles)

Appendix 11. Survey question: Employees in my organization are usually eager to try out new ways of working



Appendix 12. Survey question: I have used the following