Agile vs. Lean: A Systematic Literature Review Comparing Underlying Principles, Work-Floor Practices, and Team-Level Behaviours

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ABSTRACT

This paper aims to understand how agile and lean management differ or overlap in terms of the principles, work-floor practices, and team-level behaviours. Both management approaches seek for improving the effectiveness and performance of organisational processes. Agile management is a managerial philosophy to react adequately to changes in the environment by incrementally delivering to the customer and focussing on adaptability and flexibility. Lean management is a managerial philosophy to deliver cost- and time efficient to the customer by eliminating waste and focussing on continuous improvement. Previous comparative literature studies between agile and lean focused mainly on the manufacturing processes while mainly neglecting the human facet. Therefore, this paper tries to fill this gap by conducting a systematic literature review focussing on agile and lean management, thereby incorporating the human aspect expressed in team-level behaviours. This paper reports a systematic literature review (SLR) described by Wolfswinkel, Furtmueller, and Wilderom (2013). The initial dataset incorporated 3.306 articles, which eventually led to a final corpus of 39 relevant articles after applying exclusion criteria. Within these 39 articles, an inductive coding approach was conducted to get complete and unbiased themes. Results show that there is, to a certain extent, overlapping between the two management approaches regarding how they support continuous improvement, organise- and conduct periodic meetings, and structure teams (self-organisation and cross-functionality). However, both management approaches differ in their implementation goal (cost vs. service), continuous improvement practices, and leadership style- and behaviours (changing over time). To conclude, we put forward various theoretical and practical implications for scholars and practitioners. In line with these implications, a variety of future research topics will be discussed for a more successful understanding of the differences and similarities between the agile and lean paradigms. The following future research implications have been formulated: further discovery of a combined approach, team members behaviours focus, same sectors comparison, the team instead of organisational focus, and the essence of longitudinal studies.

Keywords: *Agile management / Lean management / Agile principles/ Lean principles / Agile practices/ Lean practices /Agile behaviours / Lean behaviours*

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1. INTRODUCTION

To deal with the increasingly competitive environment, companies pursue improving their operations by addressing specific needs depending on the marketplace's requirements (Hallgren & Olhager, 2009). Throughout the years, changes in production processes have been applied to make processes more efficient so that companies could differentiate from their competition (Gunasekaran et al., 2019; Meredith & McTavish, 1992; Prince & Kay, 2003). Therefore, organisations constantly look for methods to continuously improve their businesses and to create sustainable competitive advantages (Bruce et al., 2004).

One of the most adopted changes is 'lean' or 'lean production'. Since the '90s, lean production has become a prominent topic of scholarly and practitioner interests (Holweg, 2007). This approach, originating from manufacturing, focuses on enhancing customer value by eliminating non-value steps from work processes (Melton, 2005; Stone, 2012; Van Dun, Hicks, & Wilderom, 2017). For several years, lean has been widely adopted, also beyond manufacturing processes. However, lean production has not gone uncontested. Criticisms that have been levelled at lean production were based on its negative effects on employees and their well-being, as the implementation was entirely tool-focused, thereby generally neglecting the human aspects (Dabhilkar & Åhlström, 2013; Hines et al., 2004). So, the lean approach has been changing from initially a set of 'hard' tools for the production area, such as Just in Time (JIT), Kanban, Jidoka, to a more universally applicable approach, also focusing on the human-centric aspect, creating lean management (Danese et al., 2018). In this way, the 'hard' tools became complemented with 'soft' practices, such as training, motivation, empowerment, and auto-responsibility (Hines et al., 2004; Shah & Ward, 2007). Furthermore, Bortolotti, Boscari, and Danese (2015) pointed out that when hard practices coherently accompany intangible and soft practices, the efficacy becomes magnified. So, lean is one of the most adopted, efficient, and well-established form of productions.

More recently, agile has risen as a potential alternative to lean and has become increasingly important as a new paradigm (O'Brien, 2013). The concept owes many advances in previous manufacturing paradigms and communication technology (Yusuf et al., 1999). Agile referrers to the term 'agility', which was defined by Mason-Jones, Naylor, & Towill (2000) as "using market knowledge and a virtual corporation to exploit profitable opportunities in a volatile marketplace" (p. 4064). Agility involves the capabilities and flexibility to execute unplanned and new activities in response to unforeseen changes that are cost-effective, timely, robust, and broad in scope (Prince & Kay, 2003). The requirement for organisations to become more

responsive to customers and thus more flexible led to the concept ‘agile manufacturing’, a natural development from the original concept of ‘lean manufacturing’ (Gunasekaran, 1999). Not only manufacturing companies but also software production faces many similar problems and challenges. Therefore, agile principles were mainly addressed independently in software product development, which resulted in *The Agile Manifesto* that was declared in 2001 (Kettunen, 2009). Since then, agile has been evolved for other project management or process improvement.

Since the agile paradigm has been seen as an alternative to, and perhaps an improvement on leanness (Mason-Jones et al., 2000), between these two paradigms, there is often discussion on which approach is ‘better than the other’ in terms of situational application, efficiency, and efficacy. Some scholars see the different approaches as contrasting (Dove, 1993; Nambiar, 2010), whilst others started developing the idea that these two approaches overlap to a certain extent (Hallgren & Olhager, 2009; McCullen & Towill, 2001; Qamar et al., 2018; Wang et al., 2012). An even more radical strand of scholars coined the term *leagile* to allude a substantial overlap in the content of both paradigms; see Appendix I (Mason-Jones et al., 2000; Naylor et al., 1999; Van Hoek, 2000). When discussing these paradigms, agile and lean are often treated by authors as systems of practices, which also consist of cultural elements and philosophical values (Hines et al., 2004; Petersen, 2010; Shah & Ward, 2007). There seems to be confusion about ‘what’ their underlying principles and values are and ‘how’ they should be implemented (Purvis et al., 2014). Especially, comparative literature studies about the similarities and differences between the two management approaches are scarce, as most related literature compares the differences in practices related to manufacturing (e.g., Hallgren & Olhager, 2009; Prince & Kay, 2003; Qamar et al., 2018), wherein mostly the human aspect is lacking. The available agile literature is limited, considering that agile is a relatively new and upcoming approach. Research of agile methods and practices has grown exceedingly in the past ten years, yet little is still known about the human side of agile teams (Grass, Backmann, & Hoegl, 2020). While the authors of lean studies were initially mainly tool-focused, they are now calling for a better understanding of the behavioural and people components of lean (Shah & Ward, 2007) and have followed up on this call (e.g., Colazo, 2020; Tortorella, Van Dun, & De Almeida, 2020; Van Dun et al., 2017; Van Dun & Wilderom, 2012). To better understand the boundaries between these two approaches, a comparative examination of the two concepts is provided in this paper, focussing on the differences and similarities between the two paradigms. Moreover, this thesis stressed out, particularly the management perspective rather than the manufacturing. Consequently, the focus is on agile and lean project management and product development.

In this sense, our study tries to fill this gap by presenting a systematic literature review of the differentiation and overlapping between agile and lean management, including the human aspect expressed in team-level behaviours. Thus, this systematic literature review aims first to identify and explore the *underlying principles* of the two paradigms. Besides, scholarship has shown an inevitable overlap between the two approaches' operations and tools. Therefore, secondly, an examination of the *work practices* will be given. Lastly, *team-level behaviours* will be identified and compared. These factors stated above have led to the following research question:

How do agile and lean management differ or overlap in terms of the underlying principles, work-floor practices, and team-level behaviours?

Since this research question considers three distinct aspects, the systematic literature review's findings will be structured using these three topics: *principles, work-floor practices,* and *team-level behaviours.* These three topics structure the paper and will altogether provide an answer to the main research question. The different aspects of those topics were reflected in the search string to create the dataset used for the systematic literature review. First, background information about the two paradigms will be shown. Then, the methodology of conducting the systematic literature review is presented. After that, the findings followed by a discussion of the obtained literature can be found. Lastly, this thesis will end with the limitations of the review, theoretical and practical implications, recommendations for future research, and at last, an overall conclusion.

Given that most companies have to operate under resource constraints today, it is helpful, if not crucial, to develop a good understanding of what way these two paradigms differ from each other and how their dimensions interrelate (Narasimhan et al., 2006). Furthermore, such an understanding of this matter is necessary to test and develop theories relating to agile and lean paradigms (Narasimhan et al., 2006). Hence, exploring and clarifying the differences and similarities between the two paradigms can contribute to a deeper understanding of operational excellence. Additionally, most comparative studies between agile and lean mainly focus on the manufactural processes aspect (e.g., Hallgren & Olhager, 2009; Prince & Kay, 2003; Qamar et al., 2018), with this mainly neglecting the human facet. This literature review tries to contribute to the literature by focusing on the management approach of the two paradigms, including the human aspect, by stressing out team-level behaviours. Moreover, as many so-called ‘boutique’ consultancy firms are specialised in either agile or lean, our systematic literature review might help managers better understand the overlap and differences between both approaches.

Therefore, this thesis can notably contribute to organisations or managers planning to choose one of the approaches or even a mixture of both, which suits their current and desired situation best, without depending on consultants who might preach their specialised approach.

2. BACKGROUND AND RELATED WORK

2.1 Context Agile

2.1.1 Agile history and context

Many companies operate nowadays in competitive environments that are dynamic and uncertain. For manufacturing companies to compete in sustainable ways, the agile manufacturing concept arose in the early 1990s (Yusuf et al., 1999). A group of researchers coined this manufacturing concept at Iacocca Institute, Lehigh University, in 1991. In the Iacocca Institute (1991) report, the agile manufacturing paradigm was recommended to ensure competitiveness in the emerging global manufacturing order. This report was pioneering work and was well accepted by scholars, practitioners and government officials (Yusuf et al., 1999). The general idea behind agile manufacturing is to help companies become more competitive and prosperous, especially in challenging environments, with the ability to place competitive concerns in context, seize initiatives, and discover new product features ahead of the competition (Gunasekaran et al., 2019). Therefore, agile manufacturing facilitates the organisation to respond quickly to changing customer demands (Nambiar, 2010; Naylor et al., 1999).

On the other hand, software development companies faced many similar problems and challenges as manufacturing companies. These companies also had (and still have) to adapt rapidly to their changing environment to enhance their competitive advantages or to ensure their continuity. In response to the problems with the traditional software development models, like Waterfall, many software development process models and methodologies emerged, such as XP and Scrum (Kettunen, 2009). In the late 1990s, agile principles were addressed in software development, and in 2001 the Agile Manifesto was presented (Kettunen, 2009). The Agile Manifesto (Appendix II) underlies the development and delivery of agile frameworks (Measey, 2015). The manifesto starts with: “Facilitating change is more effective than attempting to prevent it. Learn to trust in your ability to respond to unpredictable events; it's more important than trusting in your ability to plan for disaster” (Fowler & Highsmith, 2001, p.28). This statement can be seen as the key thoughts behind the agile manifesto. Furthermore, in the manifesto, Fowler and Highsmith (2001) describes four values:”

1. *Individuals and interactions* over processes and tools
2. *Working software* over comprehensive documentation
3. *Customer collaboration* over contract negotiation
4. *Responding to change* over following a plan

While there is value in the items on the right, we value the items on the left more" (p.35).

The term *agile* refers to flexibility, responsiveness, and the ability to cope with change (Anderson, 2003). Agility is not unique to manufacturing companies nor software development companies. The Cambridge Dictionary (2020) defines agility, in the context of business, as follows: "Agility means a company is always in a position to take account of market changes". Therefore, *agility* can be seen as the ability to respond to change, whereas *agile* is more like an umbrella of tools and techniques to achieve agility (Hoda et al., 2011). Agility can be addressed in different business areas, such as enterprise agility, business agility, IT agility, agile workforce, agile manufacturing, agile software development. These different disciplines address the concept of agility from different levels and different points of view. In fact, in all those fields, agility is not precisely or uniformly defined, but in general, the objective should be the same (Kettunen, 2009). Agile methods are designed to facilitate flexibility and responsiveness to changing conditions using less documentation, implying that agile projects have more flexibility and less planning than traditional projects (Serrador & Pinto, 2015). Agile project management is an interactive and iterative project development strategy that integrates flexible project planning processes, continuous customer feedback, and stakeholder communication (Gren et al., 2020; Hassan et al., 2020).

2.1.2 Agile teams

The agile approach is contradictory to the conventional leadership perspective, wherein usually, one person has more influence than the others (Moe et al., 2009, 2010). In agile teams, leadership is a collective process that rotates between members instead of being concentrated to one individual, this role changes to the person who has the essential skills, knowledge, and abilities for a particular project or issues the team is facing, this phenomenon is also known as *shared leadership* (Moe et al., 2009). Team members are expected to act as a leader when needed (Srivastava & Jain, 2017). A shift is required within an organisation to accomplish this shared leadership, wherein command-and-control gets replaced by leadership-and-collaboration (Moe et al., 2009). As a result, most organisations would operate as mini-companies, with each its character and integrity, meaning that the management's attention would be more focused on project teams than on individuals or functional work units (Gunasekaran et al., 2019). Thus, companies change from a vertical to a horizontal structure by operating with a little formalization of behaviour and highly specialised individuals working ad hoc toward a common interest; therefore, the consensus among workgroups becomes more important than formal authority (Quinn, 1992).

When implementing agile practices, small groups of employees are responsible for the results, with the authority to decide how work gets done and how resources are utilized (Gunasekaran et al., 2019; Measey, 2015)—implying that agile teams are self-organising teams with a high level of autonomy (Hoda et al., 2011; Pikkarainen et al., 2008; Srivastava & Jain, 2017). Highsmith (2009) described those self-organised agile teams as teams composed of individuals who take accountability for managing their workload, shift the work among themselves (based on need and best fit), and take responsibility for team effectiveness. Agile teams must have a common focus, mutual trust, respect, a collective but quick decision-making process, and the ability to meet new challenges (Cockburn & Hihsmith, 2001). Furthermore, team diversity is essential (De Melo et al., 2013); agile teams thus have a multidisciplinary characteristic (Gunasekaran et al., 2019). Typically, the team members have a specialist skill and a general understanding of the team's operations (Measey, 2015). Ideally, they operate entirely within their team without additional external help (Measey, 2015). Furthermore, it is important that a successful agile team only consists of the smallest number of members necessary to reach the group goal (Gren et al., 2020).

Moreover, Duguay, Landry, & Pasin (1997) point out that employees in agile teams are given responsibilities that go beyond the regular tasks, such as improving products and processes; therefore, the division has been erased between those who think and those who execute. However, according to Moe, Dingsøyr, and Øyvind (2009), a project manager or a team leader is still needed for the responsibility of specific project management duties, such as selecting team members how to approach tasks and giving priorities, the functioning of the team, articulating trust and confidence, and determining the vision.

With the use of agile methods, the *manager* role should be more aligned with that of a *leader*, who is responsible for setting the direction, aligning people, motivating and inspiring team(s), and obtaining resources (Anderson et al., 2003; Srivastava & Jain, 2017). Leadership in agile teams is meant to be light-touch and versatile, with the provision of subtle direction and feedback (Hoda et al., 2011). Measey (2015) described this role as the *agile lead*, who is multifaced, able to self-organise, and improve the team continually and its processes; this role is to facilitate the team. Moreover, when applying Scrum, these responsibilities should be allocated to the *Scrum-Master*, excluding the project's vision, which should be assigned to the *Product Owner* because this person represents the interest of the client/stakeholder (Moe et al., 2009; Srivastava & Jain, 2017). In a successful agile team, the leader adapts her leadership style to the group development stage and emerging group needs (Gren et al., 2020).

2.1.3. Agile methods

The two most commonly adopted agile methods are Scrum and eXtreme Programming (XP) (Fitzgerald et al., 2006; Petersen, 2010; Pikkarainen et al., 2008). Scrum is an agile project management method (Shankarmani, Pawar, Mantha, & Babu, 2012), while XP focuses more on developmental practices (Hoda et al., 2011). Scrum is a project development process for small teams, where a series of short development phases, iterations, or *sprints* deliver the product incrementally (Rising & Janoff, 2000). XP, on the other hand, is described by Beck (2000) as a "style of software development focusing on excellent application of programming techniques, clear communication, and teamwork" (p. 2). XP can be seen as a lightweight methodology applicable for small-to-medium-sized teams who develop software in the presence of rapidly changing or uncertain requirements (Beck, 2000). Therefore, XP provides support for technical aspects, whereas Scrum provides support for project planning and tracking (Fitzgerald et al., 2006).

There are various frameworks within the agile paradigm. When two or more development teams integrate their work into a single product, organisations can use agile scaling methods, especially when more development teams work on a single product (Wińska & Dąbrowski, 2020). To address the issues in communication, flexibility, and coordination when scaling, organisations aspire to pursue a large-scale agile strategy (Conboy & Carroll, 2019). Due to this, large-scale agile development frameworks have been created, such as Scaled Agile Framework (SAFe), Large-Scale Scrum (LeSS), Spotify, Nexus, and Scrum at Scale (Conboy & Carroll, 2019; Wińska & Dąbrowski, 2020).

In conclusion, agile is an approach or a commonly known philosophy for its rapid adaption to environmental changes. With self-organising teams consisting of multidisciplinary team members and shared leadership, agile teams have high autonomy and adapt adequately to changes.

2.2 Context Lean

2.2.1 Lean history and context

Mention 'lean', and most people will know this as a production approach pioneered by Toyota. This understanding is more often linked to the concepts 'lean manufacturing' or 'lean production', which is seen as a production method focussing on eliminating waste. However, lean goes beyond a production approach; it is more a philosophy or approach of various

management principles (Liker, 2004; Womack & Jones, 1996). Many organisations have implemented this approach to improve their position in the competitive world.

In 1986, Shimada (a professor visiting the Sloan School) used a benchmarking index to classify companies from 'fragile' to 'robust/buffered', but later on, 'fragile' was amended to 'lean', which was seen to have a better meaning (Holweg, 2007). Arguably, the first time the concept 'lean production' was mentioned in the Master thesis of Krafcik in 1988 (Holweg, 2007; Krafcik, 1988; Williams et al., 2015). Thanks to the best-selling book of Womack, Jones, and Roos (1990), *The machine that Changed the World*, the terminology 'lean production or 'lean manufacturing' became popular (Danese et al., 2018; Holweg, 2007). Although Womack et al. (1990) did not provide a clear-cut definition of the paradigm, the book indicates that a lean manufacturer efficiently uses resources to minimise waste, aimed at continuous improvement. *Waste* or *'*muda*'* in Japanese is defined by Womack and Jones (1996) as "any human activity which absorbs resources but creates no value" (p. 15). Even though the concept of Just-In-Time (JIT) manufacturing had been acknowledged almost a decennium prior, this book played an important role in publicizing the concept outside of Japan (Holweg, 2007; Williams et al., 2015). Furthermore, the book indicates a new manufacturing paradigm of the Toyota Production Systems (TPS), this paradigm was viewed as a counter-intuitive alternative to the early manufacturing model Fordism (Danese et al., 2018). Thus, the roots of lean lie in the Japanese Toyota Production Systems, that started in the early 1940s. The Toyota Production Systems did not rely on long production runs to be efficient, just like the Western world was doing with their mass production, but was clearly the opposite (Melton, 2005). Toyota's production is based on the desire to produce in a continuous flow and high quality, and proceed this by shortening the lead time and eliminating non-value activities (waste) within the factory environs (Bruce et al., 2004). Throughout the years, many companies have developed their own specific production system, called company-specific production system (XPS), which is modelled after the successes of TPS and incorporates their approach but in a more company specific and tailored way (Netland, 2013). The lean manufacturing paradigm has not stopped by only the manufacturing side but has been evolved in the philosophy of thinking and acting in a lean way.

The follow-up book on 'The Machine that Changed the World' by Womack et al. (1990) is *Lean Thinking: Banish Waste and Create Wealth in your Organisation* (Womack & Jones, 1996). This book is an important part of the history of lean as it illustrates lean principles. Womack and Jones (1996) described in their book five principles of lean thinking. These are:

(1) precisely specify the *value* for the customer, (2) map the *value stream* for each product, (3) create value *flow* without interruptions, (4) establish *pull,* and (5) pursue *perfection.* These principles must flow with the notion of eliminating waste. Continuously improving this process is essential for lean thinkers; therefore, the improvement cycle never ends (Melton, 2005). Stone (2012) associates *lean principles* with the 'tools used to execute'; *lean thinking* to the 'operational philosophy' of an organisation; and *leanness* to the 'state' in which the organisation employs lean thinking and principles in a transformation. Lean thinking is a philosophy that aims at the continuous identification and eliminating of waste from organisational processes, creating only value-added activities, which has a strategic and operational aspect (Hines et al., 2004). Therefore, lean thinking can be characterized as terminology for making organisational decisions in a lean way. Without embracing the underlying philosophy, it is unlikely that long term results could be gained (Seddon & Caulkin, 2007). Nevertheless, if these principles are clearly understood, managers can use them interrelatedly and are able to use the entire lean techniques. In the last two decades, lean principles have been extensively adopted; different industries and sectors like healthcare, construction, fashion/clothing, banking, and food processing have developed an interest in implementing lean principles' versatility (Danese et al., 2018; Williams et al., 2015).

Various authors have defined lean management in different ways during the years and have been through many transformations, which have been discussed by different contributors (Bhamu & Sangwan, 2014). In the literature, lean management can be described from two points of view, either from a philosophical perspective which is related to guiding the principles and overall objectives (Womack & Jones, 1996) or from a more practical perspective that can be directly observed, such as management practices, tools or techniques (Shah & Ward, 2003, 2007). One literature stream considers lean management as a philosophy based on the five abovementioned principles (value, value stream, flow, pull, and perfection) by Womack and Jones (1996), to eliminate all sources of waste in the production processes and to create value for end-use customers (Bortolotti et al., 2015; Emiliani & Stec, 2005). Similarly, Liker (1996) described lean as a philosophy, when implemented, will shorten the time from customer order to delivery by eliminating sources of waste in the production flow. The other literature stream of lean management uses a more concrete/practical perspective to the philosophy, in which lean management is seen as a managerial system to reduce the internal and external variability with specific practices and techniques (Bortolotti et al., 2015; Narasimhan et al., 2006). Moreover, Shah and Ward (2003) have been aggregated these practices into four 'bundles': (1) just-in-

time (JIT), (2) total quality management (TQM), (3) total preventive maintenance (TPM), and (4) human resource management (HRM).

Thus, lean can described at different abstraction levels: as a philosophy, a set of principles, or as bundles of practices (Hines et al., 2004; Van Assen, 2018). However, the lean approach is usually defined as an aggregation of practices that have to work synergistically to build a high-quality system with little or zero waste at the rate of customer demand (Shah & Ward, 2003).

2.2.2 Lean teams

In the Toyota Way (the origin of lean), employees bring the system to life: working, communicating, solving issues, and growing together; therefore, there is more dependence on people, not less (Liker, 2004). To achieve employees' involvement in daily improvements, lean leadership is essential (Dombrowski & Mielke, 2013). Moreover, Dombrowski and Mielke (2013) defined lean leadership as "the cooperation of employees and leaders in their mutual striving for perfection" (p. 570). Typically, a lean team consist of a team leader and team members. The team needs to be cross-functional to gather the competencies to finish their tasks (Aij & Rapsaniotis, 2017; Petersen, 2010). Lean teams can be cross-functional (Aij & Rapsaniotis, 2017; Petersen, 2010); however, this is not obligatory compared to agile teams who are cross-functional by default (Gunasekaran et al., 2019). As lean team members could work in pooled task interdependence (combining individuals effort) or sequential task interdependence (individually complete tasks before anyone later in the sequence can complete theirs) (Van Dun & Wilderom, 2015). So, typically lean team members do not have to hold different backgrounds, expertise, and functions. Furthermore, the team must be in a positive 'affective state' (e.g., managing intra-team conflicts, team member support, and psychological safe feeling) for team members to behave effectively in lean ways, such as monitoring performance and sharing information (Van Dun & Wilderom, 2012).

Leadership in lean teams is essential and covers a significant part of the literature studies related to the lean management approach. From the systematic literature review by Van Dun and Wilderom (2012), it can be stated that, typically, lean team leaders monitor team performance, acquire resources, encourage autonomy, and notice opportunities for continuous improvement. Thereby are most values of effective lean leaders self-transcendence, meaning that leaders aim to support their teams rather than control them by, for example, stimulating employees to share their ideas and information (Van Dun & Wilderom, 2016). Moreover, Bicheno and Holweg (2016) described lean leaders as teachers who continually reinforce the correct usage of principles and tools by self-demonstration and coaching every day. Also, Netland, Powell, and

Hines (2019) stated that a lean leader should coach, not fix. These characteristics of a lean leader are comparable with the agile leader, who coaches and supports the team. However, Delbridge, Lowe, and Oliver (2000) pointed out that a lean leader is formally recognized and hierarchically distinct within the team. Whereas in agile teams, this is not the case.

2.2.3 Lean methods

Many lean management tools with their methodologies and techniques have been identified and developed. A few examples will be shown to highlight some key lean tools. *Gemba* walk is a practice in which leaders purposefully walk to 'go and see' what is happening on the shop floor to grasp the actual situation (Liker, 2004; Netland, Powell, & Hines, 2019; Seidel, Saurin, Tortorella, & Marodin, 2019). These walks are crucial for maintaining the adherence to the lean initiatives and are made up of three activities: go to the place, look at the process, and talk to people (Seidel et al., 2019). Another example is *vale stream mapping (VSM)*. Danese et al. (2018) showed *VSM* as the most investigated lean implementation tool. The basic idea of *VSM* is to visualise the flow of processes by doing a *Gemba* walk to define the current and future state in a way that emphasizes opportunities for improvements (Bicheno & Holweg, 2016). At last, the pull-scheduling method *Kanban*. *Kanban* is the Japanese word for card, sign, or ticket and is a tool for managing and ensuring the production and materials flow (Hines et al., 2004; Liker, 2004). For an overview of more lean tools, see Emiliani and Stec (2005) Table II and Bortolotti et al. (2015) Table 2.

There is no standard lean management implantation framework; therefore, lean management has become an integrated system made of various management practices (Bhamu & Sangwan, 2014). To optimize the results, many of these tools and techniques are used in conjunction with each other. However, for successful adoption of lean, it depends on how well the organisation's implantation plan is started (Bhamu & Sangwan, 2014). In-depth information regarding lean work-floor practices in project management is elaborated in the findings of the systematic literature review.

The 'hard' dimension or aspects in project management are mostly related to technical and analytical tools to improve the systems (e.g., Kanban; JIT; statistical process control; and other tools for measuring: performance, efficiency, cost, and time), whereas the 'soft' aspects in project management are related to people, relations, and managerial concepts (e.g., continuous improvement, leadership, and customer involvement) (Bortolotti et al., 2015; Karrbom Gustavsson & Hallin, 2014). In line with this separation of hard- and soft aspects, Bortolotti et al. (2015) showed that successful lean organisations use more extensively soft practices (e.g.,

training, problem-solving, management, and leadership) compared to unsuccessful lean organisations. Thereby they showed that soft practices are essential for the success of lean organisations.

To conclude, lean is an approach or a philosophy that is considered a set of management principles commonly used in stable business environments. It started in the manufacturing side of an organisation to increase the maximum value for the customers by minimising waste. Nowadays, lean has been evolved into a widely used strategy in other parts of organisations and other sectors.

2.3 Team Level Behaviour

There are many different views on the differences and similarities between agile and lean paradigms. Research on these paradigms is mainly of theoretical nature and related to manufacturing rather than management. Although previous studies (e.g., Hallgren & Olhager, 2009; Prince & Kay, 2003; Qamar et al., 2018) have already compared the agile and lean approaches in the manufacturing context, none of them had examined the differences in management approaches focussing on the human facet. Moreover, research on agile methods and practices has grown in the past ten years, but there is still little known about the human side of agile teams (Grass et al., 2020). With lean, the focus is often on process improvement, which is losing its people perspective (Drotz & Poksinska, 2014).

Therefore, after describing the differences in principles and work-floor practices, the focus of writing is also on team-level behaviours. This focus considers the human aspect of the two paradigms, thereby reflecting the interactions and actions within a project team. Exploring what kind of behaviours agile and lean teams typically engage in can contribute to a deeper understanding of teams' interactions. This deeper understanding can, in turn, result in better team performance as it prolongs current knowledge of team dynamics. To fully understand the results of this systematic literature review, it is essential to define what is team-level behaviour. First, to identify the behavioural components, each behaviour must be directly observable, meaning that a behaviour cannot be defined only in terms of attributions or outcomes (Yukl et al., 2002).

Moreover, since each team consist of team members and a team ‘leader’, we decided to combine the related definitions to create one practicable description of team level behaviour, which could benefit the article selection method. First, the definition of Mathieu, Gallagher, Domingo, and Kloc (2019) has been used to define team member behaviours: “‘Members’ behaviours

correspond to what Marks et al. (2001, p. 357) defined as team processes: “members’ interdependent acts that convert inputs to outcomes through cognitive, verbal, and behavioural activities directed toward organizing taskwork to achieve collective goals”’. After that, the definition of Van Dun, Hicks, and Wilderom (2017, p. 175) has been used to define leader behaviour: “‘specific observable verbal and nonverbal actions of managers “in interaction with their followers in an organizational setting”’ (Szabo, Reber, Weibler, Brodbeck, & Wunderer, 2001, p. 225). As a result, in this thesis, the definitions mentioned above were combined to define team level behaviour as: *specific team members’ and team leaders’ observable behaviour (verbal, non-verbal, and cognitive) to achieve collective goals in an organisational setting.* Thereby, as will be discussed next, articles were selected based on their focus on team members’ and leaders’ observable behaviour. In this way, the focus lies specifically on the interactions within a team to answer the last part of the research question.

3. RESEARCH METHOD: SYSTEMATIC LITERATURE REVIEW (SLR)

A systematic literature review (SLR) was chosen as the main research method. An SLR can be seen as a means of identifying, evaluating, and interpreting all the relevant and available studies on a particular research question, topic area, or phenomenon (Kitchenham, 2004). In this sense, SLRs are helpful to identify the gaps in the literature. Intentionally, an SLR has been chosen for its unbiased and reproducible way of providing practical evidence and theoretical implications. When conducting the proper steps of an SLR, the result is a reliable research method that increased the robustness of the review.

In this study, an SLR is conducted for a methodical and comprehensive literature synthesis to gain a good understanding of the differentiation and overlapping between agile and lean management, predominantly focussed on principles, work-floor practices, and team-level behaviours. The guidelines provided by Wolfswinkel, Furtmueller, and Wilderom (2013) were used as a basis to develop the SLR protocol (Appendix III). Therefore, the Grounded Theory method has been applied.

An overview of the data selection method is shown in Figure 2. The number of articles that were included and excluded can be seen in this overview. Furthermore, a brief and general description of the rationale behind these decisions has been provided. The following sections provide a detailed clarification of how the articles were selected.

3.1 Preparing the Systematic Literature Review

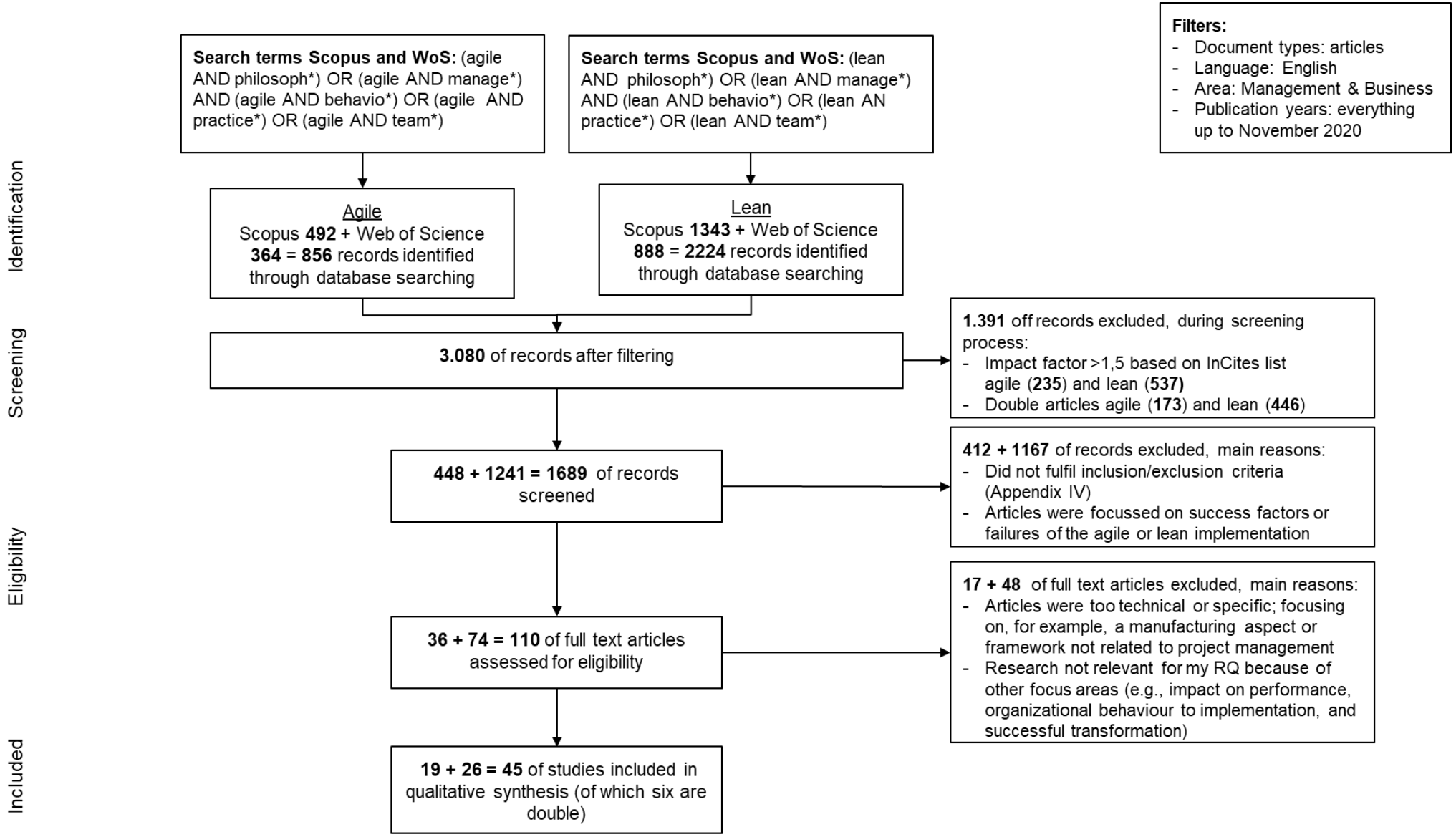
Stage 1: Preliminary search:

The purpose of the preliminary search was to get familiar with the subjects and gain knowledge for developing the search string. Besides, this stage provided related literature that was useful to write the background chapter and parts of the introduction. Moreover, in this search, various sources were consulted through the academic databases, Scopus, Web of Knowledge and Google Scholar. Occasionally, blogs and reports were used for a better perception of certain subjects.

Stage 2: Search string:

Agile and lean concepts have been evolved over the years, creating a heterogenous definition (Bhamu & Sangwan, 2014; Hines et al., 2004; Narasimhan et al., 2006). With our aim to explore and categorize the differences and overlap between the two paradigms, we decided to focus on agile and lean management with its philosophy, with this became the manufactural aspect

Figure 1
Overview data selection



largely disregarded. Therefore, it was a prerequisite that *management* or *philosophy* is included within the documents. This inclusion resulted in different types of agile and lean articles concerning the implementation of the two approaches in various contexts (beyond manufacturing processes). Based on the main research question, the preliminary search, and the use of trial and error, the search string was created.

- For *agile*: (agile AND philosoph*) OR (agile AND manage*) AND (agile AND behavio*) OR (agile AND practice*) OR (agile AND team*)
- For *lean:* (lean AND philosoph*) OR (lean AND manage*) AND (lean AND behavio*) OR (lean AND practice*) OR (lean AND team*)

The asterisk (*) is applied for including articles that use the plural denomination. The search strings were applied on 23 November 2020, in the title, abstract, and keywords on two of the most used search platforms for peer review scientific articles in this context: Scopus and Web of Science (Falagas et al., 2008). This search resulted in 5.167 (lean) and 4.150 (agile) documents in Scopus and 5.985 (lean) and 4.850 (agile) documents in Web of Science. Nevertheless, most documents in the dataset were irrelevant for this literature review; therefore, filtering was needed. Table 1 summarises the article sourcing and selection protocol used in this study.

Table 1
Overview article sourcing and selection protocol

Selection	Inclusion/exclusion criteria	Rationale
1. Search string Inclusion	• philosophy	To gain understanding about the reasoning and underlying thoughts behind the paradigms.
	• manage*	This term views the approaches from another perspective than the already well-researched manufacturing perspective. For *agile*, this term provides additional and general management information (e.g., agile thinking, agile software development, and human-related articles). For *lean*, most literature has been focussed on the manufactural aspect, so excluding *manufact** and including *manage** provides more specific management related information (e.g., lean thinking and human-related articles).
	• behavio*	To explore and examine the behaviours a team typically engage in.

	• practice*	Necessary for obtaining knowledge on the various practices to eventually compare the work-floor practices of both approaches.
	• team*	Since these management approaches were conducted in teams, it is helpful to gain insight into that aspect.
Exclusion	• agile/lean (on its own)	Too broad with too many results, in combination with other terms, it is more specific.
	• agility/leanness	Including this term result in a lot of off-topic articles were given. With the inclusion criteria, relevant documents can be found in this context.
	• manufacturing	This literature review aims to focus mainly on *agile project management* or *agile product development*, and *lean (project) management*, while these have most affirmation with the context of business administration.
	• agile manifest*:	The Agile Manifesto started almost 20 years ago. Over the years, scholars have researched this phenomenon extensively. For a more timely and diverse understanding of the agile paradigm, this term has been excluded.
2. Selection of journals	Top journals meeting specific quality criteria (> 1.5 impact factor or > 2 ABS-list number)	This decision led to higher credibility of journals and, therefore, increased the robustness of the systematic literature review.
	English language journals	The systematic literature review must be written in English.
	Only peer-reviewed journals, so 'grey literature' is excluded (i.e., books, book chapters, proceeding papers)	To increase the literature review's credibility, we decided only to include peer-reviewed journals; therefore, excluding 1 tier grey literature (as described by Adams, Smart, & Huff, 2017). These documents often have no impact factor or ABS number, so it is hard to make an inclusion decision. Moreover, grey literature does not undergo the same procedures peer-reviewed journals do; including these documents would create a disproportionate dataset that decreases robustness.

	Journals including review articles with widely recognized management aspects (i.e. *International Journal of Management Reviews, MIT Sloan Management Review, Academy of Management Review)*	We believe that including these journals will help provide a more overall impression of the agile and lean literature both from an academic and practitioner perspective.
3. Selection of time range	All available published literature from the databases Scopus and Web of Science up to November 2020	This time frame includes all possible literature from the beginning of the paradigms to the review's departure point. This time frame was considered appropriate to capture all relevant aspects, including the evolution of the paradigms.
4. Articles selected from the sampled journals	Articles related to the philosophies of agile and lean with its underlying principles and values	This criterion will identify the first part of the research question. Since this field is vast and heterogeneous, articles were selected based on its relevance concerning the principles and values of the paradigms *agile* and *lean* related to project management.
	Articles related to the work-floor practices of agile and lean	Practices reflect how the principles are implemented (Petersen, 2010). Besides, scholarship had shown that there is to a certain extend overlap between the two approaches. Therefore, it is interesting to explore and identify the practices of the two approaches to compare them. Articles were selected based on the amount of detailed description of the practices related to project management.
	Articles related to the team level behaviours	Most related literature with similar comparisons lacks the human aspect. A comparison has been made to fill this gap, including the human aspect expressed in team-level behaviours. Articles were selected if it corresponds with the compiled definition of team level behaviour: *specific team members and team leader observable behaviour (verbal, non-verbal, and cognitive) to achieve collective goals in an organisational setting.*

Stage 3: Filtering:

In Scopus and Web of Science, the document type has been filtered to article and review. Other forms of documentation were excluded from the dataset. As grey literature such as conference papers, books, and book chapters is considered lower credible than peer-reviewed journals. Moreover, this thesis was written in the context of a Business Administration Master programme. Therefore, a deliberate choice has been made to only focus on the subject area 'Business, Management, and Accounting' in Scopus, and 'Business' and 'Management' in Web of Science.

Additionally, all documents with another language than English were excluded because this thesis had to be written in English. First, all citation information of the dataset is exported to an Excel file covering both Scopus and Web of Science documents, resulting in 856 articles for *agile* and 2224 for *lean*, thus a total of 3.309 records after filtering. Within this dataset, 619 records were identified as double between Scopus and Web of Science; these records have been removed. After that, journals with an impact factor lower than 1.5 (based on the InCites-list of Web of Science) were removed from the dataset.

If no impact factor from a journal was found from the InCites-list, a manual search took place (external databases) for the impact factor. Those journals were individually searched and assessed based on their potential: relevant articles in the dataset, impact factor above 1.5, citation score, and relevant time frame of the journal. If no impact factor or any other relevant information was found (as mentioned above), the journal became excluded from the dataset. After excluding the doubles and the journals with an impact factor below 1.5 (or no other relevant found information), the dataset got reduced to 448 articles for *agile* and 1241 for *lean*.

3.2 Conducting the Systematic Literature Review

Stage 4: First reading (screening):

In this stage, a total of 1689 articles have been assessed with the inclusion- and exclusion criteria (Table 1 and Appendix IV). By reading the title, abstract, and keywords, relevant articles were marked with 'yes', whereas not relevant articles—not fulfilling the selection criteria, were marked with 'no'. When there was not enough information for assessment, we marked the article with a 'maybe' for further reading in the next stage. A brief description was made for every article; why it should be included or excluded in the corpus. A sample of 100 articles from both agile and lean articles have been sent to a second assessor (one of this thesis's supervisors) to adhere to interrater reliability. This check for interrater reliability resulted in no different significant outcomes.

Stage 5: Second reading (eligibility):

Out of the 1689 articles in total, we identified 110 potential articles for this study (36 agile and 74 lean). This corpus of eligible articles has been read in-depth and assessed based on the introduction, method, conclusion, and other parts when necessary. Moreover, a summary has been made of each article to recognize and emphasize the essential parts. When an article fit the inclusion criteria and provided insightful information for answering the research question, it was included in the final corpus. In total, we included 39 articles containing 19 of agile and 26 of lean, wherein six articles appeared in both searches and are therefore seen as double. The impact factors ranged from 1.47 to 6.62, with an average of 3.22.

Meanwhile, in the including process, the articles were exported to Mendeley's reference manager to highlight and code text sections; this process is called open-coding and is an essential analytical step to label and build a set of insights concepts (Wolfswinkel et al., 2013). In this coding process, we conducted an inductive approach, where we developed themes/concepts based on our readings and interpretations of textual data in the corpus (Chandra & Shang, 2019). An inductive coding approach can be helpful to gain a better understanding of the concepts; to identify patterns and relationships for building a theory. While reading the articles, we tried to further develop categories by aggregating the open codes; this process is called *axial coding* (Wolfswinkel et al., 2013). Meanwhile, the codes, or better-called *concepts,* are placed in an Excel sheet to generate an overview of codes from the related articles (see Appendix V). In this *selective code* step, we categorized the codes to identify and develop relationships (Wolfswinkel et al., 2013); see Appendix V for the entire coding scheme overview.

4. FINDINGS

The systematic literature review has been conducted to answer the research question of how agile and lean management differ or overlap in terms of the principles, work-floor practices, and team-level behaviours. A mixture of hard- and soft aspects will be shown to compare the differences and similarities between the two paradigms. First, an overview with descriptive methods of the resulting papers will be displayed. Second, a comparison of the underlying principles between agile and lean will be shown with accordingly a comparison between agile and lean work-floor practices. At last, a comparison focused on the human aspect expressed in team-level behaviours will be provided

To remark, we will use the Scrum framework to illustrate the agile aspect of project management as this method proclaims the aim of project management. Moreover, Scrum and its derivatives are the most well-known and applied frameworks within agile (Annosi, Foss, Brunetta, & Magnusson, 2017; Grass et al., 2020); they are employed minimally five times as frequent as the other techniques (Rigby, Sutherland, & Takeuchi, 2016). Concerning lean, we look at the lean concept as a whole since there is no clear and specified methodology within lean regarding project management.

4.1 Description of the Corpus

In the section below, various tables and figures are presented to visualise the results of the systematic literature review. To classify the articles in the corpus, Table 2 was organised. This table is inspired from the format used by Bhamra et al. (2020); adjustments have been made to stress the categorization relevance of this thesis. Table 2 shows an overview of the corpus' articles, specified by research, methodology, approach, and study.

The sub-heading 'Mixed' refers to a mixed research approach as described by Johnson, Onwuegbuzie, and Turner (2007), "in which a researcher or team of researchers combines elements of qualitative and quantitative research approaches (e.g., use of qualitative and quantitative viewpoints, data collection, analysis, inference techniques) for the broad purposes of breadth and depth of understanding and corroboration" (p. 123).

The information in Table 2 is summarised in Table 3 below. Table 3 identifies the number of articles and their percentage. As each article may contribute to one or more areas, the totals do not add up to 100% for each area. Remarkably, fewer longitudinal (31%) than cross-sectional (44%) studies are found; this discrepancy provided a limited view on the effects that occur over time given that both agile and lean focus on continuous improvement.

Table 2

Research, methodology, approach, and study in the corpus consisting of 39 agile and lean articles

Authors	Approach	Research			Methodology				Approach			Study	
		Exploratory	Descriptive	Explanatory	Conceptual	Case study/ studies	Survey	Comparative	Qualitative	Quantitative	Mixed	Cross-sectional	Longitudinal
(Aij & Rapsaniotis, 2017)	Lean		x		x			x	x				
(Angelis, et al., 2011)	Lean	x				x	x				x	x	
(Annosi et al., 2017)	Agile	x				x			x			x	
(Annosi et al, 2020)	Agile	x				x					x	x	
(Arnheiter & Maleyeff, 2005)	Lean		x					x	x				
(Aronsson et al., 2011)	Agile/ Lean	x				x		x	x				x
(Bäcklander, 2019)	Agile		x			x			x			x	
(Browaeys & Fisser, 2012)	Agile/ Lean		x		x			x	x				
(Colazo, 2020)	Lean	x				x	x				x		x
(Conboy, 2009)	Agile		x		x			x	x				
(Conforto et al., 2014)	Agile	x			x	x	x				x	x	
(Copola et al., 2020)	Agile	x				x			x				x
(Dal Forno et al., 2016)	Lean		x			x			x			x	
(Delbridge et al., 2000)	Lean		x			x	x				x	x	
(Dingsøyr et al., 2018)	Agile		x			x			x				x

(Drotz & Poksinska, 2014)	Lean		x				x				x				x				
(Eltawy & Gallear, 2017)	Agile/ Lean		x			x				x			x						
(Emiliani, 1998)	Lean		x			x					x								
(Gabriel, 1997)	Lean		x				x				x								x
(Grass et al., 2020)	Agile	x					x				x				x				
(Hennel & Rosenkranz, 2020)	Agile		x				x				x				x				
(Hernandez-Matias et al., 2019)	Lean				x		x		x					x	x				
(Karrbom Gustavsson & Hallin, 2014)	Lean		x			x				x		x							
(Mathiassen & Sandberg, 2020)	Agile/ Lean	x					x				x								x
(McAvoy & Butler, 2009)	Agile	x					x				x								x
(Middleton & Joyce, 2012)	Agile/ Lean	x					x				x								x
(Netland et al., 2019)	Lean		x			x					x								
(Parker et al., 2015)	Agile		x			x					x								
(Poksinska et al., 2013)	Lean		x				x				x				x				x
(Rigby et al., 2016)	Agile		x			x					x								
(Seidel et al., 2019)	Lean		x			x					x								
(Sońta-Drączkowska & Mrożewski, 2020)	Agile/ Lean	x					x			x	x				x				
(Toledo et al., 2019)	Lean	x					x				x								x

(Tortorella et al., 2018)	Lean	x					x				x		x		
(Tortorella et al., 2020)	Lean	x				x	x					x		x	
(Van Assen, 2018)	Lean			x			x				x		x		
(Van Dun & Wilderom, 2016)	Lean	x				x	x				x		x		
(Van Dun et al., 2017)	Lean	x				x	x					x		x	
(Yadav et al., 2018)	Lean	x				x			x				x		

Note: Empty spaces in the category *study* show no observations in the articles (e.g., conceptual papers).

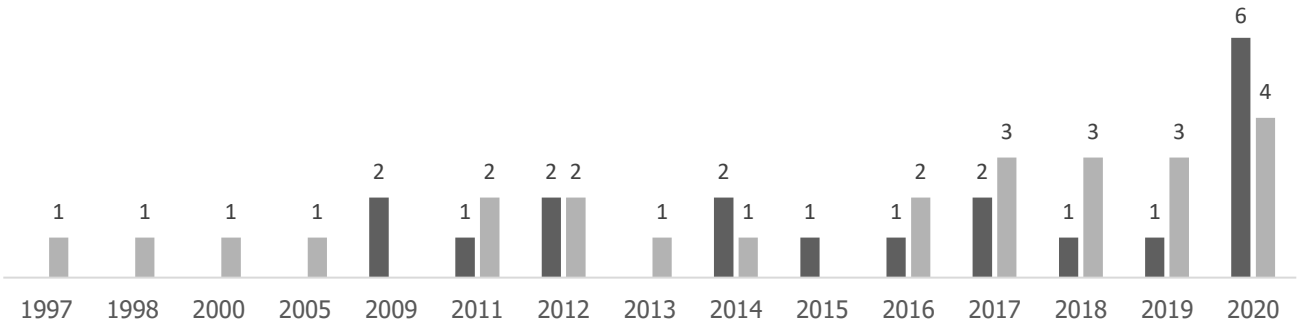
Table 3

Summary of research, methodology, approach, and study in the corpus consisting of 39 agile and lean articles

Research			**Methodology**				**Approach**			**Study**		
Exploratory	Descriptive	Explanatory	Conceptual	Case study/ studies	Survey	Comparative	Qualitative	Quantitative	Mixed	Cross-sectional	Longitudinal	No observations
18 (46%)	19 (49%)	2 (5%)	9 (23%)	25 (64%)	6 (15%)	8 (21%)	32 (82%)	4 (10%)	3 (8%)	17 (44%)	12 (31%)	10 (26%)

Figure 2 shows the distribution of agile and lean articles in the corpus in all publication years up and to (November) 2020. The study shows that before 2011 almost no relevant papers were published within our defined research boundaries. Interestingly, most articles were found between the years 2017 and 2020, especially in the recent year 2020, a significant amount of 10 articles was found. This finding stresses the relevance of this thesis's topic by other scholars.

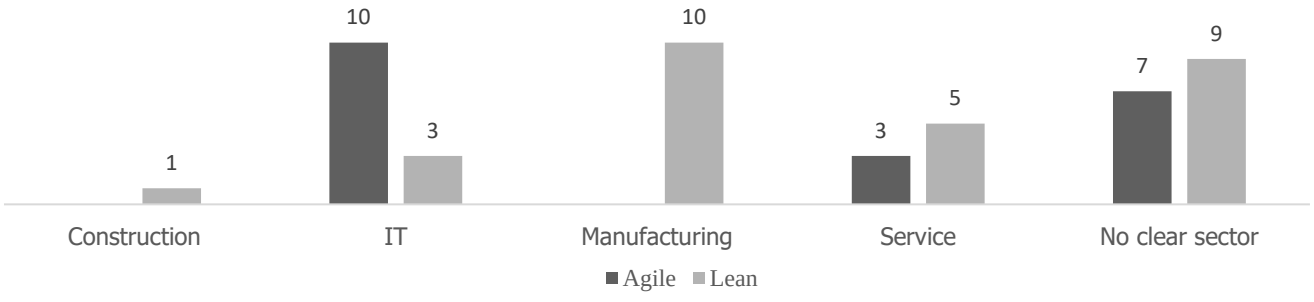
Figure 2
Distribution of the 45 selected articles (corpus) by year



Note: 45 articles are presented in figure 1 and 2, instead of 39 articles in Table 2 and 3. This difference is due to six double articles in the corpus (found in both agile and lean search strings).

Figure 2 presents the distribution of agile and lean articles. As expected, most agile articles (10) were related to the IT sector since agile has its roots in IT and is still active within this sector. Besides, in total, three lean articles were also in the context of the IT sector, of which two articles were double (concerned both agile and lean), thereby indicating lean's presence in the IT sector. Most lean articles (10) were related to the manufacturing sector as expected since lean originated from this sector.

Figure 3
Distribution of 45 selected articles (corpus) by sector of unit of analysis



Notes: articles related to:

1. two sectors, are both included;
2. three or more sectors, are defined as "no clear sector";
3. no specified sector, are also defined as "no clear sector".

Table 4 shows an overview of the distribution of agile and lean articles, specified per journal. The journals are shown in a descending way. Most articles were found in the journal 'Project Management Journal' (6), followed by 'Journal of Manufacturing Technology Management' (3) and 'European Journal of Information Systems' (3). The other journals cover two or fewer articles.

Table 4
Journal distribution of the 45 articles related to principles, practices, and team-level behaviours in the context of agile and lean management

Journal	Agile	Lean	Total
Project Management Journal	5	1	6
Journal of Manufacturing Technology Management		3	3
European Journal of Information Systems	2	1	3
IEEE Transactions on Engineering Management	1	1	2
International Journal of Operations and Production Management		2	2
Supply Chain Management	1	1	2
Learning Organization	1	1	2
Industrial Management and Data Systems	1	1	2
International Journal of Lean Six Sigma		2	2
International Journal of Project Management	1	1	2
Harvard Business Review	1		1
Operations Management Research		1	1
Journal of Workplace Learning		1	1
International Journal of Productivity and Performance Management	1		1
Production Planning and Control		1	1
The TQM Magazine		1	1
Journal of Product Innovation Management	1		1
Total Quality Management and Business Excellence		1	1
European Management Journal		1	1
Journal of Business Research	1		1
Organization Studies	1		1
Journal of Health, Organisation and Management		1	1
Information Systems Research	1		1
Journal of Healthcare Leadership		1	1
Human Relations		1	1
Creativity and Innovation Management	1		1
Benchmarking		1	1
Management Decision		1	1
International Journal of Quality and Reliability Management		1	1
Total	**19**	**26**	**45**

Table 5 provides a summary of the findings to answer the research question. In two separate columns, the findings of both agile and lean management will be shown, followed by a column with the related articles.

Table 5

Summary of findings (differences and similarities between agile and lean management)

Topic	Theme	Agile	Sources	Lean	Sources
Principles	*Aim of approach*	Focus on customer value by incrementally delivering and focus on adaptability and flexibility	Conboy (2009), Eltawy and Gallear (2017), Karrbom et al. (2014), Rigby et al. (2016)	Focus on customer value by delivering cost- and time-efficient and focus on eliminating waste	Conboy (2009), Dal Forno et al. (2016), Eltawy and Gallear (2017)
	Continuous flow/ improvements	Agile embraces change and seek continuous improvements	Annosi et al. (2017), Hennel and Rosenkranz, (2020)	Lean strives for a culture of continuous improvements (*kaizen*); the ultimate goal of any lean journey	Netland et al. (2019), Poksinska et al. (2013), Toledo et al. (2019)
Work-floor practices	*Team composition*	Relatively small teams of three to nine people, cross-functional by default, highly skilled and empowered employees, and support self-organisation	Bäcklander (2019), Browaeys and Fisser (2012), Dingsøyr et al. (2018), Mathiassen and Sandberg (2020), Parker et al. (2015), Rigby et al. (2016)	No clear capacity of team members, can be cross-functional, and are partial self-organising	Aij and Rapsaniotis (2017), Browaeys and Fisser, (2012), Hernandez-Matias, et al. (2019), Middleton and Joyce (2012), Poksinska et al. (2013), Tortorella et al. (2018),
	Meetings	Formal boundaries such as sprints (1-4 weeks), daily stand-up meetings (15 minutes), and role division	Annosi et al., (2017), Dingsøyr et al. (2018), Grass et al. (2020)	No formal boundaries. However, similar agile conditions were found in the IT and service sectors (daily stand-up meetings with a fixed time and duration)	Middleton and Joyce (2012), Netland et al. (2019), Poksinska et al. (2013)
	Visual management	Scrum, Kanban, and Scrumban boards can be used to track project status. The difference is how items got 'pulled' through the process	Annosi et al. (2020), Dingsøyr et al. (2018), Copola Azenha et al., (2020), Grass et al. (2020), Middleton and Joyce (2012), Sońta-Drączkowska and Mrożewski (2020)	Make use of various visual management tools such as Post-its and Kanban boards to track project status	Emiliani, (1998), Middleton and Joyce (2012), Yadav et al. (2018)
	Innovation, improvement, and problem-solving	Make use of 'velocity' at Scrum boards and uses retrospectives to improve the team's performance	Annosi et al. (2020), Dingsøyr et al. (2018), Grass et al. (2020), Middleton and Joyce (2012), Rigby et al. (2016)	Make use of 'lead time' to track the duration of accomplishment and uses various improvement/kaizen methods (e.g., meetings and action plans)	Drotz and Poksinska, (2014), Netland et al. (2019), Middleton and Joyce (2012), Toledo et al. (2019)
Team-level behaviours	*Leadership style and behaviours*	Agile has various pre-defined roles for people who conduct leadership tasks; these people act as coaches or mentors to guide and support the team	McAvoy and Butler (2009), Parker et al. (2015), Rigby et al. (2016)	Lean leaders act as coaches or mentors; their leadership style and behaviours can change as implementation matures. Effective lean leaders show more relation-oriented behaviours	Aij and Rapsaniotis (2017), Poksinska et al. (2013), Seidel et al. (2019), Tortorella, et al (2020), Van Dun et al. (2017)
	Team behaviours (empowering-, helping-, and communication)	Empowering behaviours essential to make (group) decisions. High psychological safety is vital for helping behaviours. Communication behaviours change positively after adopting agile practices	Bäcklander (2019), Dingsøyr et al. (2018), Grass et al. (2020), Hennel and Rosenkranz, (2020), McAvoy and Butler (2009), Rigby et al. (2016)	Empowering behaviours necessary for managerial tasks and together with communication behaviours change over time when the lean implementation matures. High psychological safety vital for helping behaviours	Aij and Rapsaniotis (2017), Colazo (2020), Poksinska et al. (2013), Tortorella, et al (2020), Van Assen (2018), Van Dun et al. (2017), Van Dun and Wilderom (2016)

4.2 Principles

In this section, the principles of both agile and lean paradigms will be compared.

4.2.1 Costs vs. Service

Both approaches are seen as a method of improving the effectiveness and performance of organisational processes (Browaeys & Fisser, 2012). The lean concept has a central aim of increasing efficiencies through eliminating waste, i.e., banishing anything that does not add value (Angelis, Conti, Cooper, & Gill, 2011; Browaeys & Fisser, 2012). By improving processes and eliminating waste, the management philosophy aims to add value for customers (Aij & Rapsaniotis, 2017) via economy, quality, and simplicity (Conboy, 2009). For example, eliminating unnecessary (dysfunctional) variability in the lead- and waiting times and reducing needless internal customer-supplier relationships in each process (Van Assen, 2018). Decreasing or eliminating those waiting times and errors led to a reduction in costs, and in turn, improved quality (Aij & Rapsaniotis, 2017). This elimination of wastes is seen as a key characteristic of lean management, as Conboy (2009) stated that quality and cost reduction are fundamental concepts within lean.

On the other hand, the agile concept is about creating and responding to change, where iterative and incremental development is critical (Karrbom Gustavsson & Hallin, 2014). Both approaches aim for customer value; lean does this by increasing value and minimizing waste to deliver cost- and time efficient to the customer (Conboy, 2009; Dal Forno et al., 2016). While agile aims at meeting customer demand by including internal and external customers in the projects' development, through incrementally delivering to the customer (Rigby et al., 2016). Therefore, agile and thus agility focuses on adaptability and flexibility, making agile more cope with variability and customer responsive, this approach aimed to be the market winner at the service level; while lean, and thus leanness is mainly concerned with reducing waste, making this approach aimed to be the market winner in terms of costs (Conboy, 2009; Eltawy & Gallear, 2017). Moreover, within lean, all wastes are eliminated, while within agile, waste is also required to be eliminated but only if it did not hinder the ability to respond to change; making lean good at things you can control while agile is to be good at things you cannot (Conboy, 2009).

However, it is not mandatory to follow one management approach, as two articles were found in the corpus that used a combination or hybrid approach of both paradigms (Aronsson Aronsson, Abrahamsson, & Spens, 2011; Mathiassen & Sandberg, 2020). For example,

Aronsson, Abrahamsson, and Spens (2011) showed in their study (related to the healthcare sector) that the lean concept had been used for hospitals to improve production planning and reduce waste, while agile sub-processes had been applied for more flexibility.

4.2.2 Continuous flow/improvements

Another important principle in both paradigms is continuous improvement. As agile methods are common in the IT sector (see Figure 2), this approach is often present in software and product development teams or organisations (Browaeys & Fisser, 2012; Grass et al., 2020; McAvoy & Butler, 2009; Rigby et al., 2016). Its focus on embracing change instead of avoiding it makes agile unique; it differentiates agile practices from traditional project management methods (Hennel & Rosenkranz, 2020). Within Scrum are cross-functional teams continuously evaluating task and team progress using daily stand-up meetings (Mathiassen & Sandberg, 2020). These daily stand-up meetings give agile teams suggestions and highlight opportunities for improving how they organise their deliveries (Annosi et al., 2017).

In line with this focus on embracing change, the study of Annosi, Foss, Brunetta, and Magnusson (2017) showed that in those daily stand-up meetings, the high performers in agile teams push others towards continuous improvement, due to this, team members are exposed to the scrutiny of other members; therefore, low performers are stimulated to improve their efforts. At the end of each *sprint,* a reflection takes place, called a *retrospective.* This retrospective focuses on improving the organisational processes, where actions from the previous work iterations are reflected and adaptions for the following work iterations are considered (Annosi, Martini, Brunetta, & Marchegiani, 2020; Dingsøyr, Moe, & Seim, 2018; Grass et al., 2020).

Whereas lean strived to create a culture where improvement is central, this improvement culture is also known as *kaizen* (Netland et al., 2019; Poksinska, Swartling, & Drotz, 2013; Toledo, Gonzalez, Lizarelli, & Pelegrino, 2019). Besides, Netland et al. (2019) even mentioned that "continuous improvement is the ultimate goal of any lean journey" (p. 550). Continuous improvement or *daily kaizen* is achieved through practices that encourage learning, knowledge sharing, lean leadership, and cooperation among employees (Toledo et al., 2019). This continuous improvement culture is encouraged by leadership through managers and management of a lean organisation (Poksinska et al., 2013; Van Assen, 2018). To support and encourage (daily) *kaizen*, lean focus, among other things, on the standardization of processes, which ease the detection of problems (Arnheiter & Maleyeff, 2005; Toledo et al., 2019) or 'blockers' (Middleton & Joyce, 2012), for more improvement practices see chapter *4.2.4*

Innovation, Improvement, and Problem Solving. Additionally, Dal Forno, Forcellini, Kipper, and Pereira (2016) state that the standardization of the processes avoids 'reinventing the wheel', thereby simplifying things. Lean encourages standardisation of work and continuous improvement, while agile encourages self-management (Eltawy & Gallear, 2017).

4.3 Work-Floor Practices

Based on the readings in the corpus, numerous codes have been made. The codes that were relevant in both paradigms are aggregated into themes and used in this chapter. Due to this, identified codes that were not relevant or only related to one management paradigm have been excluded. Practices found in the corpus that only relate to technical aspects made the comparison difficult, as case-specific factors played a significant role (e.g., standardised work and autonomous maintenance, concerning lean manufacturing; eXtreme Programming and DevOps, concerning agile software development). Thus, it is undoable to compare a phenomenon that is only used or applied by one paradigm. Therefore, the more 'generic' work-floor practices in agile and lean project management were compared. A mixture of both hard and soft work-floor practices will be discussed in this section (if they occur in both paradigms). However, the focus on writing the findings section is on the soft dimension, as this has more outstanding interfaces with management and its human facet. The following aspects will be discussed in this section: team composition, meetings, visual management, and innovation/improvements.

4.3.1 Team composition

An agile team, especially within Scrum, usually consists of three to nine people and is cross-functional, including all the necessary skills and people to accomplish its tasks (Dingsøyr et al., 2018; Rigby et al., 2016). In the literature, scholars use the terms *self-managing* (Annosi et al., 2017, 2020; Dingsøyr et al., 2018) and *self-organising* (Bäcklander, 2019; Browaeys & Fisser, 2012; Grass et al., 2020; Parker, Holesgrove, & Pathak, 2015) interchangeably when referring to agile teams. Generally, agile teams are self-organising, meaning that they can decide *how* to tackle specific tasks (Bäcklander, 2019; Parker et al., 2015). Nevertheless, agile teams are, to a certain extent, self-managing in terms of their processes by delegating task responsibility to team members (*what*) and deciding *how* and *when* to achieve project goals (Grass et al., 2020). Agile team members are highly skilled and empowered (Browaeys & Fisser, 2012). However, these teams are not leaderless or uncontrolled (Bäcklander, 2019) and remain reliant on, for example, senior management's support (Browaeys & Fisser, 2012).

As agile teams have formal boundaries of a maximum of nine team members (Dingsøyr et al., 2018; Rigby et al., 2016) shaping relatively small teams, nothing concrete has been found in the corpus for lean, as lean teams have no such clear boundaries regarding the capacity of the team. Nevertheless, Delbridge et al. (2000) described that lean team leaders do not typically exceed 20 workers as a span of control. Moreover, lean teams are also considered 'self-organising' or 'self-managing' (Browaeys & Fisser, 2012; Middleton & Joyce, 2012; Tortorella, De Castro Fettermann, Frank, & Marodin, 2018). Furthermore, many lean teams are multi-skilled or cross-functional (Aij & Rapsaniotis, 2017; Hernandez-Matias, Ocampo, Hidalgo, & Vizan, 2019; Poksinska et al., 2013). The study of Delbridge et al. (2000) found that lean teams as a whole have some degree of responsibility for management related task on the work-floor, but in practice, this degree of autonomy and responsibility lies mainly with the team leader. Actually, the team leader's role is also limited, as the majority of responsibilities for all the employee's activities are carried by personnel specialists and other management staff (Delbridge, Lowe, & Oliver, 2000). The study of Browaeys & Fisser (2012) showed that although agile and lean differ from an epistemological point-of-view, the two concepts may unify to the context of teamwork and thus the solution of self-organising teams, in which the teams remain dependent on, e.g., senior management.

4.3.2 Meetings

When a project has been given to a Scrum team, the work will be broken down into smaller tasks and listed in the *product backlog* by the Product Owner (Annosi et al., 2017; Dingsøyr et al., 2018). With agile, and especially within Scrum, the planning and meetings are based on short intervals, called *sprints* (Annosi et al., 2017; Dingsøyr et al., 2018; Grass et al., 2020). These sprints have a fixed period or consistent duration (1-4 weeks, most commonly two weeks) to create a releasable increment of a product (Annosi et al., 2017; Dingsøyr et al., 2018; Rigby et al., 2016). Each sprint is proceeded by a sprint planning meeting, run by the Scrum Master and attended by the Product Owner and the team, in which the Product Owner provides priority on backlog items together with the team to create a sprint backlog, where the team focus to work on the coming period (Annosi et al., 2017; Dingsøyr et al., 2018). Every day, the Scrum team gets together for a daily scrum meeting to discuss progress and identify any 'roadblocks' (Rigby et al., 2016). These daily 'stand-up' meetings have a duration of approximately 15 minutes (Annosi et al., 2017). An interesting finding of the study of Dingsøyr, Moe, and Seim (2018) is that scheduled meetings reduced over time as the team members got to know each other better; consequently, people started approaching others directly; arranged unscheduled

meetings around the Scrum boards; or even discussed issues by the coffee machine. The sprint ends with two rituals: *the review*, which is a demonstration of new functionality to the stakeholders and *the sprint retrospective*, which is an examination of what went well, what went poorly, and what can be improved, so that the next sprint is more efficient and effective than the last sprint (Annosi et al., 2017; Dingsøyr et al., 2018).

Just as with agile, lean teams (in healthcare) have brief daily meetings to ensure follow-up tasks and to support two-way communication, therefore, aiming at giving and receiving feedback from employees (Drotz & Poksinska, 2014; Poksinska et al., 2013). These short daily meetings usually have a fixed start time and duration followed by a standardised agenda which often contains the planning of daily activities; checking the conditions to meet the day's demands; discussing various daily work problems; and reviewing objectives (Poksinska et al., 2013). In the case of Middleton and Joyce (2012), where lean was implemented in a software company, daily stand-up meetings lasted for about 15 minutes and were carried out with all team members. These daily stand-up meetings are essential for the operations of the lean system, as they update the status- and prioritization of work items and facilitate the recognition- and removal of bottlenecks and blockages (Middleton & Joyce, 2012). Moreover, Netland et al. (2019) stated that the stand-up meetings should extend beyond floor operators and front-line management. Therefore, each level of the organisational hierarchy in a lean organisation should participate in the stand-up meetings so that everybody becomes acquainted with the ongoing operations (Netland et al., 2019). Not in all sectors where lean was implemented was the frequency of organised meetings daily. Namely, the study of Gabriel (1997) focussed on lean in the construction sector and showed that instead of daily meetings, weekly meetings were organised concerning the project's costs, while monthly meetings were organised with the client to discuss the progress of the project. These examples show that the frequency of organised meetings in lean teams may differ per sector and have not been determined.

4.3.3 Visual management

Both approaches visualise the daily operations of the team with the use of a visualisation board. Lean uses Kanban boards (Emiliani, 1998; Middleton & Joyce, 2012; Yadav, Mittal, & Jain, 2018), whereas agile makes use of a variety of visualisation boards, namely: Scrum boards (Annosi et al., 2020; Dingsøyr et al., 2018); Kanban boards (Copola Azenha, Aparecida Reis, & Leme Fleury, 2020; Grass et al., 2020; Sońta-Drączkowska & Mrożewski, 2020); or even a combination of both, called Scrumban boards (Middleton & Joyce, 2012; Sońta-Drączkowska

& Mrożewski, 2020). Conforto, Salum, Amaral, Da Silva, and De Almeida (2014) mentioned in their paper that *product vision concept* and *simple project plan communication tools and processes* are essential work-floor practices of agile project management, thereby referring to visual boards, sticky notes, figures, or simplified descriptions, for example, drawings. These visual boards (often referred to as whiteboards or 'huddle boards') are called in the Scrum framework *Scrum boards* and in lean approach *Kanban boards*, which are physical boards with various space area's (columns) to coordinate the work on the team level (Dingsøyr et al., 2018; Grass et al., 2020). With Scrum, team members break the highest-ranked tasks from the backlog into small modules, decide how much work it takes and how to accomplish it, establish a clear 'definition of done', and start making iterations of the product in *sprints* (Rigby et al., 2016). Both Scrum and Kanban boards can be used within the agile paradigm to track the project status (Copola Azenha et al., 2020; Grass et al., 2020). Kanban is a method that originates from the principles of lean and utilizes the visualisation of workflows (Grass et al., 2020). This method aims to improve the prioritization of work tasks using columns on the Kanban boards, so-called *swimming lanes*, which allow the team to visualise the tasks' prioritization and classify the tasks corresponding to their degree of completion (Grass et al., 2020).

The main difference between Scrum and Kanban boards is how iterations/tasks got pulled through the project (Middleton & Joyce, 2012). With Scrum, the Scrum Master select in dialogue with the Product Owner and the other team members the high priority items and, therefore, 'pull' from the *product backlog* to the *sprint backlog* (Dingsøyr et al., 2018). As the items are in the sprint backlog and thus in the current sprint, a fixed period has been set to finish the (increment of a) product (Annosi et al., 2017; Dingsøyr et al., 2018; Rigby et al., 2016). Whereas within Kanban, there is no periodically fixed 'sprint' or time-boxed iteration because it is a continuous process (Middleton & Joyce, 2012). The pull system in Kanban is used with 'work-in-progress limits' related to the team's capacity to ensure a team becomes not overloaded; therefore, there are no arbitrary deadlines and items got *pulled* if there is capacity free (Middleton & Joyce, 2012). Moreover, Middleton and Joyce (2012) state that the Scrum framework and its stand-ups in front of Scrum boards are more focused on the people, what they did yesterday and what they are doing today (planning). Although with the lean approach, data is not seen as a management control tool, but rather as a source of empowerment to expose problems and expect the team to take action by addressing leading indicators of issues using Kanban boards (Middleton & Joyce, 2012).

4.3.4 Innovation, improvement, and problem solving

Velocity vs. Lead time

Both agile and lean teams use a metric to measure the effort and time to accomplish tasks. Agile teams are continuously engaged in the process of adapting their innovative endeavours to changes in their environments, which led to reduced cycle times, less rigid product development, and the ability to respond adequately to changing customer requirements (Grass et al., 2020). To track and measure the amount of work accomplished in each sprint, the concept of 'velocity' has been used, indicating the amount of work a team can tackle during a sprint (Middleton & Joyce, 2012; Rigby et al., 2016). This concept of velocity is measured by team members allocating story points per iteration to calculate the (projected) amount of work (Middleton & Joyce, 2012; Rigby et al., 2016). Lean teams also track the duration of accomplishing a task but do this using 'lead time', which records the total time from the customer's initial request to the final delivery (Middleton & Joyce, 2012). The main difference between story points/velocity and lead time is the subjective allocation process from the agile team members, and therefore the story points are easy to manipulate (Middleton & Joyce, 2012). In contrast, lead time is much harder to game as it records (and is, therefore, more objective) the total duration from the customer's request to the delivery (Middleton & Joyce, 2012).

Methods for improving

Different methods have been applied to improve the processes and performance within both paradigms. With Scrum, as previously mentioned, an after-sprint reflection (retrospective) takes place on how to improve further the team's performance based on the routines and processes within the project (Annosi et al., 2020; Dingsøyr et al., 2018; Grass et al., 2020). Although with lean, there is no formal methodology found in the corpus regarding process improvement, there have been several methods used within the articles for systematic problem-solving and continuous improvements, namely *kaizen* (Arnheiter & Maleyeff, 2005; Colazo, 2020; Netland et al., 2019; Poksinska et al., 2013; Toledo et al., 2019). Various practices have been identified related to *kaizen* events or activities, as mentioned below.

Colazo (2020) referred to, for example, *kaizen* circles or *quality control circles* (QCC) which are groups of workers (with sometimes the supervisors) who collectively solve complex problems by applying simple analytical tools such as fishbone charts and Pareto diagrams.

Moreover, within the papers of Netland et al. (2019) and Toledo, Gonzalez, Lizarelli, and Pelegrino (2019), lean teams created an *action plan* to systematically address each of the prioritised challenges or problems (using a problem-solving process). In the study of Toledo et al. (2019), a lean team used an existing instrument, called a quality clinic (or *kaizen* event), in which employees were encouraged to report problems in their processes in a weekly meeting after the reviews. After that, the leader summarised the problems by classifying each problem based on their nature, for example, supplier problems or employee training (Toledo et al., 2019). Roughly the same approach was applied in the study of Netland et al. (2019), where the structured problem-solving process took place at the shop floor, and managers helped identify improvements and manage the whole problem-solving process with the help of visualisation boards. When the action plan was addressed, the structured problem-solving process continued by investigating the effects of these single changes to define a new standard for the process in question (Netland et al., 2019). The process is finalized by sharing the lessons learned with others (Netland et al., 2019).

Another example of continuous improvement and problem-solving is mentioned in the paper of Drotz and Poksinska (2014), in which employees had to write down on Post-its every problem and disruption they experienced during the working day and post it on a whiteboard. Just as in the paper of Toledo et al. (2019), weekly meetings were initiated, and just like in the paper of Netland et al. (2019), visualisation boards were used to review, discuss, solve the problems.

Lastly, the study of Delbridge et al. (2000) showed that their lean sample used formal suggestion schemes for improvements and that work-floor employees played a significant role in improvement activities; more than three-quarter of their sample used their related 'contextual' knowledge to fill-in formal suggestion schemes, whereby work-floor employees found themselves with greater responsibility to solve their own problems.

Since there will be strived with lean to the creation of a culture where improving is central, *kaizen*/continuous improvement became an agenda item in meetings whereby time- and resources were allocated to enable continuous improvement (Poksinska et al., 2013; Toledo et al., 2019). Improvement activities were monitored and visualised, and managers gave recognition if improvement ideas were submitted or employees participated actively in the improvement realisation (Netland et al., 2019; Poksinska et al., 2013).

4.4 Team-Level Behaviours

In this part of the paper, a comparison of agile and lean teams' behaviours will be shown.

4.4.1 Leadership style and behaviours

As a significant part of the corpus was related to leadership behaviours, we first focus on leadership style and behaviours in a team-level context, after we discuss the behaviours found within agile and lean teams.

4.4.1.1 Agile leadership

Even though agile teams are self-organising, they are not entirely leaderless or uncontrolled; instead of conventional managers, teams often have an *Agile Coach, Scrum Master,* or an alternative leadership role (Bäcklander, 2019). In larger organisations with more agile teams (also called *squads),* various teams can be clustered together in a 'tribe', in which each team is typically supported by a *Product Owner* and have the accessibility to an *Agile Coach* (Bäcklander, 2019). The goals of an Agile Coach are to help teams find suitable ways of working and keep improving them, be motivated to the team and have a sense of autonomy and ownership (Bäcklander, 2019).

Copola Azenha, Aparecida Reis and Leme Fleury (2020) described three managing or leadership roles in agile, namely: the *Project Manager*, who is responsible for the whole project; the *Product Owner*, who is responsible for every single project; and the *Scrum Master,* who deliver strategies based on the needs and complexities of the project. In the study of Copola Azenha et al. (2020), three of the five companies followed a more centralised leadership approach where a team leader was identified, generally the role of the Product Owner, who reported directly to the Project Manager and was responsible for the indirect management and internal planning of the iterations (conducted together with the team). Whereas in the other two companies, the leadership was less centralised, as within those teams, there was no straightforward leadership role, and thus agile teams reported directly to the Project Manager.

The agile Project Manager has a facilitating role; instead of telling each employee what to do and how to do it, the agile Project Manager fosters an environment where team members can make decisions based on the best available information (McAvoy & Butler, 2009). Moreover, the agile Project Manager provides the vision to teams (Copola Azenha et al., 2020; McAvoy & Butler, 2009). This finding is in line with what Rigby, Sutherland, and Takeuchi (2016) mention in their paper about agile leadership behaviours: "Tell them what to do, and they will surprise you with their ingenuity." Rather than give orders, leaders in agile organisations learn

to guide with questions, such as “What do you recommend?” and “How could we test that?” (p. 50). Moreover, the agile leader, generally represented by the figure of the Product Owner, is hierarchically not above the other team members (Copola Azenha et al., 2020). Therefore, empowering employees is essential (Grass et al., 2020; McAvoy & Butler, 2009). Due to this leadership style, a vision is provided of what is needed from the team; after that, the team members decide how to tackle this and fill in the details (McAvoy & Butler, 2009).

Parker, Holesgrove, and Pathak (2015) explained that for leadership of self-organising teams and thus agile teams, ‘building skills’ is an essential requirement, just as ‘building good relationships’ among team members. The agile leader can achieve this by getting to know each team members as a person and know what motivates each person at work and outside of work; furthermore, treating each person with respect will establish more robust working relationships (Parker et al., 2015).

4.4.1.1 Lean leadership

Lean leaders act as coaches by helping others develop new skills and knowledge; self-development is thereby crucial for lean leaders (Aij & Rapsaniotis, 2017). Moreover, Aij and Rapsaniotis (2017) found in their systematic literature review that in all their articles, the lean leaders were focused on problem-solving by creating an environment in which problems are acknowledged as improvement opportunities rather than blaming others. When lean is effectively implemented, lean leaders were seen as guides of the team's behaviour by influencing the behaviour of employees through the leader’s values (Poksinska et al., 2013; Van Dun & Wilderom, 2016).

Typical lean leadership behaviours are paradoxical; it incorporates, on the one hand, the hard technical perspective (e.g., management based on facts, actively steering on performance, and setting ambitious goals); on the other hand, the social aspects like stimulating employee responsibility, collaboration and empowerment to boost teamwork, and creativity for continuous improvement (Van Assen, 2018). This perception is in line with Van Dun et al. (2017), who observed that both task- and relation-oriented behaviours are present with effective lean leaders. Moreover, this study showed that lean managers were seen as effective in leadership as they reflected positive behaviours akin to relationships by active listening and agreeing with their employees, thereby encouraging their employees' views (Van Dun et al., 2017). At the same time, behaviours related to the tasks and counterproductive work such as ‘providing negative feedback’ were displayed less by effective lean managers (Van Dun et al.,

2017). That relation-oriented behaviours are more likely to lead to more favourable lean results also correspond with the study of Tortorella, Van Dun, and De Almeida (2020). However, Van Assen (2018) point out that the absence of some task-oriented behaviours may hamper process improvement, thereby indicating that these hard- and technical task-oriented behaviours are essential to achieve process improvement and thus effective lean (e.g., steering on performance improvement; managing on facts, by the utilization of objective data; and providing feedback on performances). However, excessive focus on this might hamper continuous improvement (Van Assen, 2018).

Additionally, Tortorella et al. (2020) note that the lean implementation in the healthcare sector necessitates leaders to demonstrate task-oriented behaviours, especially when short-term results are required. Whereas more mature lean leaders develop besides their task-oriented behaviours, their relations-oriented behaviours, hence showing both styles of behaviours (Tortorella et al., 2020). This finding is also in line with their literature review in the context of manufacturing organisations, which indicated that at the beginning stages of lean, the behaviours of lean leaders were more task- than relations-oriented. Nevertheless, as the implementation progressed, lean leaders underlined the value of interpersonal relationships (relation-oriented).

The study of Seidel, Saurin, Tortorella, and Marodin (2019) showed that various leadership theories are relevant for lean leadership, thereby indicating that this is dependent on the environment of where the organisation is currently located. For example, a manufacturing organisation moving from a traditional mass production system to a lean system may encounter more resistance and fear from employees; therefore, a transformational leadership style may be more effective than a servant leadership style (Seidel et al., 2019). This corresponds with the findings of Poksinska, Swartling, and Drotz (2013), who observed that lean leadership is related to transformational- and servant leadership, but this varies on the maturity of the lean implementation. When the lean implementation matured, as the employees' abilities evolve into lean practices and the organisation developed a solid management system, the need for transformational behaviours decreased (Poksinska et al., 2013). Whereby it became more important to guide the behaviour and thinking of the employees (servant leadership) and to build a supportive culture, so the managerial push will eventually be replaced by the employees' pull; the system will proceed without dependence on the individual leader (Poksinska et al., 2013). Thereby showing that both task- and relation-oriented behaviours are essential to achieve effective results, and this varies within the maturity of the implementation.

Moreover, in our corpus, leadership is mainly discussed separately in agile or lean teams. However, Mathiassen and Sandberg (2020) did a case study focusing on a combination of both approaches called the Agile-Lean paradigm, in which a coaching culture was supported with facilitating leadership. Due to this, the decision-making process changed from a highly centralised structure with a top-down approach to a decentralised structure with a clear focus on empowered teams, whereby the goal was to take more team responsibility, increase inter-team communication and coordination, and hold them collectively accountable for larger tasks (Mathiassen & Sandberg, 2020).

4.4.2 Team behaviours

In this section, behaviours corresponding to the whole team will be shown. Team behaviours identified in both management approaches and covered by various articles will be discussed.

4.4.2.1 Empowering behaviours

Empowerment is essential in both agile (Grass et al., 2020; McAvoy & Butler, 2009; Rigby et al., 2016) and lean teams (Aij & Rapsaniotis, 2017; Poksinska et al., 2013; Van Assen, 2018). Empowerment is beneficial for performance outcomes related to innovation and creativity (Grass et al., 2020; Van Assen, 2018). Empowering behaviour to make group decisions is seen as a characteristic of agile teams, as agile teams have a collective responsibility for delivering the product or project (McAvoy & Butler, 2009). Moreover, Grass, Backmann, and Hoegl (2020) identified empowerment within agile teams as a focal human factor and a dynamic social process to make certain (group) decision, in which agile teams and their leaders balance and negotiate empowerment by reacting and adapting to new circumstances and changes in the product requirements (empowerment-enhancing and empowerment-reducing activities). Their research showed that that empowering leadership behaviours result in performance improvements over time and that empowerment is not exclusively relevant at the team- and leadership level in agile teams but also at other layers in the organisation, such as top management and other organisational levels (Grass et al., 2020).

The study of Poksinska et al. (2013) showed that as the implementation of lean progressed, employees became more empowered and involved in the decision making process. This finding is in line with the previous findings, as mentioned earlier, that lean leadership behaviour changed over time as the lean implementation got more mature (Tortorella et al., 2020). When leadership was performed correctly regarding the lean philosophy, employees received increasing responsibility for controlling and managing daily operations, which took over many

managerial tasks such as performing audits or updating and monitoring performance measures (Poksinska et al., 2013). Moreover, within lean teams is empowering employees and promoting employee responsibility essential to solve problems, cooperate in teams, and improve processes and activities (Van Assen, 2018).

4.4.2.2 Psychological safety and helping behaviours

The study of Hennel and Rosenkranz (2020) showed that if there is a low psychological safety within agile teams; team members are less likely to speak their minds; are less likely to give valuable input to achieve successful outcomes; and are less likely to offer improvement ideas. In contrast, a higher psychological safety led to more helping behaviour, more engagement, and the willingness to give helpful input and offer new ideas, ultimately leading to improvements and a learning organisation (Hennel & Rosenkranz, 2020). Due to this finding, Hennel and Rosenkranz (2020) showed that psychological safety is a critical success factor for agile teams, which directed, among other things, to more helping behaviours (e.g., asking for help, speaking up about concerns or mistakes, and seeking for feedback). Moreover, besides trust, mutual respect, and high quality of interactions, is psychological safety essential for change in organisations (Bäcklander, 2019). The abovementioned characteristics create honest communication, so that, for example, another person (preferentially someone without their interest in any outcome) could lead and facilitate the team when the manager is not present (Bäcklander, 2019).

Van Dun et al. (2017) observed that effective lean leadership such as building close human relations at work is likely to result in psychological safety. Just as with agile, psychological safety within lean teams will, in turn, encourages employees to express their ideas and reflective thoughts for improving their work practices, even about their mistakes (Van Dun et al., 2017). Moreover, Van Dun and Wilderom (2016) has shown that information sharing within lean teams is vital for team learning, innovation, and performance. However, this is not automatically achieved; a lean leader with conservation values are less likely to achieve team successes than leaders with more self-transcendence values, who create a more psychologically safe climate (Van Dun & Wilderom, 2016). To foster this type of behaviour, a company must experience a cultural shift where change is accepted and where team members feel empowered to seek out and apply improvements, even when setbacks occur (Hernandez-Matias et al., 2019). This type of culture has a free flow of information, allowing managers to obtain and combine creative ideas (Hernandez-Matias et al., 2019).

Another example of helping behaviour within lean teams is in the study of Middleton and Joyce (2012), who showed that when there was a bottleneck blocking the work items, all team members, regardless of their skills, were expected to help eliminate the bottlenecks and deliver value as soon as possible to the customer. Whereas, within Scrum teams, the responsibility of working on improvements of blockages can be diffuse (Middleton & Joyce, 2012).

4.4.2.3 Communicating behaviours

Dingsøyr et al. (2018) showed that with agile, personal communication changes over time after adopting the agile practices. As the agile implementation progressed, there was a high presence of personal communication found in both the group and induvial mode, which emphasized the essence of horizontal personal coordination and its openwork landscape (Dingsøyr et al., 2018). Due to this, the vertical personal coordination was made easier for project managers to inform the teams' status to others (Dingsøyr et al., 2018).

Similarly, the study of Colazo (2020) showed that when a company advances its lean transformation, its communication patterns within teams fundamentally change. So when a company becomes leaner, the observed changes are (1) higher frequency of communication among team members; (2) teams share more of their communications, becoming more decentralised; (3) more communication with supervisors/leaders; (4) more collaboration and communication among supervisors/leaders; and (5) more exhibition of those changes from better performing teams (Colazo, 2020). This analysis of the corpus has shown the differences and similarities of both agile and lean (project) management.

5. DISCUSSION

This study helps us understand how agile and lean management differ or overlap in terms of the principles, work-floor practices, and team-level behaviours. We conducted a systematic literature review because it is crucial for building a coherent body of knowledge and guiding future research endeavours (Danese et al., 2018). Previous comparative literature studies, especially related to agile and lean project management, are scarce, as most comparative literature studies focus on the manufacturing process (e.g., Hallgren & Olhager, 2009; Prince & Kay, 2003; Qamar et al., 2018), while largely neglecting the human facet. Our study tried to fill this gap by conducting a systematic literature review with an initial dataset of 3.306 articles that eventually led to a final corpus of 39 relevant articles, of which six articles were found in both agile and lean search strings. The results indicate that there is, to a certain extent, an overlap between the two approaches. They both support continuous improvement, organise- and conduct periodically meetings (daily, short-term, and visualisation boards), and generally have the same team characteristics related to cross-functionality and self-organisation (actually partial self-organisation for lean teams). In a broad sense, these principles and work-floor practices look the same; however, there are some differences. Both management approaches differ in their implementation goal (cost vs. service), continuous improvement practices, and changes in leadership over time. In the sections below, the implications that have been considered as most interesting are highlighted.

5.1. Key Findings

5.1.1 Aim of the management approach

Both management approaches aim to improve the effectiveness and performance of organisational processes and for customer value (Browaeys & Fisser, 2012; Conboy, 2009). Agile focuses on adaptability and flexibility, making agile cope better with variability and customer responsiveness (Conboy, 2009; Eltawy & Gallear, 2017). Moreover, agile aims to meet customer demands by incrementally delivering to the customer; therefore, incremental and interactive development is key in agile project management (Rigby et al., 2016). Whereas lean focus on eliminating all waste, leading to more cost-efficient use of resources (Conboy, 2009; Eltawy & Gallear, 2017). Lean does this to deliver cost and time-efficient to the customer (Conboy, 2009; Dal Forno et al., 2016). Hence, where agile focuses more on adaptability and service, lean focus more on costs reduction.

Both approaches pay great attention to continuously improving. As agile embraces change (Hennel & Rosenkranz, 2020), teams need to continuously highlight opportunities and improve their processes (Annosi et al., 2017). Therefore, Scrum uses retrospectives to reflect and innovate processes (Annosi et al., 2020; Dingsøyr et al., 2018; Grass et al., 2020). Social group pressure also helped agile teams improve their organisational processes (Annosi et al., 2017). On the contrary, with lean, a culture of continuous improvement (*kaizen*) is central and is encouraged both at the team level as well as within the whole organisation (Toledo et al., 2019). To benefit this culture of continuous improvement, lean focuses, among other things, on the standardization of processes (Dal Forno et al., 2016). In order to achieve continuous improvement, *kaizen* became an agenda item in their team meetings. Kaizen events or activities were implemented in which suggestion schemes (Delbridge et al., 2000), action plans (Netland et al., 2019; Toledo et al., 2019), or Post-its (Drotz & Poksinska, 2014) can be used.

5.1.2 Meeting structure

Agile, especially Scrum, has some formal boundaries related to the duration and frequency of meetings and how they should be structured and organised. For example, short intervals called *sprints* (1-4 weeks); daily stand-up meetings, with a fixed time of approximately 15 minutes; and a division of roles and tasks (Annosi et al., 2017; Dingsøyr et al., 2018). There are no clear 'formal boundaries' found regarding the frequency and duration of meetings with lean. However, when lean was implemented in the software industry (Middleton & Joyce, 2012) and the healthcare sector (Drotz & Poksinska, 2014; Poksinska et al., 2013), similar conditions were found as with the agile approach; concerning the duration, frequency, and planning of the meetings (Drotz & Poksinska, 2014; Middleton & Joyce, 2012; Poksinska et al., 2013).

Another similarity in both approaches is that daily stand-up meetings occurred in front of visualisation-boards. In the agile approach, Scrum boards are generally used (Annosi et al., 2020; Dingsøyr et al., 2018), but also Kanban boards can be used to track project status (Copola Azenha et al., 2020; Grass et al., 2020; Sońta-Drączkowska & Mrożewski, 2020). However, the lean approach uses only Kanban boards (Emiliani, 1998; Middleton & Joyce, 2012; Yadav et al., 2018). There is a difference in the implementation of the 'pull system' (Middleton & Joyce, 2012). With Scrum boards, a fixed period has been set to finish the tasks and items got 'pulled' from the *product backlog* to the *sprint backlog* (Annosi et al., 2017; Dingsøyr et al., 2018; Rigby et al., 2016). Whereas with Kanban boards, 'work-in-progress limits' are being used related to the team's capacity; there are no arbitrary deadlines and items got 'pulled' if there is capacity free; it is a continuous process (Middleton & Joyce, 2012). Agile and their

Scrum boards focus on the planning and people aspect by visualising what the team members did yesterday and what they will do today (Middleton & Joyce, 2012). In comparison, lean use their Kanban boards as a source of empowerment to expose problems and follow-up actions (Middleton & Joyce, 2012).

5.1.3 Team composition and leadership behaviours

A typical agile team consist of three to a maximum of nine people (Dingsøyr et al., 2018; Rigby et al., 2016), in which team members are highly skilled, empowered, and support self-organisation (Browaeys & Fisser, 2012). Nonetheless, nothing specific has been found in the corpus regarding the members' capacity of lean teams. Lean teams also support self-organisation (Browaeys & Fisser, 2012). Moreover, lean teams can also be cross-functional (Aij & Rapsaniotis, 2017; Poksinska et al., 2013), but this is not mandatory. In comparison, Scrum teams are cross-functional by default.

Even though both teams are self-organising, they are not leaderless or uncontrolled (Bäcklander, 2019; Parker et al., 2015) and remain dependent on, e.g., senior management (Browaeys & Fisser, 2012). In agile, various roles are specified related to the leadership tasks. Especially within Scrum, this is generally the *Project Manager*, the *Product Owner* and *Scrum Master* who can function as leaders (Copola Azenha et al., 2020). In lean teams, this is more the conventional leader or manager called the *Lean Leader* or *Lean Manager*.

Given the above, it can also be stated that both management approaches have much in common in regard to relation-oriented leadership. Agile leadership roles reflect this by, for example, building good relationships and knowing each team member as a person (Parker et al., 2015). Lean leaders reflect this by showing relation-oriented behaviours such as active listening and agreeing with their employees, thereby encouraging their employees' views (Van Dun et al., 2017). Also, by guiding team members' behaviour and thinking (Poksinska et al., 2013). Besides, task-oriented behaviours (e.g., steering on performance improvement and providing feedback on performance) are still needed for effective lean (Van Assen, 2018). Although, Van Dun and Wilderom (2015) showed that such task-oriented behaviours are taken over by employees so that the team leader does not need to act in a controlling or micro-managing manner (article outside the corpus).

In line with these findings, both agile and lean leaders are expected to act as coaches or mentors to develop new skills and knowledge; moreover, they find suitable ways of working and continuously improving those ways (Aij & Rapsaniotis, 2017; Bäcklander, 2019).

Interestingly, more leadership styles could be present within lean teams, depending on the context and lean maturity stage of the organisation (Seidel et al., 2019). The lean maturity stage has been discussed by Netland and Ferdows (2016), who refer to the S-curve theory (article outside the corpus). A graph has made in the form of an 'S', representing the changes that occur over time with the implementation of lean. Showing that in the beginning phase of the lean implementation, a steep increase is present in the operational performance, which later weakens if the implementation matures (Netland & Ferdows, 2016). This change in operational performance is also found in the studies of Poksinska et al. (2013) and Tortorella et al. (2020) but then related to leadership behaviours. As the lean implementation matured, more relation-oriented behaviours were found, thereby showing that other leadership styles could be present depending on the maturity stage. However, within the corpus of agile literature, nothing was found about a (potential) change in the agile leadership style related to the implementation maturity stage. This discrepancy could be due to the relatively short amount of time agile teams exist and the scarcity of longitudinal studies on this topic.

5.1.4 Empowering-, helping-, and communicating behaviours

Empowering behaviours are found present and essential in both agile and lean teams. Such behaviours are essential for agile teams to make (group) decisions (Grass et al., 2020; McAvoy & Butler, 2009) and for lean teams to take over managerial tasks such as monitoring performance measures and performing audits (Poksinska et al., 2013); which is also in line with the findings of Van Dun and Wilderom (2015) (article outside the corpus). Remarkably Poksinska et al. (2013) found that empowering behaviours increased over time when the lean implementation matures, as lean team members were not directly empowered to make decisions. In comparison, agile team members were directly empowered to make decisions since this is one of the agile teams' core values. Nevertheless, the changes in agile team-level behaviours have not been researched over time, so the effect of empowering behaviours due to the implementation maturity is still unknown.

Empowerment within teams has also to do with mutual trust (Bartram & Casimir, 2007). High psychological safety is essential within agile and lean teams—where people feel safe and trust each other. A high psychological safety has shown to be a critical success factor for helping behaviours such as sharing information, asking for help or feedback, and express their ideas (Hennel & Rosenkranz, 2020; Van Dun et al., 2017; Van Dun & Wilderom, 2016).

Moreover, it was found that communication significantly changes for both management approaches. Dingsøyr et al. (2018) found that personal communication within agile teams changes positively over time after adopting agile practices (higher personal communication in individual and group mode). The same kind of effect was found by Colazo (2020), that communication patterns changed positively within lean teams when a company turns leaner (higher frequency of communication among team members and supervisors/leaders).

5.2 Theoretical and Future Research Implications

The results of this systematic literature review are important and beneficial for both theory and practice, as comparative studies of the two management approaches are relatively scarce. Such an understanding is necessary to test and develop theories relating to agile and lean paradigms (Narasimhan et al., 2006). Below the research agenda is sketched.

5.2.1 Combining approaches

Some scholars suggest a combined approach of agile and lean called the *leagile* approach (Mason-Jones et al., 2000; Naylor et al., 1999; Van Hoek, 2000). Other scholars refer to a *hybrid* strategy (Aronsson et al., 2011) or an *agile-lean* approach (Mathiassen & Sandberg, 2020). The *leagile* approach has been mainly applied and researched within the manufacturing context (see Appendix I) and previous works on this topic, especially related to management, is remarkably scarce. Given the overlaps and differences found between agile and lean management (e.g., overlaps in meeting structures and team-level behaviours), this systematic literature review offers the opportunity to discover further this combined approach.

5.2.2 Cross-sector comparisons

For a significant part, the agile studies were focussed on the person seen as the *Agile Lead* or in Scrum the *Scrum Master* and *Product Owner*. Thereby, was often the whole team (thus all team members) involved in the context, resulting in an all-embracing view of agile team-level behaviours. This all-embracing view of team-level behaviours may be due to agile teams formally seen as autonomous, where leadership is considered a shared phenomenon, therefore encompassing the whole team in the literature.

In contrast, empirical evidence of lean team-level behaviour is scarce. Most relevant studies are related to lean leadership in the manufacturing or service context. Within lean teams, there is formally seen a greater detachment of those who lead and those who follow. A plausible cause for this discrepancy could be the sector where lean is most present; namely, the manufacturing sector, where in general, relatively less educated (and skilled) team members are present.

Compared to the IT sector, where agile is primarily present and in which highly educated and skilled employees are usually needed. So, a recommendation for future empirical research is to study both paradigms' team-level behaviours, focusing on the team members behaviours and not only the leadership behaviours. Especially for lean teams, as most of its empirical literature focuses on leadership behaviours, therefore lacking other team members' behaviours.

5.2.3 Sector differences

When team members' behaviour becomes more researched, we advise studying this in sectors within the same context. While comparing team behaviours of both paradigms, a clear difference was found between the operating sectors. Our corpus of lean literature was often related to the manufactural or service sectors, whereas the agile literature in our corpus was mainly found in the IT sector (e.g., software and research & development fields). Therefore, an equivalence comparison was not made, as both sectors may have other factors influencing, for example, their leadership and team behaviours.

To illustrate, the field of software generally has to deal with uncertainty, flexibility, and resiliency (Hennel & Rosenkranz, 2020), while manufacturing has more to cope with process flow and efficiency (Browaeys & Fisser, 2012). It would have added value to our research's robustness if insightful and empirical data in the same context were found related to the human aspect of the management approaches. For example, lean teams and agile teams in the same sector with the same market circumstances, and how would they differ.

For now, empirical studies related to team-level behaviours in the same sector as both agile and lean are present is scarce. Therefore, a recommendation for future research is to focus on team-level behaviours regarding the same sector of both paradigms, for example, in the IT sector where lean management is also considerably present. In this way, a more equivalence comparison can be made of team-level behaviours.

5.2.4 Team focus

Project management literature or empirical studies were more challenging to find for lean than agile. This scarcity might be because the agile approach is often implemented for project management because of its flexibility and iterative planning characteristic. In contrast, lean is often implemented for managing processes within the whole organisation. Therefore, it is often referred to as 'employees of lean organisations' in the lean literature, whereas agile literature is more focused on teams and team members. So, as seen from our systematic literature review, in the literature of agile, authors often mention agile in the context of teams, whereas lean

literature often refers to the whole organisation's context and not so much in separate teams. Hence, future research could explore this gap by focussing more specifically on lean teams.

5.2.5 Longitudinal studies

From our systematic literature review can be concluded that changes take place within the lean team-level behaviours as the lean implementation matures. These changes were predominately found within the leadership behaviours. Moreover, few studies were longitudinal in our corpus, which provides a limited view on the effects that occur over time.

The *S-curve theory* by Netland and Ferdows (2016) shows how operational performance changes over time with lean implementation. Based on these changes, specific lean leadership styles/behaviours are preferred. This finding could also be relevant to research for the agile literature as Gren, Goldman, and Jacobsson (2020) stated that in a successful agile team, the leader adapts her leadership style to the group development stage and according to emerging group needs.

Nevertheless, changes over time in agile team-level behaviours are not so much found in the agile literature; only three articles in our corpus devoted attention to the (potential) changes related to the maturity of the agile implementation (Conboy, 2009; Dingsøyr et al., 2018; Mathiassen & Sandberg, 2020). However, these articles were mainly based on the changes in impact or practices over time. Only Dingsøyr et al. (2018) devoted a small part of their study to communication changes over time.

A plausible reason could be that most agile studies in our corpus were cross-sectional (see Table 2 and 3) and focussed on the beginning stage of the agile implementation or how to implement agile. Moreover, these articles devoted not much focus on the behavioural changes that take place over time. The few longitudinal agile studies in our corpus did not incorporate the (potential) change in leadership behaviour. This scarcity could be due to agile leadership being less researched than lean leadership, as there are no hierarchical layers within an agile team due to the horizontal structure (Copola Azenha et al., 2020). Considering the points mentioned above, agile studies are more focused on the team itself instead of only on the person(s) who execute the leadership tasks. While lean studies intentionally focus more on the leader instead of the team members. Therefore, a recommendation for future research is to examine the changes in team-level behaviours (especially the leader roles) of agile teams as the implementation matures.

5.3 Practical Implications

The findings of this thesis can contribute to a deeper understanding of operational excellence. By mainly incorporating empirical articles in our systematic literature review, we provided practical examples of how the two management approaches differ, overlap, or interrelate with each other. The practical implications of the results are mainly for practitioners planning on introducing agile, lean, or even a combination of both approaches. Now, they have a better understanding of these two management approaches; therefore, managers are better able to choose which approach suits their business environment.

If you as a manager want to transit to an agile or lean environment, or even from agile to lean environment (or vice versa), consider the following points. If the organisation's environment quickly changes, whereby a focus on flexibility and adaptability is essential, agile management should be considered. Bear in mind that for the implementation of the agile management approach, a horizontal organisation structure is required as within agile predefined roles are created regarding the execution of leadership tasks (depending on the size of the implementation, more teams/squads have more identified leadership roles). The agile leadership roles are seen as mentors or coaches who provide support and guidance to the team members. This potential change in organisational structure could cause resistance and friction from formal managers. Besides, when applying the Scrum framework, formal boundaries should be followed up regarding the team composition (team of three till nine people, cross-functional by default, empowered, and support self-organisation), meetings structure (sprints of 1-4 weeks with retrospectives, daily stand-ups of maximum 15 minutes, and use of Scrum boards), and role division.

When the organisation's environment is relatively stable and focuses primarily on cost- and time efficiency, lean management should be considered. By implementing lean, there will be strived for a culture of continuous improvement and eliminating waste. There is no need for a horizontal organisation structure (as with agile) as lean teams have a conventional leader. Nevertheless, bear in mind that the behaviours of this leader should be adjusted corresponding to the maturity level of implementation. When the lean implementation matures, managers should show more behaviours to maintain the relationships for effective lean besides their task-oriented behaviours. Furthermore, lean teams should support self-organisation and can make use of Kanban boards. There are no further formal restrictions to the team composition and meetings structure.

Besides, practitioners who want to transit to an agile or lean approach could base their decision on their organisation's current sector, or at least, they could be aware of the implementation's frequency. This study has shown that agile is primarily present in the IT sector (e.g., software and research & development fields) and lean mainly in the manufacturing and service sectors. However, a decision based on the sector is not evident, as agile could also be present in the manufacturing sector (see Appendix I), and lean also be in the IT sector (see Figure 3).

Lastly, this comparison gave insights into the typical behaviours within agile and lean teams. So, leaders or coaches of agile and lean teams can use this research to get to know their team members' general behaviours and the leadership style of other leaders. Furthermore, practitioners could even combine work-floor practices if they think it will benefit their business or employees.

5.4 Limitations

There are some limitations to this thesis that must be considered. One of the limitations is that we compared most of the time a methodology with a philosophy. As several agile methods and frameworks are present within the umbrella of agile, we deliberately choose the Scrum framework to illustrate the agile aspect of project management. While within lean, no specified method or framework is present regarding project management; therefore, we looked at the lean philosophy as a whole. The Scrum framework has formally seen various practical requirements and boundaries, such as the frequency and duration of meetings, team capacity, and team roles. Simultaneously, these formally or pre-defined requirements were not found within the lean approach as this a philosophy on its own. Thus, a comparison between a framework and a philosophy can be seen as a limitation of this research since this can cause a discrepancy in the appropriateness of the findings.

A further limitation of this research is that an interrater reliability check has not been followed up during the coding process. Since an inductive approach was used for the coding process, no predefined codes or themes were followed; to explore all the related topics for this thesis' aim. Nevertheless, since there was no interrater reliability check on the first and second round codes (for codes, see Appendix V), we did not exclude the possibility that other codes or themes could be present in the corpus. To minimise this possibility, a second assessor could check the used codes/themes and make additions based on the corpus where themes lacked information. This check could add value to the completeness of the paper.

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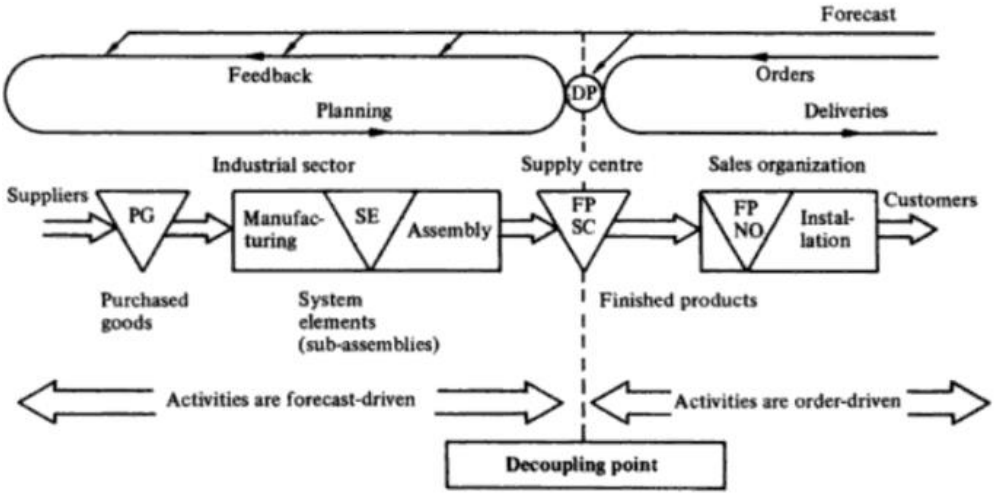
Appendix I: Leagile

Leagile or *leagility* is considered a combination of lean and agile paradigms for optimal supply chain management by positioning the decoupling point in a way that is the best suit for the response to volatile demand and the forecast/planning of demand (Mason-Jones et al., 2000; Naylor et al., 1999). The decoupling point (figure 1) separates the activities based on forecast/planning of demand and the customer orders (Hoekstra & Romme, 1992). Naylor et al. (1999) suggested that lean principles should be applied before the decoupling point (left) and agile principles after de decoupling point (right). This view is also supported by Mason-Jones et al. (2000), who establish that agility will be used downstream from the decoupling point in the supply chain, whereas leanness should be used upstream from that point. In this way, leagile facilitate cost-effectiveness in the upstream chain; and high service levels in volatile market places in the downstream chain (Bruce et al., 2004).

Nonetheless, although Van Hoek (2000) demonstrates that the leagile approach may work operationally, he argues that leagility challenge the fundamentals of lean in its focus on waste elimination/efficiency. In contrast, it does not challenge the agility concept's fundamentals because leagility assures flexibility into operations such as efficiency and rapid responsiveness. Since leagile is mainly related to the supply chain activities, a deliberate choice has been made to exclude this approach from our scope of focus for this systematic literature review.

Figure 1:

Figure 1: Decoupling point in a logistic structure (Hoekstra & Romme, 1992)



Relationship between agile and lean (need for each other)

There is a relationship between agile and lean; however, scholars debate in the literature on the relationship's direction if lean is the predecessor of agile, or vice versa (Eltawy & Gallear, 2017). Conboy (2009) showed that an underlying concept of agility is leanness, so to achieve agility within an organisation, leanness has first to be obtained. Similarly, McCullen and Towill (2001) showed that agile in the supply chain context can subsume the lean paradigm. Conversely, Papadopoulou and Ozbayrak (2005) argue that the organisation should first exhibit a high agility state to achieve a lean enterprise. Likewise, Shah and Ward (2003) show agile methods as one component of their JIT bundle of leanness. So, depending on which point of view you are looking, leanness needs, to a certain extent, agility, and vice versa.

Appendix II: 12 principles behind The Agile Manifesto

The 12 principles behind The Agile Manifesto (retrieved from https://agilemanifesto.org/principles.html):

1. Our highest priority is to satisfy the customer through early and continuous delivery of valuable software.
2. Welcome changing requirements, even late in development. Agile processes harness change for the customer's competitive advantage.
3. Deliver working software frequently, from a couple of weeks to a couple of months, with a preference to the shorter timescale.
4. Business people and developers work together daily throughout the project.
5. Build projects around motivated individuals. Give them the environment and support they need, and trust them to get the job done.
6. The most efficient and effective method of conveying information to and within a development team is face-to-face conversation.
7. Working software is the primary measure of progress.
8. Agile processes promote sustainable development. The sponsors, developers and users should be able to maintain a constant pace indefinitely.
9. Continuous attention to technical excellence and good design enhances agility.
10. Simplicity—the art of maximizing the amount of work not done—is essential.
11. The best architectures, requirements and designs emerge from self-organizing teams.
12. At regular intervals, the team reflects on how to become more effective, then tunes and adjusts its behaviour

Appendix III: How to conduct a Systematic Literature Review

Table 1 Five-stage grounded-theory method for reviewing the literature in an area: to be used in an iterative fashion

Number	*Task*
1. DEFINE	
1.1	Define the criteria for inclusion/exclusion
1.2	Identify the fields of research
1.3	Determine the appropriate sources
1.4	Decide on the specific search terms
2. SEARCH	
2.1	Search
3. SELECT	
3.1	Refine the sample
4. ANALYZE	
4.1	Open coding
4.2	Axial coding
4.3	Selective coding
5. PRESENT	
5.1	Represent and structure the content
5.2	Structure the article

1. **Define:**
   1.1. This first task involves marking out the scope of the review as well as inclusion and exclusion criteria (Step 1.1 of Table 1). This also includes additional sampling criteria at work that are not related to the substantive content of the research (other database, other year, etc.).
      1.1.1. Later on, the initial inclusion criteria of the review may need to be relaxed or further limited (revisited). By keeping a logbook, every 'important' decision can be seen and reported for explaining your change in early decisions.
   1.2. Ideally, the chosen fields must contain the most relevant texts on the topic, and if one were to redo the same sampling task again, the same results should surface.
   1.3. Based on the filtering power of the inclusion and exclusion criteria and the research field(s) involved, a list needs to be compiled of all probable corresponding outlets. (Scopus / Web of Science)
   1.4. With a wildcard token, every word that starts with 'recruit' can be searched using the search term 'recruit*'. To effectively and honestly show the reader how the search was conducted, all the used search terms must be listed in the review article.
2. **Search**
   2.1. Searching through the databases can be time-consuming. It may become apparent that some essential synonyms of search terms were originally missing or that the scope was not sufficiently comprehensively set during the first stage. This means some steps of the Define stage need to be revisited before moving to the next stage. Thus, this situation routinely involves iteration, that is, refinements or adjustments in one of the steps of Stage 1.

3. **Select**

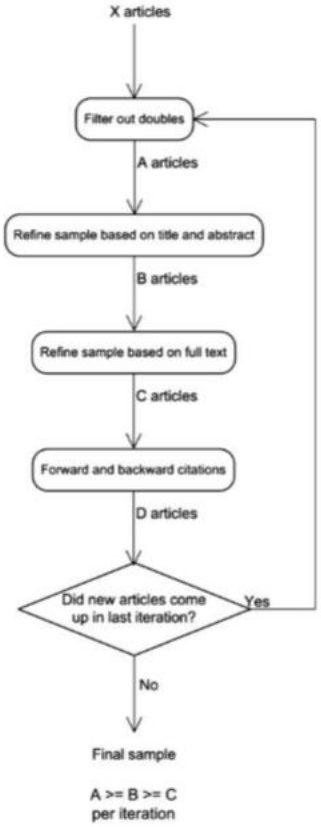


Figure 1 Select stage in reviewing the literature in an area.

Table 2 Example of one individual reviewer's selection

Year	*Author(s)*	*Title*	*Journal*	*Reason(s) for its selection*
1999	X	K	A	...
2000	Y	L	B	...
2001	Z	M	C	...

4. **Analyse**
   4.1. We propose to start analysing each set of papers as follows: pick a random paper and read and highlight any findings and insights in the text that seem relevant to the review's scope and research question(s). All of the selected studies will eventually undergo this highlighting procedure at least once. Every word, sentence or paragraph that is highlighted in each paper represents a relevant 'excerpt'. Give every highlighted item an open code. Use a logbook to know where you at and what you have done, which makes it easy for revising the codes (because it is an iterative process)
   4.2. Axial coding: looking for interrelations between categories and their sub-categories.
   4.3. Selective coding (Step 4.3 of Table 1) is used to integrate and refine the categories that were identified

Table 3 Basic concept matrix for literature-reviewing

Article	*Concepts*		
	X	*Y*	*Z*
A	√	√	√
B	√	√	

Table 4 Advanced concept matrix for literature-reviewing

Article	*Concepts*		
	W	*XY*	*Z*
A		√	√
B		√	
C	√	√	

5. **Present**
   5.1. Representing and structuring the knowledge of an area's content (Step 5.1 of Table 1) must first of all be based on set(s) of empirical findings and the associated insights captured in the

log-and codebooks. It may well be that certain earlier noted insights or even empirical facts only become more relevant at the end of the analytical process when the accumulated knowledge, including theoretical points and progress, needs to be shown in a somewhat integrated fashion

5.2. The structure of a review paper (Step 5.2 of Table 1) may be organised similarly to empirical accounts. An Introduction section should briefly state the scope, how and why the topic was approached by the reviewer, the problem addressed in the review and present one or more specific review questions (Creswell, 2008). The beginning of the paper needs to yield the substantive rationale for the review, including why this type of literature review is relevant to the world and particular groups of potential readers; it should also offer insights on the definitions of the key terms. There of course ought to be a methodological section. In each main section of a literature review paper, the specific findings are elaborately discussed, and future research directions could be suggested. The article ends with a discussion and/or conclusion, containing implications, not only for new research options but also possibly for new practices. The discussion section should bring surprising findings to the fore and show the benefits of using Grounded Theory for explicating interconnections of emerging concepts. The last section also includes the review's limitations and the unavoidable biases that may have occurred in one or more steps of the entire process. The paper would need to be explicit also about the development of theory in the chosen area and how other theory, ideas or other fields might be of substantive relevance to the reviewed area.

Appendix IV: Article inclusion and exclusion

Inclusion article criteria:

- **Articles mentioning various *aspects / principles / practices* of agile and lean and elaborate on this in more detail, or talk about agile and lean as management approaches (in general sense)**
  (related to the first part of research question)

As this literature review stresses the difference between agile and lean, it is helpful to gain knowledge about almost every aspect, or at least the most used/applied principles or practices. Therefore, articles mentioning different facets of the paradigms are included (mostly theory articles or empirical papers specified on several practices / principles / teams).

- **Empirical articles focussing on *behaviours / interactions / leadership / relations* within agile or lean teams**
  (related to the last part research question)

To gain new insights and knowledge on the behaviours that take place on team-level

Exclusion article criteria:

- **Articles related to the effect of agile and/or lean on X**

A lot of articles are empirical articles researching the effect of lean practices on X (banking/hotel/healthcare/educational/construction) sectors. Those articles explain probably in their introduction / theory section something about agile or lean principles. But I think we should exclude those empirical/case studies because they only research the effect of lean/agile on X and not explain in-depth specifically the practices and principles of agile and lean as management approaches.

- **Articles focussing only on one *aspect / principle / practice* of agile and lean**

Many articles explain/research only one aspect or a part of agile and lean (TQM, 5S, VSM, etc.), therefore, it is difficult to make a deliberate decision when to include an article and when not (I can include almost every article). So, articles only focussing on one aspect of management approaches are excluded.

- **Articles only focussing on manufacturing or supply chain processes, without taking any management aspects into account.**

Most articles focus on the supply chain processes of agile, lean, leagile, or even LARG (lean, agile, resilience and green). Whereas my literature review will focus on the (project) management aspect, so more the way of working in general and how to tackle/manage those tasks in departments or projects. It is therefore necessary "to compare apples with apples, and not apples with pears", so there must be alignment in the context of documents. Otherwise, I probably compare agile project management with lean manufacturing processes. The thoughts and red line between lean manufacturing and lean management are the same (optimizing results), but there are some differences:

  - Manufacturing: tangible, eliminating waste, focussed on efficiency, big data, streamlined supply chain, optimised production,
  - Management: more in-tangible objectives, long-term approach, continuous improvement, staff/people, quality

- **Articles related to Lean Six Sigma (LSS)**

Several articles combine *lean* and *Six Sigma*, but these two approaches are different of each other and in my literature review the focus is on lean management and not the process optimalization by reducing

the error or defect in a manufacturing process (Six Sigma), or the combination of lean and Six Sigma (Lean Six Sigma). So, articles related to LSS are be excluded.

Appendix V: Coding scheme

This table presents an overview of the codes that were used. The second code reflects the themes that were used to write the findings section.

	First code	Second code	Reason
Principles			
	Cost	Cost vs. Service	
	Value		
	Customer/ Service		
	Continuous improvement	Continuous flow/improvements	
	Flow		
	Agile management	→	These codes have been used to gain a general knowledge of the topic. Besides, the related information is intertwined within the other two sections.
	Lean management		
	People (training, focus)	x	This code had not sufficient coverage in the corpus for writing a section.
	Environment/ Atmosphere	x	This code had not sufficient coverage in the corpus for writing a section.
Work-Floor Practices			
	Teams	Team composition	
	Self-organisation		

	Meetings	Meetings	
	Planning		
	Kanban	Visual management	
	Scrum		
	Innovation	Innovation, improvement, and problem-solving	
	Improvement		
	Problem-solving		
	eXtreme Programming	→	These codes only relevant to one of the management approaches; therefore, these codes are excluded.
	Value stream mapping		
	Gemba (walks)		
	Just-in-time		
Team-Level Behaviours			
Leadership style and behaviours	Coaching	Agile leadership/ Lean leadership	
	Improving		
	Leadership-style		

Team behaviours	Empowering	Empowering	
	Helping	Psychological safety and helping	
	Communicating	Communicating	
	Workers commitment	x	This code had not sufficient coverage in the corpus for writing a section.
	Learning	x	This code had not sufficient coverage in the corpus for writing a section.