Lean and Employee Well-being

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28/10/2019

Abstract

This mixed-method study researches the relationships between Perceived Lean Adoption and Employee wellbeing and Job Performance. A positive relationship, mediated by Relational Coordination (Gittell & Waltham, 2011) and moderated by effective Leadership Behaviour (Van Dun, Hicks, & Wilderom, 2017) was predicted. Study 1, video observation of lean teams performing week and day start events, focussing on the leader's display of supportive behaviours. Study 2, questionnaires distributed among operational team members assessed: *Perceived Lean Adoption*, *Relational Coordination*, *Leadership Behaviour* of their team leader, *Employee Well-being* and *Job Performance*. We have utilised three main hypotheses: direct relations; independent and dependent, mediating variables and direct and moderating relationships of Leadership Behaviours. Study 3, team leaders and team members were interviewed using the critical incidence technique (CIT) (Flanagan, 1954). We found behavioural determinants of actors in good and bad lean practices. Study 1 showed observed behaviours to be *Relationship-Oriented Leadership*. Study 2 found a significant positive correlation between *Perceived Lean Adoption* and *Relational Coordination* (shared communication dimension; t=2.94, p=.003, shared relationships dimension of *Relational Coordination* (t=1.99, p=.047). Moreover, *Perceived Lean Adoption* and *Task- and Relation-Oriented Leadership Behaviour* show a significant positive relations (t=3.26, p=.001; t=2.32, p=.021). The data do not support all other posed assumptions and paths. Furthermore, no moderation effect was found. Study 3 found the underlying determinants of employee behaviour in good and bad lean practices.

Keywords: Lean Management, Employee Well-being, Leadership Behaviour, Health, Psychology.

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1. Introduction

Moving towards a leaner way of working is an essential strategy for various companies to get an edge over their rivals in the increasingly competitive global markets (Minh, Zailani, Iranmanesh, & Heidari, 2018; Srinivasa Rao & Niraj, 2016). Lean emphasises continuous (work) process improvement to maximise customer value while minimising waste (Teich & Faddoul, 2013).

Originating from the Japanese car manufacturing strategy known as the Toyota Production System (TPS) (Cusumano, 1988; Krafcik, 1988a; Monden, 2011), the significant paradigm shift know as lean production (Krafcik, 1988b) led to an increase in both quality and Job Performance. In the early '80s, MIT's International Motor Vehicle Program launched, and lean got introduced to the West(Fujimoto, 1999; Womack, Jones, & Roos, 1990). Practices associated with lean then began to spread across the supply chain (Buonamico, Muller, & Camargo, 2017; Lemieux, Lamouri, Pellerin, & Simon, 2012; Martinez Sànchez & Pérez Pérez, 2001) and have set a revolutionising example of transforming various organisations in public- and private sector. From software development to the service industries; such as financial services, healthcare, education and retail (Dobrzykowski, Mcfadden, & Vonderembse, 2016; Hadid & Afshin Mansouri, 2014; Reijula, Nevala, Lahtinen, Ruohomäki, & Reijula, 2014; Zhu, Johnson, & Sarkis, 2018). Lean practices seem to create a solution to increased work output, or as Womack et al. (1990) describe that successfully adopting lean, companies could use half the human effort, manufacturing space, investment in tools, engineering hours, to reach the same output.

Despite being used for the past decades little is known about the possible effects that lean practices may have on working conditions of frontline employees (Huo & Boxall, 2018b) and managers (Håkansson, Holden, Eriksson, & Dellve, 2017), especially the subject of well-being was not engaged as extensively as other aspects of lean (Huo & Boxall, 2017). While the first, system-driven pillar of lean and TPS, JIT (i.e., the right parts needed for assembly reach the assembly line at the time they are needed and only in the amount needed (Genaidy & Karwowski, 2003), has been studied extensively by researchers, namely; innovative operations and organisation management concepts, the second part of Toyota's motto: "We do not just build cars, we build people", autonomation or automation with human touch, has not nearly received as much consideration by many (Genaidy & Karwowski, 2003; Koenigsaecker & Taha, 2012).

The importance of human experience is starting to become more apparent as Well-being is decreasing in our working forces. The number of burn-out related cases in society are

annually more than over 15 % in the entire Dutch working population (Cbs, 2018). Researchers suggested that lean adoption can either have a *positive* impact on employees' psychological and physical health (Conti, Angelis, Cooper, Faragher, & Gill, 2006; Cullinane, Bosak, Flood, & Demerouti, 2014; Longoni, Pagell, Johnston, & Veltri, 2013a; Losonci, Demeter, & Jenei, 2011; Seppälä & Klemola, 2004; Shadur, Rodwell, & Bamber, 1995; Toralla, Falzon, & Morais, 2012), a *negative* impact (Bouville & Alis, 2014; Genaidy & Karwowski, 2003; Hasle, 2014b; Lindsay et al., 2014; Mathew & Jones, 2013; Parker, 2003; Robinson, Radnor, Burgess, & Worthington, 2012) or an *indeterminate* impact (Carter et al., 2011; Distelhorst, Hainmueller, & Locke, 2016; Landsbergis, Cahill, & Schnall, 1999; Mehri, 2006; Stewart et al., 2009). The large variety of these findings can be a result of the various types of definitions, interpretations and implementations of lean in these studies (Magnani, Carbone, & Moatti, 2019). If lean practices are inadequately understood or not wholly integrated by professionals applying its philosophy, its application can result in "lean-type approaches" (Lindsay et al., 2014). Similarly, short-term, profit-maximising strategies show to depreciate human assets and create merely the illusion of empowerment, as they are utterly contradictory to the essence of the lean philosophy (Bhasin & Burcher, 2006; Jones, Latham, & Betta, 2013).

Accounting for these underlying human factors seems to be an essential component of why so many lean practices diverge and result in lean-look-a-likes and others succeed (Achanga, Shehab, Roy, & Nelder, 2006). Reverse-engineering the important constructs underlying the "good", also known as "successfully implemented" lean practices, we find employee relationships and interpersonal communication, and Leadership Behaviour crucial.

Shared relationships and shared interpersonal communication among employees have shown to have a positive relationship with lean and Job performance (Marin-Garcia & Bonavia, 2015). The critical role of communication has also been recognised by Cassell, Worley, and Doolen (2006), as much in the adoption as in the process of working with lean. Researchers Gittell and Douglass (2012) describe the importance of these constructs in their Relation Coordination theory, which poses that employee effectiveness bases itself on both the dimensions of *relation and communication;* availability of shared goals, shared knowledge and mutual respect, and communicating frequent, timely, accurate and problem-solving. For the sake of comprehensibility in this thesis, we will, from here on out, unless we consider one dimension individually, refer to these two dimensions as the *Relational Coordination.*

Leadership Behaviour can stimulate both shared relationship and shared communication in work processes. Furthermore among several other critical factors, leadership plays a crucial role in the succeeding of the adoption and implementation of lean practices (Achanga et al.,

2006; Camuffo & Gerli, 2018a; Van Dun et al., 2017). Huo and Boxall (2018a) even suggest that the overall impact, of the production of a company using lean practices, on worker well-being is likely to depend on the ways in which managers engage employees in involvement in decision-making, target resources to the specific job demands, and adjust resource levels to the degree of these demands. Moreover, Håkansson et al. (2017) write that managerial practices should actively support necessary job resources as an integral part of lean, supporting sustainable working conditions. These findings suggest that by empowering employees, leaders can stimulate an environment where relational aspects are enhanced, and interpersonal communication plays an essential role in the everyday work process. Wullbrandt and Downing (2016) go even a step further and consider it to be a vital element in the complex stress-employee construct.

In summation, from these previous findings a suspected relationship arises between *Lean Practice Adoption* and the *Relational Coordination*. In turn, the *Relational Coordination* is likely to play a mediating role between *Lean Practice Adoption* and *Employee Well-being*. Moreover, leadership plays a vital role in the implementation and suggests it has two possible positively supporting effects. Firstly, a direct impact on the manifestation of *Relational Coordination* in itself, and secondly a moderating effect on the relation lean has on the *Relational Coordination*. However, the current body of knowledge is yet to provide us with concrete evidence of these suspected specific relations.

Therefore, this study assesses the nature of these relations, and it influences through a mixed-method approach the researchers to seek the answer to the following question:
"What is the relation between Lean Practice Adoption, Employee Well-being and Job Performance, and how do Leadership Behaviour and Relational Coordination moderate and mediate this relationship?"

2. Theoretical Framework

2.1 Perceived Lean Adoption, Employee Well-being and Job Performance

The adoption of lean requires a change in the management of workers and job design (Tortorella, Vergara, & Ferreira, 2017). Upon implementing traditional lean models of mass production and Tayloristic organisation of the company needs to shift to new models, with an emphasis on work systems and management practices (Longoni, Pagell, Johnston, & Veltri, 2013b). It is essential to assess the level of adoption of lean management within a company to be sure that faulty or incomplete interpretation of the lean theory taints the outcome of its practices. The incorrect or defective implementation of lean can be detrimental for the optimisation process. One can, therefore, argue that the positive health benefits reported, although seen in several reports, can remain absent in other. As there is room for interpretation and theorists are not unanimous on an absolute definition of lean, it can be found challenging to compare results from previous studies. Shah and Ward (2007) even describe that any discussion of lean production with managers, consultants, or academics specialising in the topic points to an absence of a standard definition of the concept.

Therefore, this study uses the definition of lean as described and operationalised by Shah and Ward (2007) as it is true to the content and objectives of its historical roots in TPS. The ten factors they describe constitute the operational complement to the philosophy of lean production and characterise ten distinct dimensions of a lean system. They are: *firstly*, the *supplier feedback*; provide regular feedback to suppliers about their performance, *secondly*, *JIT delivery by suppliers*; it ensures that suppliers deliver the right quantity at the right time in the right place, *thirdly*, the *supplier development*; when you seek to develop suppliers, they can be more involved in the production process of the focal firm, fourthly, the *customer involvement*; the focus on a firm's customers and their needs, *fifthly*, the *pull*; the facilitation of JIT production including Kanban cards (scheduling devises that authorize a production line to produce more units) which serves as a signal to start or stop production, *sixthly*, the *continuous flow*; establishing mechanisms that enable and ease the continuous flow of products, *seventhly*, set up of time reduction; reduce process downtime between product changeovers, *eighthly*, total productive/preventive maintenance: address equipment downtime through total productive maintenance and thus achieve a high level of equipment availability, *ninthly*, statistical process control; ensure each process will supply defect free units to subsequent process and *tenthly* and finally employee involvement; the employees' role in problem-solving, and their cross functional character. The application of these principles ensures an organisation of adequate lean practices. We expect that the level of completeness of the lean practices, also called

maturity, positively affects the work process and therefore, the work output, also known as *Job Performance.* Many of our forbearers conclude this in prior studies (Genaidy & Karwowski, 2003).

In this study, the circumplex model of affect (Russell, 1980) is being used as a theoretical framework to distinguish specific types of work-related subjective well-being, including work engagement, job satisfaction, happiness at work, workaholism, and burnout. For the sake of applying a questionnaire suitable for the context of the study, we have replaced the burnout construct with that of work pressure due to the similarity of the construct. The phrasing of the items of the burnout scale found inappropriate for this studies context and might have had an impact on the overall compliance of the questionnaire, due to its emotionally prying mater. Additionally, we assess *Job performance* to measure the effect of the lean context, on the employees in its entirety.

Employee Well-being, as described by Bakker & Oerlemans (2011), can be seen as people's evaluation of life. *Employee Well-being* consists out of the conscious evaluation about ones satisfaction of life as a whole, and the frequency and duration of occurring pleasant or unpleasant emotions, not as much the intensity of these emotions (Diener, Sandvik, & Pavot, 2009; Diener, Sandvik, Pavot, & Gallagher, 1991). In (Russell, 1980, 2003) the model of circumplex, he provides a two-dimensional view with the four quadrants. Firstly, assessing workaholism, divined as spending an excessive out of a proportional amount of effort or hours of work. Secondly, work engagement, the amount of pleasure work brings. Thirdly, job satisfaction, the level of being content with ones working activities. The final and fourth quadrant is burnout, being the state of being in which a person feels overwhelmed and overloaded by the perceived work-related activities. Some previous research shows that increased employee well-being can be a predictor for increased job performance and vice versa (Judge, Erez, & Bono, 1998; Wright, Cropanzano, & Bonett, 2007). As research of Wright and Cropanzano (2000) point out that psychological safety plays a significant role in work performance we feel adding this proposed relation to this current investigation goes beyond the span of our present study. In this study, we will use job performance as a dependent variable.

As lean maturity increases and is being implemented with clear structure (Bäckstrand, Bergman, Högberg, & Moestam, 2013) we can assume that the more mature lean practices are the higher the perceived well-being will be. The following hypotheses therefore arise:

Hypothesis 1a. The Perceived Adoption of Lean Practices relates positively to Employee Well-being.

Hypothesis 1b. The Perceived Adoption of Lean Practices relates positively to Job Performance.

2.3 Relational Coordination Mediating Lean Practices Adoption and Employee Well-being and Job Performance

Previous studies Relational Coordination can have a severe impact on Job Performance (Gittell, 2011). Such an underlying link could suggest it is imperative to our theoretical model. In this study, the theory of Relational Coordination (Gittell & Douglass, 2012) is being used to asses and map the strength of the relational and communication ties among participants in a work process. The theory describes a work process as a set of interdependent tasks that transforms inputs into outcomes of value to the organisation.

The theory identifies three distinctive dimensions of relationships; shared goals, shared knowledge and mutual respect, that together underlie the effective coordination of work. These dimensions are conceived as existing between work roles rather than between individual participants. The theory explains how relational forms of coordination influence quality and efficiency outcomes, and how this influence is weaker or stronger depending upon the nature of the work. Moreover, the theory explains how formal organisational structures can be designed to support relational forms of coordination, rather than suggesting that formal structures are necessarily substitutes or impediments to *Relational Coordination* (Gittell, 2011).

Coordination often occurs through coordinating mechanisms such as supervision, routines, scheduling, pre-planning or standardisation (Kogut & Zander, 1996). These coordinating mechanisms can enable organizations to achieve Coordination with little direct interaction among participants, yet are limited due to information processing capacity and are only expected to be effective in settings with low levels of task interdependence and uncertainty (Argote, 1982; Tushman & Nadler, 1978; Van De Ven, Delbecq, & Koenig Jr, 1976);

However, in lean contexts, especially, work is being characterized by higher levels of interdependence and uncertainty. Therefore, the relevance of mutual adjustment has been expanding. This brings forth the importance of frequent, timely, accurate and problem-solving communication, the communication dimensions of relational Coordination, as this supports the relationships of shared goals, shared knowledge and mutual respect and vice versa (Gittell, 2011).

Hypothesis 1c. The Perceived Adoption Lean Practices positively relates to a score of Relational Coordination (Both the Relation and Communication dimension).

The *Relational Coordination* theory is developed and tested in the context of air travel (Gittell, 2001; 2003), surgical care (Gittell, Fairfield, et al, 2000; Gittell, 2002b; Gittell, 2009), medical care (Gittell, Weinberg, Bennett and Miller, 2008), long term care (Gittell, Weinberg, Pfefferle and Bishop, 2008), care across the continuum (Weinberg, Lusenhop, Gittell and Kautz, 2007) and the criminal justice system (Bond and Gittell, 2010), relational Coordination theory is expected to generalize to work processes in which multiple providers are engaged in carrying out highly interdependent tasks under conditions of uncertainty and time constraints (Gittell, 2011). "Furthermore, high scores of relational Coordination is being seen a mediator […] of performance effects"(Gittell, 2002). This brings about the hypotheses that:

Hypothesis 2a. Relational Coordination relates positively to Employee Well-being.

Hypothesis 2b. Relational Coordination relates positively to Job Performance.

2.2 The Direct and Moderating Role of Leadership Behaviour

This study is focussed team leader behaviour on an operational level within organisations. In their 2017 study, Tortorella and Fogliatto (2017) found that general managers that adopt lean prefer to show supporting types of behaviours. This increases in the later stages of lean adoption. Moreover, research by (Van Dun et al., 2017) found that the active lean middle managers […], compared to other middle managers, engage significantly more in positive relations-oriented "active listening" and "agreeing" behaviours, and significantly less in "task monitoring" and counterproductive work behaviours (such as "providing negative feedback" and "defending one's own position"). We assume that *The Perceived Adoption Lean Practices* positively influences *Relations-oriented leadership behaviour.* As the maturity of the *Perceived Adoption Lean Practices* increase, the,,y will have a direct positive effect on *Relations-oriented leadership.* To minimize the number of hypotheses in this study we have generalised the hypothesis to fit the integrity of the model compared to the sample size used. However, we will test and discuss the all separate leaderships styles to be thorough.

Hypothesis 3a. Perceived Adoption Lean Practices has a positive relationship with the Leadership Behaviours (Task-, Relations-, Change-oriented).

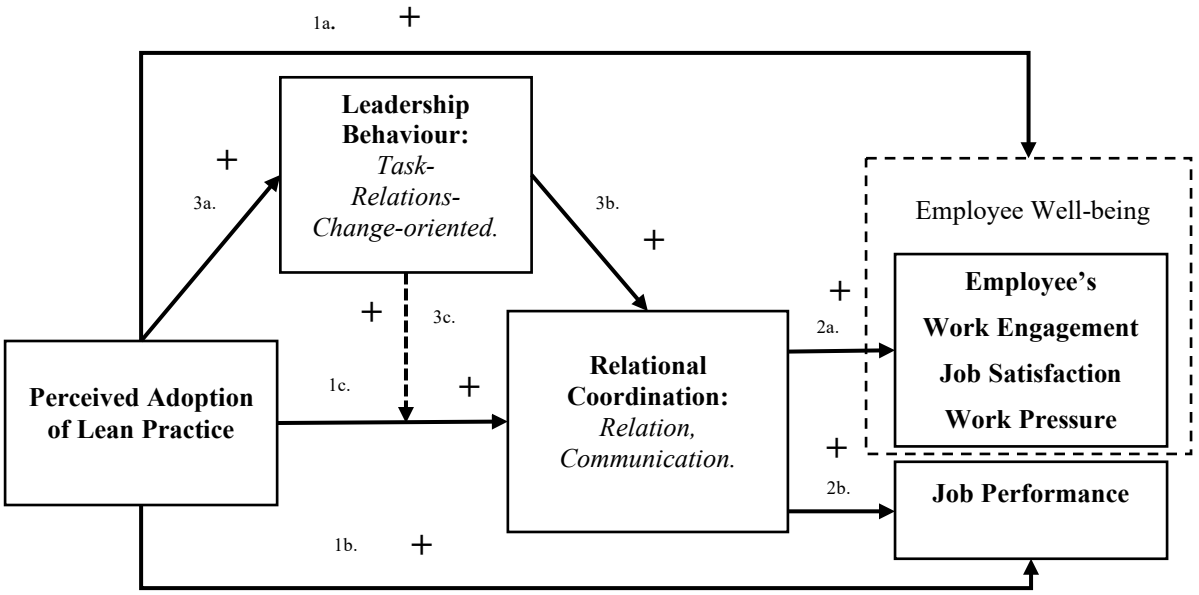
Hypothesis 3b. Leadership Behaviours (Task-, Relations-, Change-oriented) have positive relations with the Relational Coordination among team members.

It can be suggested that team leaders scoring higher on these relation-oriented behaviours yield teams with higher output on the same behaviours. Thus stimulating the beforementioned shared goals, shared knowledge and mutual respect is seen by (Gittell, 2011). It stands to reason that relation-orientated behaviours alone will not suffice for significant differences in output and therefore we include frequent, timely, accurate and problem-solving communication, the communication dimensions of relational Coordination, upon which also that *Relations-oriented Leadership Behaviour* will have a positive effect. From these findings, the following hypothesis has been drafted:

> *Hypothesis 3c. Leadership Behaviour(s) (Task-, Relations-, Change-oriented) will have a positive moderating effect on the relationship between Lean Practices and Relational Coordination.*

Several authors have suggested comprehensive taxonomies of successful leadership behaviour perceptions, focussed on integrating the plethora of different leadership behaviour styles (Derue, Nahrgang, Wellman, & Humphrey, 2011; Yukl, 2012). In this current study, we use three out of four behavioural meta-categories comprised by 12 component behaviours (see Appendix B) out of the Yukl's (2012) taxonomy, which is based on an extensive literature review. Every behaviour is specified with excessive behavioural descriptions based on seven to seventeen empirical studies, ranging from diary studies to laboratory and field experiments. Most of the studies are based on data from independent sources for behaviour perception and leadership success to ensure high internal validity.

The four behavioural meta-categories integrate all behavioural concepts of the previously discussed leadership models: task-oriented leadership behaviour (integrates initiating structure behaviours), relations-oriented leadership behaviour (integrates empowering and several transformational behaviours), change-oriented leadership behaviour (integrates the remaining transformational behaviours), and external leadership behaviours (integrates boundary-spanning behaviours). We explicitly exclude external leadership behaviours as networking, external monitoring and representing. Although interesting, this behaviour is not directly applicable to the context of this current research or to the constructs of the conceptual model which focusses on processes of internal leadership.



Hypothesis 1a. = *Perceived Adoption of Lean Practice – Employee Well-being.*
Hypothesis 1b. = *Perceived Adoption of Lean Practice – Job Performance.*
Hypothesis 1c. = *Perceived Adoption of Lean Practice – Relational Correlation.*
Hypothesis 2a. = *Relational Correlation – Employee Well-being.*
Hypothesis 2b. = *Relational Correlation – Job Performance.*
Hypothesis 3a. = *Perceived Adoption of Lean practice –Leadership Behaviour(s).*
Hypothesis 3b. = *Leadership Behaviour(s) – Relational Correlation.*
Hypothesis 3c. = *(Moderating Effect) Leadership Behaviour(s)- Relationship Lean practices and Relational Coordination.*

Figure 1. Schematic overview conceptual model

In summary, this study aims with its theoretical and practical contributions, to be of value to the body of science in the field of both business administration and health psychology. We will answer the beforementioned research question by a multitude of three studies.

In the first study, we will observe and capture lean teams performing either week or day start events; we focus on the leader's display of supportive behaviours namely those that characterise as task- relations- or change-oriented behaviours. Van Dun et al. (2017) refer to these a specific set of positive, relations-oriented behaviours at work as fundamental to effective lean leadership. In this study, we will answer the question: "*Which team leaders display effective lean leadership behaviour?"*

In the second study, questionnaires have been distributed among operational team members to assess the *Perceived Lean Adoption*, the *Relational Coordination*, the *Leadership Behaviour* of their team leader, the *Employee Well-being* and their *Job Performance*. This study allows us to test our conceptual model of constructs, which we will present in the next chapter. In this study, we will answer the question: *"What are the relationships between the constructs: Perceived Lean Adoption, Relational Coordination, Leadership Behaviour, Employee Well-being and Job Performance?"* We define the answer to this question utilising the hypotheses

previously described in this chapter. The hypotheses are categorised for the feasibility and comprehensiveness of the thesis.

Hypotheses category 1; will be about direct relations regarding and independent and dependent variables (*Perceived Adoption of Lean Practices, Employee Well-being,* and *Relational Coordination*).

- *Hypothesis 1a.* The Perceived Adoption of Lean Practices relates positively to Employee Well-being.
- *Hypothesis 1b.* The Perceived Adoption of Lean Practices relates positively to Job Performance.
- *Hypothesis 1c.* The Perceived Adoption Lean Practices positively relates to a score of Relational Coordination (Both the Relation and Communication dimension).

Hypotheses category 2; will be about mediating relations *(Relational Coordination and Employee Well-being, and Relational Coordination).*

- *Hypothesis 2a.* Relational Coordination relates positively to employee well-being.
- *Hypothesis 2b.* Relational Coordination relates positively to job performance.

Hypotheses category 3; will be about direct and moderating relationships of Leadership Behaviours. *(Perceived Adoption Lean Practices and Leadership Behaviours, Leadership Behaviours and Relational Coordination, moderation on Lean, Relational Coordination Relationship.)*

- *Hypothesis 3a.* Perceived Adoption Lean Practices has a positive relationship with the Leadership Behaviours (Task-, Relations-, Change-oriented).
- *Hypothesis 3b.* Leadership Behaviours (Task-, Relations-, Change-oriented) have positive relations with the Relational Coordination among team members.
- *Hypothesis 3c.* Leadership Behaviour(s) (Task-, Relations-, Change-oriented) will have a positive moderating effect on the Relationship between Lean practices and Relational Coordination.

In the third and final study, the team leaders and team members were interviewed using the critical incidence technique as described by Flanagan (1954). Here we gained further insights into the behavioural determinants of actors in good and bad lean practices. In this study, we will answer the question: *"How do good and bad lean practices differ in Employee Well-being?"* We define the answer to this question using the three themes: *Perceived Lean Adoption, Relational Coordination, and Leadership Behaviour.* The collection of these three studies will give us a holistic overview of the behaviours of the actors involved and perceptions

within the companies. These insights will provide us with invaluable recommendations for future research and the implementation of lean practices.

3. Research Design

This cross-sectional field study used two-day visits, including a mixed-methods approach to study the leaders and members of teams that adopted lean practices. A mixed-method approach has been chosen as the state of prior theory and research is that of a mature nature. Both quantitative and qualitative data are being used, therefore the methodological fits as described by Edmondson and Mcmanus (2007). For the sake of clarity and conciseness, we will divide the methodology into the following four segments:

- *Study 1*; an observation of weekly occurring lean events and meetings, in which the behavioural patterns and leadership styles of the team leaders have been analysed.
- *Study 2*; consisting of team leader and team member surveys, measuring the constructs of Perceived Lean Adoption, Relational Coordination, Leadership behaviour, Employee-well-being and Job performance.
- *Study 3*, by use of the critical incidence interview method, we measured the employee and team leaders experience with a significant lean (continuous improvement) interventions in the past year to determine behavioural determinants of good and bad lean practices.

3.1 Sampling

For this study, two separate sampling strategies have been used. Firstly, at the onset of the sampling process, a list of potential lean organisations has been constructed. The list of 185 organisations has been constructed based on organisations that have shown interest, or willingness to partake in previous lean studies by Dr. van Dun. Initially, 33 organisations responded positively, 2 responded dismissively, and 100 organisations abstained. Additionally, an invitational flyer has been distributed via LinkedIn shown in Appendix D. Then, 33 organisations were contacted for an intake call appointment. After expressing interest collaboration on this study, ten spokespersons stated willingness to share their lean documents and let researchers on-site for two full days of data collection. During the intake by telephone, the participating companies background has been thoroughly reviewed. Here attention has been paid to the composition of the observed teams, the tasks of the operational teams, the history the company has with lean management and any other official documents regarding the matter of lean. At the end of these scheduled calls, an appointment has been planned for the on-site visitation dates and conformation of consent have been sent per email. The entire sample

consists of 13 organisations, yielding seven teams with a mean of 10 participants. Inclusion criteria for this study were that the participants had to be part of a team that had at least one year of work working experience with lean or continuous improvement practices. The employee has been actively working with lean practices for at least six months before the study. This left us with a sample size of N=7 for study 1, N=74 for study 2 and N=12.

Table 1

Overview Checklist Onsite Visitation Planning

Segment	Day 1	Day 2
Morning	• Meet the team leader & team. • Check whether all employees have completed the questionnaires. • Employee 1 introduces us to operational process.	• We are attending and filming "the Day start" or other weekly team meetings. • Walk along with a team member/team leader. • Interviews.
Afternoon	• Employee 2 introduces us to the operational process. • Work with the team or walk around with a team member/team leader. • Starting, one on one, critical incidence interviews.	• We are working with the team. • Walk along with a team member/team leader. • We give feedback and first impressions to team leader.

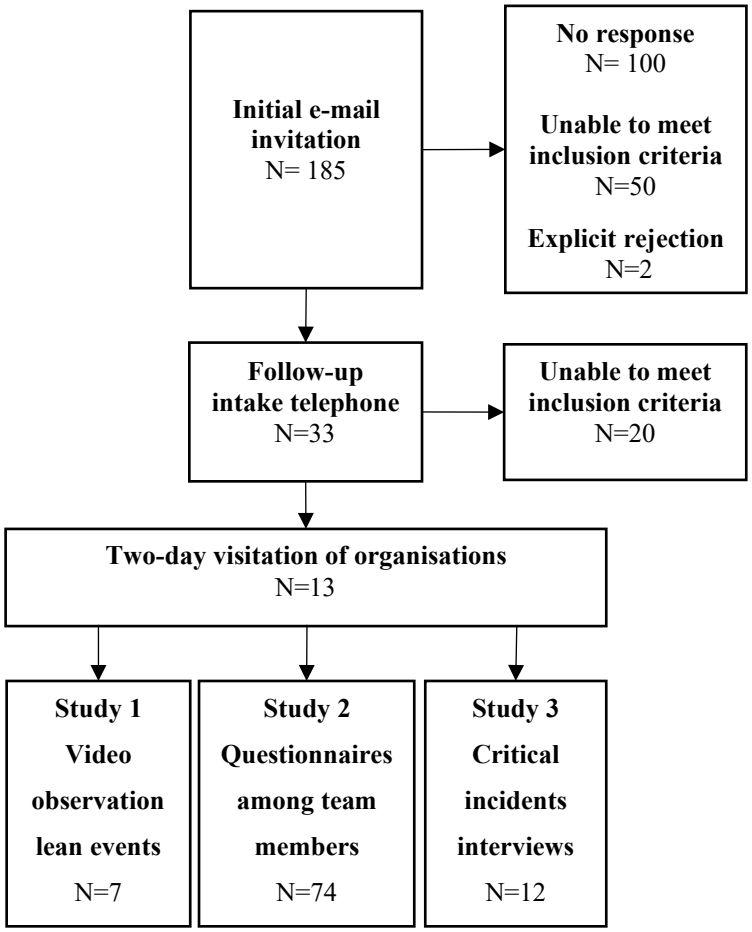


Figure 2. Overview research design. This figure illustrates the stages of acquiring and visitation of the partaking organisations.

4. Study 1: Video Observation Lean Events

4.1 Method

As stated by Van Dun et al. (2017) is that video observation is a method whereby multiple raters code the fine-grained behaviours of managers. Moreover, this suggestion gets support from Bardi & Schwartz, 2003; Liu & Maitlis, 2014; Luff & Heath, 2012; Smith, Phail, & Pickens, 1975. During the visits on-site, both researchers recorded and documented the lean events via two wide-angled video cameras. After which they had several of the attendees filled out a three-item post-video questionnaire regarding the representability of the meeting in contrast to regular non-measured meetings. The meeting contained regular meetings where the team managers met their subordinates (Allen & Rogelberg, 2013; Vie, 2010) The team leader has been scored on the amount of shown behaviours corresponding with either task-, relations or change-oriented leadership behaviour. As previously stated, we derived from the findings Van Dun et al. (2017), that the expected behaviours of lean leader, which should be present upon mature implementation of lean within an organisation, will predominantly be relation-orientated leadership behaviour. Then, the employees were scored on the shown traits of shared goals, shared knowledge and mutual respect. This observational study's goal was to analyse the behavioural patrons of the team leaders. The outcomes of the observed behaviours are being compared to the results from study 2, which have been measured utilising study 2's questionnaire. In this study, the following question was answered: "*Which team leaders display effective lean leadership behaviour?"*

4.1.1 Sample

Twelve teams have been recorded on video consisting of a mean of 5 members. From the 12 recordings, six have been used for data analysis, due to a low score mean on the representability of the meeting from the post-meeting questionnaire. The lean events consisted of 5 day-start meetings and one weekly improvement meeting. Monthly multiteam or multidisciplinary meeting such as Kaizen (continuous improvement) events has been excluded from the sample as the dynamics of these meeting reach beyond the scope of the current study.

4.1.2 Procedure

Firstly, the researcher(s) were introduced to the participating department/ teams by its team leader. The researchers observed one workday without recording any video material. After a day getting acquainted with the working circumstances and environment, the researchers started collecting video data using two wide-angled mobile video devices. One angle pointed towards the team leader, and the other towards the team members. For the video setup two mobile devices were used: Huawei Mate 20 Pro ™, set on FHD (1920 × 1080p; 60 fps; ultra-

wide angle.) and Samsung S7 ™, set on FHD (1920 × 1080p; 60 fps): Joby ™ GripTight Gorillapod Stand for Smartphones (JB01256 B). Directly after the recorded meeting, the researchers have distributed a printed out three-item questionnaire, or have verbal conducted the following questions in Table 3.

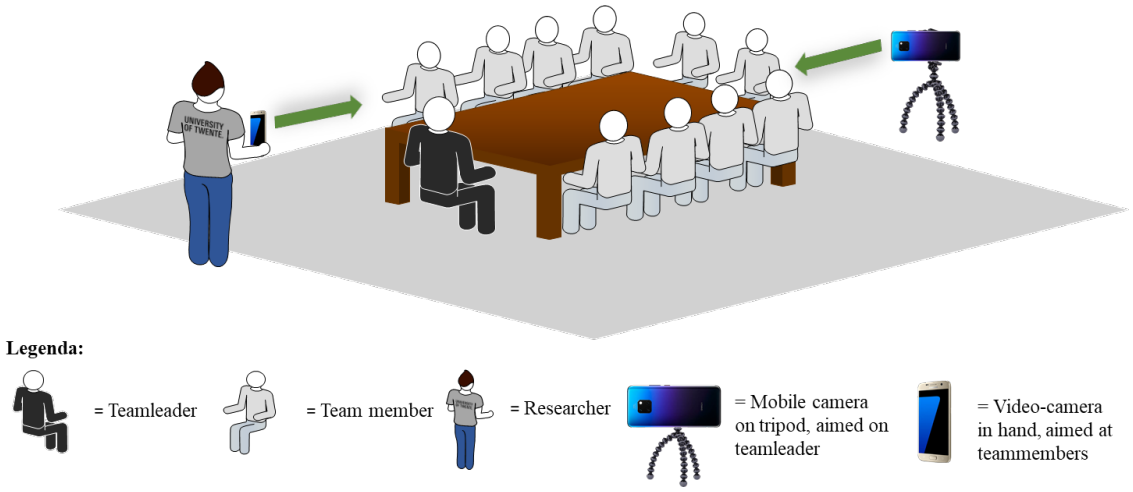


Figure 3. Visual representation video setup (copied and edited, Van Dun et al. (2017))

4.1.3 Coding of Data

Two researchers separately used Observer XT 12.5 ™ software (REF) to rate the video data and after that, compute the interrater reliability. For the analysis of the leadership behaviour an already established codebook, similar to the one used by (Van Dun et al., 2017), and can be found in Appendix B. Van Dun et al. (2017) describe the coding scheme to be consisted of 19 specific, mutually exclusive behaviours (developed by Hoogeboom & Wilderom, 2015; Van der Weide, 2007), which are clustered around Yukl's (2002) three behavioural domains (five task-oriented behaviours; seven relations-oriented behaviours; and two change-oriented behaviours), supplemented by a set of five counterproductive behaviours (Van der Weide, 2007).

4.1.4 Data Analysis

Before analysing the data, the researchers have been trained with a training file, consisting of dummy data, to ensure alignment and yield a higher percentage of agreement. At the end of this training, they scored ≥ 85% of interrater reliability (with, $\kappa > 0.7$). The first coding round was dedicated to coding the behaviour of the team leaders. After the first round, the two logs have been compared, and the pre-discussion inter-rater reliability metrics scores have been calculated.

Then during the discussion of the results, the list of disagreements has been assessed until congruency was reached. Later in the second round of coding proceeded until agreement ≥ 95% and the interrater reliability was κ>0.8. The observations differed in time for 5 min to 20 min. Therefore, we first standardised the scores, so they can be compared. We took the total time of all observations and

Table 2. *Overview steps of "team leader" analysis*

Steps	Analysis	Outcome
1	Training researchers	% of agreement ≥ 85% of interrater reliability (κ>0.8)
2	First coding round (separate)	First data in event logs
3	Comparing results	Pre-discussion inter-rater reliability metrics.
4	Discussing results	Reaching agreement on congruency of codes.
5	Second coding round	Change observations to reach an agreement — update the event log.
6	Conduct a reliability analysis	Post-discussion inter-rater reliability metrics.
7	Conclusion	% of agreement ≥ 95% of interrater reliability (κ>0.9)

4.2 Results

Table 3 displays the mean duration and frequency of the leadership behaviours in the observations. Task-oriented behaviour occurs in 28.3% of the behaviours, with a mean duration of 28,8% of the time observed. Relations-oriented behaviour occurs in 39.6% of the behaviours with a mean duration of 32,6% of the time observed. Change-oriented behaviour occurs in 10.8% of the behaviours, with a mean duration of 12,2% of the time observed. Counterproductive behaviour occurs in 24.4% of the behaviours, with a mean duration of 26,6% of the total time observed.

The most common behaviours observed are active listening (%), informing (92%) and showing disinterest (124%). Furthermore, we see a combination of active listening, clarifying and verifying. Also, the behaviour of intellectual stimulation- asking for ideas stands out. These findings are congruent with previous studies showing that lean middle managers exhibit significantly more in positive relations-oriented "active listening" and "agreeing" behaviours, and substantially less in "task monitoring" and counterproductive work behaviours (such as "providing negative feedback" and "defending one's own position").

Answering our initial research question: which team leaders display effective lean leadership behaviour; it seems the team leaders of team 1 and 6 are showing a high percentage of "disinterest". For team 1 this can be explained in study 3 where this behaviour is congruent with the leadership behaviour described in the interviews. Yet for team 6 this behaviour is not explained in other studies. Furthermore, they don't align with the leadership treads of a lean

leader as described in Van Dun (2017). This could indicate an ineffective leadership style.

There is a noticeable variance between organisations in the duration of the behaviours, team 3 clearly has more *Relations-oriented Leadership Behaviour*, in contract with team 6 where the team leader show predominantly counterproductive behaviour and team 1 where the team leader shows a combination of a mainly *counterproductive* and *Task-oriented Leadership behaviour*. This indicates that when these team leaders partake in the behaviour they tend to continue doing so for a longer period of time.

and a difference in duration and frequency.

Overall, we see that all teams predominantly score higher on *Relations-oriented Leadership Behaviour.* This could be because they all engage in lean practices.

Table 3. *Behaviours of team leaders in percentage and frequencies.*

Behaviours	Percentage mean duration								Percentage frequency							
Teams:	1	2	3	4	5	6	7	Mean	1	2	3	4	5	6	7	Mean
Task-oriented behaviour																
1. Structuring the conversation	5.9%	3.2%	-	3.3%	-	6.5%	-	4,7%	3.7%	1.9%	-	4.9%	-	2.8%	-	3.3%
2. Informing	14.2%	15.7%	-	16.8%	-	9.3%	23.1%	15,8%	18.5%	25.3%	-	20.7%	-	27.6%	16.9%	21.8%
3. Directing/delegating	-	-	-	4.5%	-	-	-	4,5%	-	-	-	3.7%	-	-	-	3.7%
4. Directing/interrupting	4.9%	3.4%	5.3%	2.8%	11.5%	-	-	5,6%	3.7%	1.9%	5.0%	2.4%	2.3%	-	-	3.1%
5. Directing/correcting	8.2%	8.1%	-	-	11.8%	-	-	9,4%	7.4%	3.9%	-	-	6.8%	-	-	6.0%
6. Verifying	7.6%	-	16.7%	-	17%	1.3%	-	10,7%	14.8%	-	5.0%	-	15.9%	2.8%	-	9.6%
SUM TEAMS	**41%**	**30.4%**	**22%**	**27.4%**	**40.3%**	**17.7%**	**23.1%**	**28,8%**	**48.1%**	**33.1%**	**10.0%**	**31.7%**	**25.0%**	**33.1%**	**16.9%**	**28.3%**
Relations-oriented behaviour																
7. Active listening	11.1%	29.6%	62.9%	15%	21.7%	6.7%	14.4%	23,1%	14.8%	33.1%	45.1%	35.54 %	34.1%	25.5%	32.4%	31.5%
8. Agreeing	-	-	2.1%	2.5%	0.8%	0.6%	11.4%	3,5%	-	-	5.0%	8.5%	4.6%	16.6%	2.8%	7.5%
9. Individualized consideration - positive rewarding	-	-	-	4.6%	4.2%	-	-	4,4%	-	-	-	4.9%	2.3%	-	-	3.6%
10. Individualized consideration - being friendly	3.3%	5.2%	-	-	-	10.3%	-	6,3%	3.7%	1.9%	-	-	-	2.8%	-	2.8%
11. Individualized consideration – encouraging	-	-	3.4%	-	-	-	-	3,4%	-	-	2.5%	-	-	-	-	2.5%
12. Individualized consideration - personal interest	-	-	-	18%	-	-	-	18,0%	-	-	-	1.2%	-	-	-	1.2%
SUM TEAMS	**14.4%**	**34.8%**	**68.4%**	**40.1%**	**26.8%**	**17.6%**	**25.8%**	**32,6%**	**18.5%**	**35%**	**52.5%**	**50.0%**	**40.9%**	**44.8%**	**35.2%**	**39.6%**
Change-oriented behaviour																
13. Visioning	-	8.4%	-	6.8%	5.1%	2.4%	9.5%	6,4%	-	3.9%	-	1.2%	6.8%	2.8%	1.4%	3.2%
14. Intellectual stimulation-asking for ideas	-	8.2%	-	21.8%	9%	8.6%	4.6%	10,4%	-	13.6%	-	4.9%	2.3%	11.0%	5.6%	7.5%
SUM TEAMS	**0%**	**17.6%**	**0%**	**28.6%**	**14.1%**	**11%**	**14.1%**	**12,2%**	**0%**	**18.2%**	**0%**	**6.1%**	**9.1%**	**13.8%**	**7.0%**	**10.8%**
Counterproductive behaviour																
15. Showing disinterest	9.2%	18.2%	9.5%	3.6%	14.9%	52.9%	19%	18,2%	22.2%	13.6%	37.5%	9.8%	22.8%	5.5%	35.2%	20.9%
16. Providing negative feedback	22.5%	-	-	0.4%	4%	-	-	9,0%	3.7%	-	-	2.4%	2.3%	-	-	2.8%
17. Disagreeing	5.8%	-	-	-	-	-	-	5,8%	3.7%	-	-	-	-	-	-	3.7%
18. Nett task behaviour	7.1%	-	-	-	-	0.9%	18%	8,7%	3.7%	-	-	-	-	2.8%	5.6%	4.0%
SUM TEAMS	**44.6%**	**18.2%**	**9.5%**	**4%**	**18.9%**	**53,8%**	**37%**	**26,6%**	**33.3%**	**13.6%**	**37.5%**	**12.2%**	**25.0%**	**8.3%**	**40.8%**	**24.4%**

Note: - means the absence of the behaviour in the observation.

5. Study 2: Questionnaires Among Team Members

5.1 Method

In study 2 a questionnaire was dispersed among team members; measuring their *perception on lean adoption,* their perception of the team *leaders' behaviour*, a description of the employees' *Relation Correlation,* existing of the dimensions shared communication and shared relationships with other team members, their perceived *Well-being*, measured by *job satisfaction*, *work engagement, work pressure* and finally their *job performance*. To get both a broad understanding of the interrelatedness of the constructs and an in-depth understanding of the inner workings the constructs, we tested two models a general model and a specific model. Our research models have then been tested, through the two-step Smart Partial Least Squares (PLS) approach, as described in the data analysis section.

In this study, we answer the research question: *"What are the relationships between the constructs: Perceived Lean Adoption, Relational Coordination, Leadership Behaviour, Employee Well-being and Job Performance?"* As before mentioned, we define the answer to this question utilising the following hypotheses:

Hypotheses category 1; about direct relations regarding and independent and dependent variables (Perceived Adoption of Lean Practices and Employee Well-being, and Relational Coordination).

- *Hypothesis 1a.* The Perceived Adoption of Lean Practices relates positively to Employee Well-being.
- *Hypothesis 1b.* The Perceived Adoption of Lean Practices relates positively to Job Performance.
- *Hypothesis 1c.* The Perceived Adoption Lean Practices positively relates to a score of Relational Coordination (Both the Relation and Communication dimension).

Hypotheses category 2; about mediating relations (Relational Coordination and Employee Well-being, and Relational Coordination).

- *Hypothesis 2a.* Relational Coordination relates positively to employee well-being.
- *Hypothesis 2b.* Relational Coordination relates positively to job performance.

Hypotheses category 3; about direct and moderating relationships of Leadership Behaviours. (Perceived Adoption Lean Practices and Leadership Behaviours, Leadership Behaviours and Relational Coordination, moderation on Lean, Relational Coordination Relationship.)

- *Hypothesis 3a.* Perceived Adoption Lean Practices has a positive relationship with the Leadership Behaviours (Task-, Relations-, Change-oriented).
- *Hypothesis 3b.* Leadership Behaviours (Task-, Relations-, Change-oriented) have positive relations with the Relational Coordination among team members.
- *Hypothesis 3c.* Leadership Behaviour(s) (Task-, Relations-, Change-oriented) will have a positive moderating effect on the Relationship between Lean practices and Relational Coordination.

5.1.1 Sample

The final sample consisted of n=74 team members. The respondents are 54.8 per cent male and 46.6 per cent female. Mostly full time employed, and the median of the employees has a secondary vocational education level. Table 4 shows a full overview of the descriptive statistics.

Table 4. *Descriptive Statistics of the Sample (N=74)*

Demographic Variables	Categories	M	SD
Age	Scale	41.4	10.9
		Frequency	Percentage (%)
Gender	Male	40	54.8
	Female	34	46.6
Employment	Full time	52	70.3
	Part-time	20	27
	Other	2	2.7
Education	Secondary School	3	4.1
	Lower Vocational	5	6.8
	Secondary Vocational	28	37.8
	Higher Vocational	19	25.7
	University	16	21.6
	Other	1	1.4

5.1.2 Procedure

The questionnaires have been dispersed among the participating team members via email before the arrival of the researchers on-site. Through a hyperlink was provided that redirected the participants to the online survey distribution program Qualtrics ™, provided by the Faculty of Behavioural, Management and Social sciences at the University of Twente. In this environment, a letter of consent was to be read and signed digitally. The data was stored on the secured encrypted servers of the University of Twente. Upon arrival at each organisation site, the employees and managers/team leaders were asked by the researchers whether they had fully completed the questionnaires. If questionnaires remained incomplete after repeated reminders (during the days of the visits and four weeks after that), the data were omitted from the study. The questionnaires were distributed both online and via printed copies depending on

the team members' tasks of the participating companies. Team members with jobs that involved working on computers were quick to fill out online versions of the questionnaire. Team members in production and physical labour were more prone to the printed versions of the questionnaire.

5.1.3 Instruments

5.1.3.1 Perceived adoption of lean. Three items, like those used by (Van Dun & Wilderom, 2016), have been added to measure the perceived adoption of lean practices. The Sample items include: *"How do you assess the involvement of team members in the continuous improvement process?"* (α= .66; 1= strongly disagree to 5 = strongly agree).

5.1.3.2 Job satisfaction. We used three items found in Thompson and Phua's (2012) variation of the Job Satisfaction Blank (JSB) by Hoppock (1935). (α= .84; 1= strongly disagree to 5 = strongly agree). Sample items included: *"I find real enjoyment in my job."*

5.1.3.3 Work engagement. We used seven of the nine items of the Utrecht Work Engagement Scale (UWES), developed by Schaufeli et al. (2002). (α= .90; 1= strongly disagree to 6 = strongly agree). Sample items included: "*When I get up in the morning, I feel like going to work."*

5.1.3.4 Work pressure. We used six of the ten items of the Questionnaire on the Experience and Evaluation of Work (QEEW) with the quantitative demands subscale as seen in (Veldhoven & Meijman, 1994). (α= .90; 1= strongly disagree to 5 = strongly agree). Sample items included: *"Do you work under time pressure?"*

5.1.3.5 Job performance. Job Performance is measured by four items, as seen in Gibson, Cooper, and Conger (2009). (α= .82; 1= strongly disagree to 5 = strongly agree). We translated the questionnaires to an individual perspective, with a five Likert-type. Sample items included: *"I am consistently high performing."*

5.1.3.6 Relational coordination. Team members were surveyed about their communication and relationships with other team members and in their work process with their team leader, as seen in Gittel (2011). The relational Coordination measures shown are aggregated from eight survey questions including five questions about communication (α=.88) (frequency, timeliness, accuracy, problem-solving) and three questions about relationships (α=.81) (shared goals, shared knowledge, mutual respect). The responses were recorded on a five-point Likert-type scale. (1= strongly disagree to 5 = strongly agree). Sample items included: *"Team members frequently communicate with you about the team tasks"*. Additionally, added two items to this construct as sought out to deepen the dimensions of shared

personal values and face to face contact following suggestions described in by Van Dun and Wilderom (2019). We did so by mean of: *"Team members are communicating face-to-face with about work processes"* (CR.=.86), and *"Team members are sharing your values in your work process."* (CR.=*89).* More on the composite reliability of this scale can be found in 5.1.4.1. Then employee well-being was measured through the constructs: *work engagement, job satisfaction, and work pressure*.

5.1.3.7 Leadership behaviour. Leadership behaviours were measured with a short version of the Multifactor Leadership Questionnaire by Avolio & Bass (2004). It contained a 9-item scale, on the questionnaire comprises three scales: task (α=.79), relation (α=.78) and change-oriented leadership (α=.83). (1= strongly disagree to 5 = strongly agree). Sample items included: *"[My team leader] supports me in exchange for my efforts."*, *"[My team leader] suggests new options for looking at task performance."* and *"[My team leader] expresses confidence that the goals will be achieved."*.

5.1.3.8 Control variables. As control variables, we gathered descriptive data such as ages, tenure, gender and educational level. Based on earlier research, we decided upon these variables due to its descriptive nature as they might be of service explaining unforeseen outliers. An overview of the questionnaire items can be found in Table 5.

5.1.4 Data Analysis

Firstly, all items that used inverted scales have been recoded. The recoding applied to the scale assessing work pressure (items: RQ_44_ 1, RQ_44_ 3, RQ_44_ 4, RQ_44_ 5, RQ_44_ 9 and RQ_44_ 10). After using SPSS's reliability analyses for the scales, all Cronbach's alpha scores were found to be 7.0 or above. Having taken Mccrae, Kurtz, Yamagata, and Terracciano (2011) into consideration as they state this measure has "limited utility for evaluating the potential validity of developed scales" we used the rule of thumb (α > 0,6) instead as guideline to conform to conventional scientific norm, rather than a strict cut-off point. Then to look at correlations between the constructs, bivariate correlation analysis has been calculated, using SPSS. Here the Pearson scores have been used to determine the strength of the correlations.

After these preliminary analyses, the entirety of the research model has been dissected and analysed with the Partial Least Squares (PLS) approach(Hair, Black, Babin, & Anderson, 2013). This approach was deemed appropriate as analyses of similarly constructed models such as by Surienty, Ramayah, Lo, and Tarmizi (2014) yielded fruitful outcomes.

Table 5. *Overview Questionnaire Items.*

Construct	Name measure	#Items	Example item	Scale	Source**
Lean Adoption					
Perceived Adoption Lean Practices	Commitment to Change Scale	3	"How do you assess the involvement of team members in the continuous improvement process?"	1-5	Herscovitch and Meyer (2002)
Team leader behaviour				1-5	
Task-oriented	MLQ	4	"Supports me in exchange for my efforts."	1-5	Avolio and Bass (2004)
Relations-oriented	MLQ	5	"Suggests new options for looking at task performance."	1-5	Avolio and Bass (2004)
Change-oriented	MLQ	4	"Expresses confidence that the goals will be achieved."	1-5	Avolio and Bass (2004)
Relational Coordination Score					
Communication	Relational Coordination Score	6	"Team members communicate with you in a timely manner about the team tasks."	1-5	Gittell (2011)
	Face-to-face contact	1	"Team members are communicating face-to-face with about work processes."	1-5	Own item
Relation	Relational Coordination Score	3	"Team members share your goals regarding team tasks/."	1-5	Gittell (2011)
	Personal Values	1	"Team members are sharing your personal values in your work process."	1-5	Own item
Employee well-being					
Work engagement	Utrecht Work Engagement Scale-9 (short version)	7	"When I get up in the morning, I feel like going to work."	1-6	Schaufeli, Bakker, and Salanova (2006)
Job satisfaction	Job Satisfaction Blank (JSB)	3	"I find real enjoyment in my job."	1-5	Thompson and Phua (2012)
Work pressure	QEEW/VBBA	10	Do you work under time pressure?	1-4	Veldhoven and Meijman (1994)
Job performance	Job performance scale	4	"I am consistently high performing."	1-7	Gibson et al. (2009)
Control variables					
Age	n.a.	1	"What is your age?"	1-100	n.a.
Gender	n.a.	1	"To which gender do you most identify with?"	Male/ Female/ Other	n.a.
Organisational tenure	n.a.	1	"How long have you been employed at this organisation?"	Years & months	n.a.
Team tenure	n.a.	1	"How long have you been part of this team?"	Years & months	n.a.
Lean Practices	n.a.	1	"How long have you been working with lean practices?"	Years & months	n.a.
Educational level	n.a.	1	"What is your highest level of education?"	Categorical	n.a.

We followed the recommended two-stage analytical procedures by Anderson and Gerbing (1988), as we tested the measurement models through confirmatory factor analysis (validity and reliability of the measures), followed by an examination of the structural model and its primary and moderating latent variables (testing the hypothesized relationships) (Ramayah, Lee, & In, 2011; Ramayah, Yeap, & Ignatius, 2013).

5.1.4.1 Confirmatory factor analysis. We used confirmatory factor analysis, to test convergent validity and to assure the construct validity of the items. This confirmatory approach was deemed appropriate as many of the scales used were already established and validated in earlier publications (see Table 5). We added two items in the construct of *Relational Coordination* yet deemed this alteration too small to stray from the confirmatory approach. We then proceeded using the PLS Algorithm, developed by (Wold, 1982), as a sequence of regressions in terms of weight vectors (Henseler, Ringle, & Sinkovics, 2009). As (Hair et al., 2013) suggest, we used the factor loadings, composite reliability and average variance extracted to assure convergence validity. In order for all the loadings of all items to exceeded the recommended value of 0.6 such as suggested by (Chin, Gopal, & Salisbury, 1997) we deleted the items: Q33_2 of the Perceived Lean Adoption scale, Q25_1 for the Task-Oriented leadership behaviour scale, Q25_7 from the Relation-Oriented leadership behaviour scale and Q44_2 from the work pressure scale. Composite reliability values (which are shown in Table 6), show the degree to which the construct indicators indicate the latent, construct ranged from 0.78 to 0.96 which exceeded the recommended value of 0.7 (Hair et al., 2013). The average variance extracted, which reflects the overall amount of variance in the indicators accounted for by the latent construct, were in the range of 0.55 and 0.90 which exceeded the recommended value of 0.5 (Hair et al., 2013). The outer loadings of the added items of shared personal values and face to face contact are reported .86 and .89. These outcomes consolidate the items' absolute contribution to its assigned construct.

5.1.4.2 Discriminant validity and reliability analysis The discriminant validity of the measures was examined by comparing the correlations between constructs and the square root of the average variance extracted for that construct (Fornell & Larcker, 1981). All the square root of the average variance extracted was higher than the correlations values in the row and the column, indicating adequate discriminant validity. Both convergent validity and discriminant validity were therefor deemed accurate for the measurement model. To test the consistency of our measuring instrument, we performed a reliability analysis, as suggested by (Sekaran & Bougie, 2010). All the alpha values are higher than 0.6. We, therefore, assume that our measurements are reliable. Sang and others (2010) stated that the structural model

indicates the causal relationships among constructs in the model (path coefficients and the R^2 value). Together, the R^2 and the path coefficients (beta and significance) indicate how well the data support and hypothesised model (Chin, 1995; Sang et al., 2010).

5.1.4.3 Moderation effect. We expected moderation to be present between the strength of the relationship between; *lean maturity,* and the two dimensions (*Communication and Relationships*) of *Relational Coordination,* dependant on either of one of the leaderships behaviours (*Task-, relation-, or change-orientated leadership behaviour*). Ergo, the nature of the relationship can differ depending on the values of one of these three variables. We will use the two-stage calculation method in SMART-PLS (Henseler & Chin, 2010). This approach uses the latent variable scores of the latent predictor and latent moderator variable from the primary effects model (without the interaction term). These latent variable scores are saved and used to calculate the product indicator for the second stage analysis that involves the interaction term in addition to the predictor and moderator variable (Chin, 1995).

5.1.4.4 Bootstrapping PLS-SEM has been chosen due to its ease of applicability, and it does not presume the data to be normally distributed. This implies that parametric significance tests (e.g., as used in regression analyses) cannot be applied to test whether coefficients such as outer weights, outer loadings and path coefficients are significant. Instead, PLS-SEM relies on a nonparametric bootstrap procedure (Davison & Hinkley, 1997; Efron & Tibshirani, 1986) to test the significance of estimated path coefficients in PLS-SEM (Hair, Hult, Ringle, & Sarstedt, 2016).

To test the significance of the path coefficients and the loadings a bootstrapping method was used to determine the significance levels for loadings, weights, and path coefficients between the main constructs (the latent variables) and the moderating effects (of the moderating variables). With bootstrapping, subsamples are created with randomly drawn observations from the original set of data (with replacement). The subsample is then used to estimate the PLS path model. This process is repeated until many random subsamples have been created. For our study, we used 5,000 subsamples. The parameter estimates (e.g., outer weights, outer loadings and path coefficients) estimated from the subsamples are used to derive standard errors for the estimates. With this information, t-values are calculated to assess each estimate's significance. We first tested the structural model on a general level to see broader perhaps stronger overall effects and then secondly the specific sub-construct level for detailed, between constructs, relational insights.

5.2 Results

5.2.1 General Model

In the general model, starting with Hypotheses category 1; direct relations regarding and independent and dependent variables. We see the path of *Perceived Lean Adoption* with *Relational Coordination* showing a significant positive relation (t=3.74, p=.000). Indicating that *Hypothesis 1c*, is supported and the Perceived Adoption Lean Practices positively relates to a score of Relational Coordination.

Secondly, in Hypotheses category 2; mediating relations, the path of *Relational Coordination* and *Employee Well-being* shows a significant positive relation (t=2.19, p=.028). This indicates that *Hypothesis 2a*, is supported and Relational Coordination relates positively to employee well-being.

Thirdly, in Hypotheses category 3, direct and moderating relationships of the Leadership Behaviours, the path of *Perceived Lean Adoption* and *Leadership Behaviour* shows a significant positive relation (t=3.23, p=.001). Indicating that *Hypothesis 3a* is supported and Perceived Adoption Lean Practices has a positive relationship with the Leadership Behaviours (Task-, Relations-, Change-oriented). All other claims are not significantly supported. The significance levels for loadings, weights, and path coefficients between the primary constructs (the latent variables) and the moderating effects of are shown in Table 8.

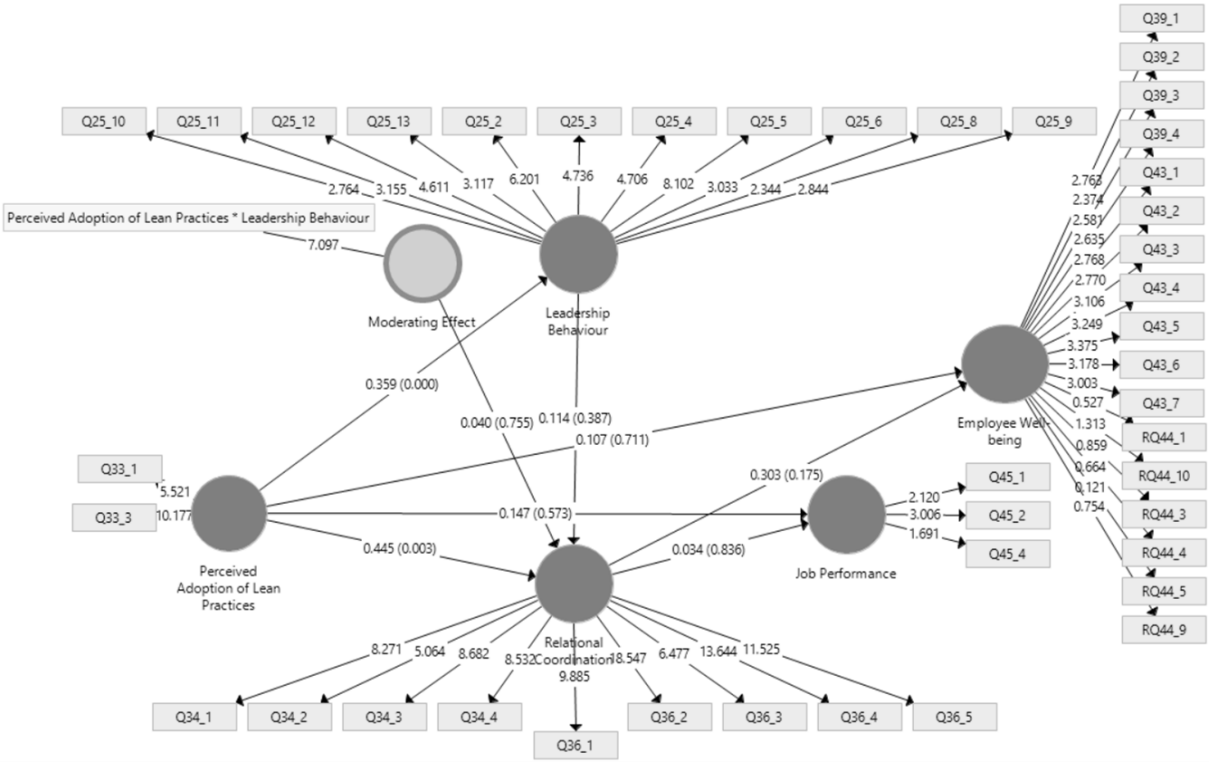


Figure 4. General Structural Model, as displayed in Smart-PLS3.

Table 6.

Overview results of the Confirmatory Factor Analysis General Model

Constructs	Items	Loading	CR[a]	AVE[b]	Constructs	Items	Loading	CR[a]	AVE[b]
Lean Maturity	Q33_1	0.85	0.85	0.74	Employee Well-being	Q39_1	0.902	0.89	0.67
	Q33_3	0.87				Q39_2	0.785		
Leadership Behaviour	Q25_11	0.927	0.89	0.657		Q39_3	0.879		
	Q25_12	0.755				Q39_4	0.709		
	Q25_2	0.821	0.88	0.71		Q43_1	0.809	0.92	0.61
	Q25_3	0.849				Q43_2	0.864		
	Q25_4	0.849				Q43_3	0.862		
	Q25_5	0.943	0.85	0.58		Q43_4	0.811		
	Q25_6	0.711				Q43_5	0.761		
Relational Coordination	Q34_1	0.826	0.90	0.64		Q43_7	0.666		
	Q34_2	0.8				RQ44_1	0.869	0.89	0.59
	Q34_3	0.795				RQ44_3	0.872		
	Q36_1	0.849	0.91	0.68		RQ44_4	0.818		
	Q36_2	0.878			Job Performance	Q45_2	0.815	0.86	0.67
	Q36_3	0.787				Q45_3	0.808		
	Q36_4	0.853				Q45_4	0.883		
	Q36_5	0.732							

[a] Composite reliability (CR), describes the square of the summation of the factor loadings, divided by the square of the summation of the factor loadings, plus the square of the summation of the error variances.
[b] Average variance extracted (AVE) is the summation of the square of the factor loadings divided by the summation of the square of the factor loadings plus summation of the error variances.

Table 7.

Pearson Correlation General Model

	Variables	Range	M	SD	N	1	2	3	4	5
1	Perceived Lean Adoption	1-5	3.4	0.82	72	0.66				
2	Leadership Behaviour	1-5	3.67	0.71	73	.30*	0.79			
3	Relational Coordination	1-5	3.63	0.64	70	.44**	.24	.22		
4	Employee Well-being	1-7	3.91	0.66	72	.26*	.10	.22	.16	
5	Job Performance	1-7	5.40	0.80	71	.05	.04	.06	.05	.08

Cronbach's alphas are displayed diagonally.
*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).

Table 8.

Summary of The Structural Model

Path Description	Path coefficient	t-value	P-Value	Hypothesis	Results
Perceived Lean Adoption => Employee Well-being	.107	0.35	.721	1a	Not Supported
Perceived Lean Adoption => Employee Job Performance	.034	0.56	.560	1b	Not Supported
Perceived Lean Adoption => Relational Coordination	.355	3.74	.000	1c	Supported
Relational Coordination => Employee Well-being	.350	2.19	.028	2a	Supported
Relational Coordination => Job Performance	.095	0.54	.591	2b	Not Supported
Perceived Lean Adoption => Leadership Behaviour	.451	3.23	.001	3a	Supported
Leadership Behaviour => Relational Coordination	.116	0.91	.360	3b	Not supported
Leadership Behaviour on the path of: Perceived Lean Adoption=> Relational Coordination	.046	0.37	.708	3c	Not Supported

5.2.2 Specific Model

For the specific model, we will first test the scale reliabilities by going through the process of confirmatory factor analysis. We will then asses the Pearson correlations look to the general relations between the constructs. Finally, we will summarize our specific model by means of all tested paths and how our findings have an effect on our hypotheses

5.2.2.1 Confirmatory factor analysis. Table 6 presents the items that were removed to ensure a reliably CR and AVE score of the model. The question "*How do you assess the level of customer focus of your team"* Might indicate that this virtue of the lean paradigm is not fulling embodied by the participants in our dataset, or at least not consciously being taken into consideration daily, a phenomenon supported by (Radnor & Johnston, 2013). *"My supervisor supports me in exchange for my achievements"* Surprisingly this item scored less successfully in the construct. This seems to be a contrast with the findings of study 1 in which most leaders seem to display supportive behaviours.

Table 9.

Delete Questions from study 2.

#	Question	Constructs
Q33_2	*"How do you assess the level of customer focus of your team."*	Perceived Lean Adoption
Q25_1	*"My supervisor supports me in exchange for my achievements."*	Leadership behaviour
Q25_7	*"My supervisor requested me more as an individual and only as a member of the team."*	Leadership behaviour
Q45_3	*"I rarely make mistakes."*	Job Performance
RQ44_2	*"Do you have much extra work to do?"*	Employee Well-being
RQ44_6	*"Can you do your work at your leisure?"*	Employee Well-being
RQ44_7	*"Are you dealing with a backlog in your work?"*	Employee Well-being
RQ44_8	*"Do you have too little work?"*	Employee Well-being

Table 10.

Overview results of the Confirmatory Factor Analysis

Constructs	Items	Loading	CR [a]	AVE [b]	Constructs	Items	Loading	CR [a]	AVE [b]
Lean Maturity	Q33_1	0.85	0.85	0.74	Job Satisfaction	Q39_1	0.902	0.89	0.67
	Q33_3	0.87				Q39_2	0.785		
Change-Oriented Leadership Behaviour	Q25_11	0.927	0.89	0.657		Q39_3	0.879		
	Q25_12	0.755				Q39_4	0.709		
Task-Oriented Leadership Behaviour	Q25_2	0.821	0.88	0.71	Work Engagement	Q43_1	0.809	0.92	0.61
	Q25_3	0.849				Q43_2	0.864		
	Q25_4	0.849				Q43_3	0.862		
Relationship-Oriented Leadership Behaviour	Q25_5	0.943	0.85	0.58		Q43_4	0.811		
	Q25_6	0.711				Q43_5	0.761		
Relational Coordination Relation	Q34_1	0.826	0.90	0.64		Q43_7	0.666		
	Q34_2	0.8			Job Performance	Q45_2	0.815	0.86	0.67
	Q34_3	0.795				Q45_3	0.808		
Relational Coordination Communication	Q36_1	0.849	0.91	0.68		Q45_4	0.883		
	Q36_2	0.878			Work Pressure	RQ44_1	0.869	0.89	0.59
	Q36_3	0.787				RQ44_3	0.872		
	Q36_4	0.853				RQ44_4	0.818		
	Q36_5	0.732				RQ44_5	0.869		
						RQ44_9	0.872		
						RQ44_10	0.818		

[a] Composite reliability (CR), describes the square of the summation of the factor loadings, divided by the square of the summation of the factor loadings, plus the square of the summation of the error variances.
[b] Average variance extracted (AVE) is the summation of the square of the factor loadings divided by the summation of the square of the factor loadings plus summation of the error variances.

5.2.2.2 Correlations. For the sake of comprehensibility, the model results will be discussed by the hypotheses categories, mentioned on page 23 and 24.

Table 11.

Pearson Correlation Specific Model

	Variables	Range	M	SD	N	1	2	3	4	5	6	7	8	9	10
1	Perceived Lean Adoption	1-5	3.4	0.82	72	0.66									
2	Task-Oriented Leadership Behaviour	1-5	3.67	0.71	73	.30*	0.79								
3	Relationship-Oriented Leadership Behaviour	1-5	3.58	0.66	73	.27*	.38**	0.78							
4	Change-Oriented Leadership Behaviour	1-5	3.80	0.61	72	.30*	.46**	.70**	0.83						
5	Relational Coordination Communication	1-5	3.63	0.64	70	.44**	.24	.22	.17	0.88					
6	Relational Coordination Relation	1-5	3.69	0.60	68	.46**	.30*	.21	.19	.91**	0.81				
7	Job Satisfaction	1-5	3.91	0.66	72	.26*	.10	.22	.16	.26*	.29*	0.84			
8	Work Engagement	1-7	2.71	0.53	71	-.18	-.02	.02	-.004	-0.01	-.05	-.06	0.90		
9	Work Pressure	1-4	2.83	0.37	71	-.16	-.00	.03	-.001	0.02	-.04	-.05	.97**	0.90	
10	Job Performance	1-7	5.40	0.80	71	.05	.04	.06	.05	.08	.07	.18	-.04	.01	0.82

Cronbach's alphas are displayed diagonally.

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Hypotheses category 1; direct relations independent and dependent variables. *(Perceived Adoption of Lean Practices and Employee Well-being, and Relational Coordination).* As shown in Table 8 and Table 9, the *Perceived Lean Adoption* shows a significant positive correlation with *Job Satisfaction* ($\beta = 0.26$, $p < 0.05$). It also shows a significant positive correlation with both the *Relational Coordination "Communication"* dimension ($\beta = 0.44$, $p < 0.01$) and *Relational Coordination "Relation"* dimension ($\beta = 0.46$, $p < 0.01$).

Hypotheses category 2; mediating relations *(Relational Coordination and Employee Well-being, and Relational Coordination).* Both the *Relational Coordination Communication and Relation* dimensions positively correlate significantly with *Job Satisfaction* ($\beta = 0.26$, 0.29, $p < 0.05$).

Hypotheses category 3; direct and moderating relationships of Leadership Behaviours. *(Perceived Adoption Lean Practices and Leadership Behaviours, Leadership Behaviours and Relational Coordination, moderation on Lean, Relational Coordination Relationship.)* Furthermore, the *Perceived Lean Adoption* shows a significant positive correlation with *all leadership* styles ($\beta = 0.30$, 0.27 and 0.30, $p < 0.05$). We also found a significant correlation between *Task-Oriented Leadership Behaviour* and the *Relational Coordination Relation*-dimension ($\beta = 0.30$, $p < 0.05$).

All other correlations were not significant; also, the moderating variables show no significant effects.

Table 12.

Summary of the Specific Structural Model

Path Description	Path coefficient	t-value	P-Value	Hypotheses	Results
Perceived Lean Adoption => Job Satisfaction	.143	1.01	.312	1a	Not supported
Perceived Lean Adoption => Work Engagement	.045	2.03	.839	1a	Not supported
Perceived Lean Adoption => Work Pressure	-.221	1.08	.282	1a	Not supported
Perceived Lean Adoption => Job Performance	-.164	0.77	.445	1b	Not supported
Perceived Lean Adoption => Relational Coordination Shared Communication	.433	2.94	.003	1c	Supported
Perceived Lean Adoption => Relational Coordination Shared Relationships	.298	1.99	.047	1c	Supported
Relational Coordination Shared Communication => Job Satisfaction	.174	0.99	.323	2a	Not supported
Relational Coordination Shared Communication => Work Engagement	.221	0.73	.466	2a	Not supported
Relational Coordination Shared Communication => Work Pressure	-.235	0.92	.359	2a	Not supported
Relational Coordination Shared Relationships => Job Satisfaction	.198	1.08	.279	2a	Not supported
Relational Coordination Shared Relationships => Work Engagement	.080	0.30	.762	2a	Not supported
Relational Coordination Shared Relationships => Work Pressure	.254	1.13	.258	2a	Not supported
Relational Coordination Shared Communication => Job Performance	.226	0.80	.428	2b	Not supported
Relational Coordination Shared Relationships => Job Performance	-.113	0.46	.649	2b	Not supported
Perceived Lean Adoption => Task-Oriented Leadership Behaviour	.308	3.26	.001	3a	Supported
Perceived Lean Adoption => Relation-Oriented Leadership Behaviour	.321	2.32	.021	3a	Supported
Perceived Lean Adoption => Change-Oriented Leadership Behaviour	.251	1.50	.135	3a	Not supported
Task-Oriented Leadership Behaviour => Relational Coordination Shared Communication	.239	1.74	**.083**	3b	Not supported
Relation-Oriented Leadership Behaviour => Relational Coordination Shared Communication	-.110	0.58	.565	3b	Not supported
Change-Oriented Leadership Behaviour => Relational Coordination Shared Communication	.027	0.13	.896	3b	Not supported
Task-Oriented Leadership Behaviour => Relational Coordination Shared Relationships	.086	0.17	**.083**	3b	Not supported
Relation-Oriented Leadership Behaviour => Relational Coordination Shared Relationships	.145	0.80	.425	3b	Not supported
Change-Oriented Leadership Behaviour => Relational Coordination Shared Relationships	-.117	0.59	.556	3b	Not supported
Task-Oriented Leadership Behaviour on the path of: Perceived Lean Adoption => Relational Coordination Shared Communication	.227	1.57	.117	3c	Not supported
Relationship-Oriented Leadership Behaviour on the path of: Perceived Lean Adoption => Relational Coordination Shared Communication	-.101	0.55	.580	3c	Not supported
Change-Oriented Leadership Behaviour on the path of: Perceived Lean Adoption => Relational Coordination Shared Communication	.055	0.29	.776	3c	Not supported
Task-Oriented Leadership Behaviour on the path of: Perceived Lean Adoption => Relational Coordination Shared Relationships	-.108	0.63	.530	3c	Not supported
Relationship-Oriented Leadership Behaviour on the path of: Perceived Lean Adoption => Relational Coordination Shared Relationships	-.143	0.72	.471	3c	Not supported
Change-Oriented Leadership Behaviour on the path of: Perceived Lean Adoption => Relational Coordination Shared Relationships	-.156	0.67	.506	3c	Not supported

Marginal significant results are displayed in **bold**.

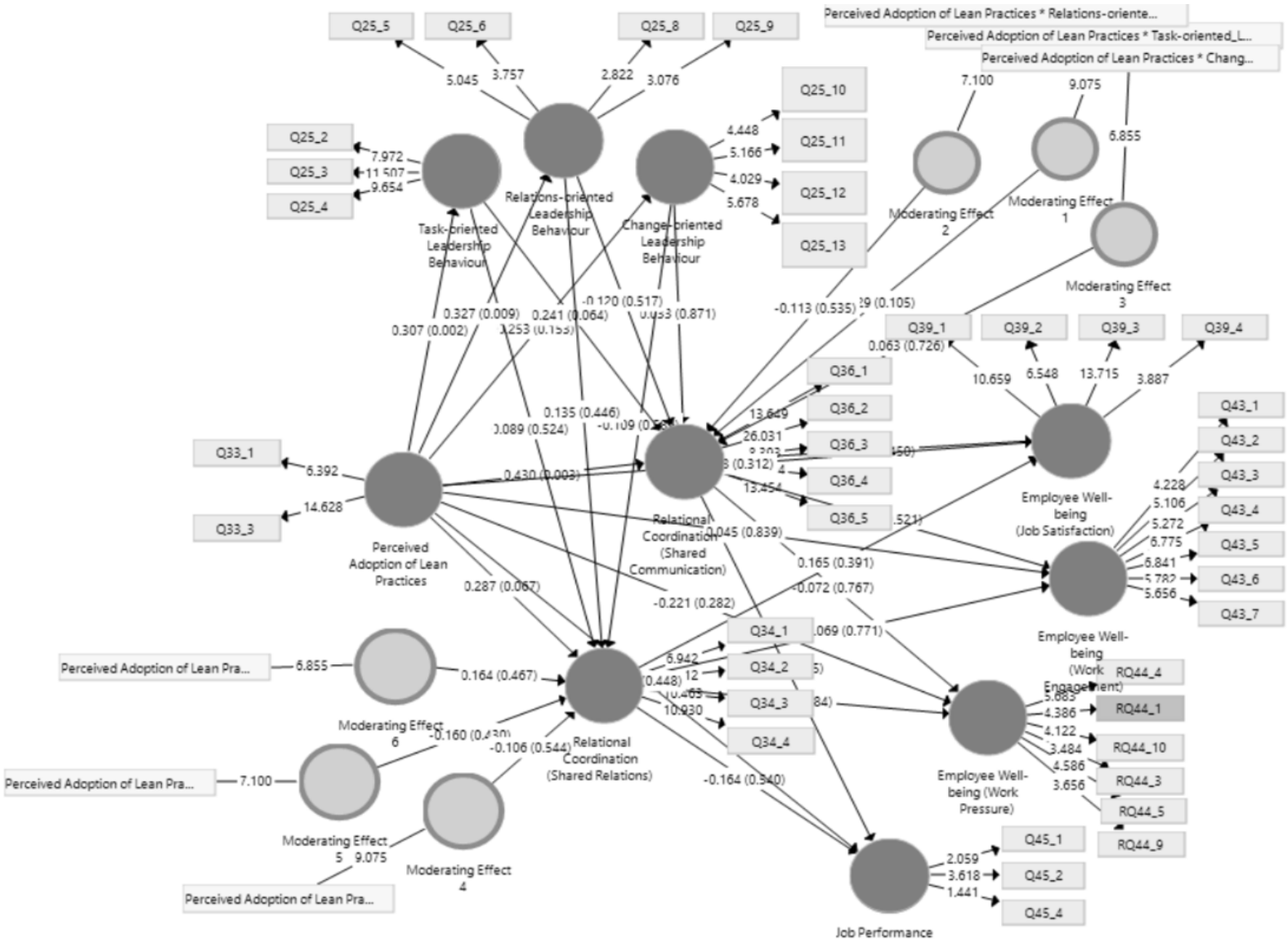


Figure 5. Overview Specific Structural Model

5.2.2.3 Model summary.

The significance levels for loadings, weights, and path coefficients between the primary constructs (the latent variables) and the moderating effects of are shown in Table 12. We see that the first four of the paths hypothesised to have a significant positive correlation are deemed statistically correct.

In hypotheses, category 1; direct relations regarding and independent and dependent variables (Perceived Adoption of Lean Practices and Employee Well-being, and Relational Coordination), two significant relations are found. Firstly, the path between *Perceived Lean Adoption* and the shared communication dimension of *Relational Coordination* shows a significant positive relation (t=2.94, p=.003), indicating that *Hypothesis 1c* is supported, the Perceived Adoption Lean Practices positively relates to a score of Relational Coordination. Secondly, the path of *Perceived Lean Adoption* and the shared relationships dimension of *Relational Coordination* shows a significant positive relation (t=1.99, p=.047). This finding reaffirms the support for *Hypothesis 1c.*

Then in hypotheses, category 3; direct and moderating relationships of the Leadership Behaviours (Perceived Adoption Lean Practices and Leadership Behaviours, Leadership Behaviours and Relational Coordination, moderation on Lean, Relational Coordination Relationship), two more are found. The path of *Perceived Lean Adoption* and *Task-Oriented Leadership Behaviour* shows a significant positive relation (t=3.26, p=.001). This indicates that *Hypothesis 3a,* Perceived Adoption Lean Practices has a positive relationship with the Leadership Behaviours (Task-, Relations-, Change-oriented), is supported. Additionally, the path of *Perceived Lean Adoption* and *Relation-Oriented Leadership Behaviour* shows a significant positive relation (t=2.32, p=.021).

All other posed assumptions and paths are not supported by the data. Furthermore, no moderation effect was significantly found. For moderation 1 through 6 the following values of f-square were reported; .044, .007, .004,.010, .014, .030, therefore deemed not meaningful.

6. Study 3: Critical Incidents Interviews

6.1 Method

In order to collect data on actual behaviours of the selected individuals, both researchers engaged in semi-structured interviews drawn upon the critical incident interview technique (Flanagan, 1954). With this gathering rich quantitative data to further explore the nature of the relationship that team leaders and team members had with lean practices. We gained further insights into an underlying deeper quantitative rationale of their behavioural determinants. We then divided the practices per construct in successful lean practices and suboptimal implemented lean practices, which for the sake of relatability will be referred to as *good lean practices* and *bad lean practices*.

6.1.1 Sample

The 29 audiotaped interviews have been conducted among N=12 team leaders and N=17 team member. Ten of which were female and 19 of which were male. They have worked with lean practices for at least six months prior and can be therefore be considered acquainted with the terminology and basic theory. The employees were randomly selected by the researcher's on-site location. Due to the operational nature of the practical activities of the participant, the researchers occasionally (N=12) worked alongside the participants during the interviews. In all other instances (N=17), the participants were brought to a secluded part of the building, such as a canteen or a quiet place to pursue questioning. This so the participants felt they could speak freely without being interrupted by their superiors or peers.

6.1.2 Procedure

As explained by Bonesso et al. (2014), the CIT aims to retrieve real stories about specific crucial moments; in this case: situations involving continuous improvement. We have investigated individuals' perceptions of the extent to which they were engaged in performing continuous improving (lean) activities in the last year. There was a specific focus on their awareness of existing lean or continuous improvements protocols and programs and important actors in the lean program, such as their team leaders. Then the participants were asked to exemplify and to reflect upon their personal experiences. Specifically, we asked: "Could you tell about a recent example of something that was improved successfully?" (Description of *Perceived Lean Adoption*.) We probed to hear more details about the actual situation, e.g., "Who brought this improvement about?", "How did your team leader react to this?" (*Leadership behaviour),* and "How happy does lean make you on a scale from one to ten" (*Employee Well-being*). These interviews, which lasted approximately 10 to 30 minutes, were

audio recorded by a mobile device, to provide a more abundant account of the data and to allow the researchers to monitor the conversations (Silverman, 1994). We then transcribed each interview, making use of the online transcribing tool AmberScipt, which allowed the researchers to transcribe with a more considerable amount of data in both the German (N=3) and Dutch (N=26) language. Subsequently, these interviews have been coded and thoroughly analysed in an exploratory fashion to deepen our understanding of the constructs earlier discussed in Study 1 (*Leadership Behaviour*) and study 2 (*Perceived Lean Adoption, Relation Correlation* and *Employee Well-being*).

6.1.3 Data Analysis

Each of the interview transcripts has been coded by the first researcher using the computer program Atlas.ti version 8 (Muhr, 2004). Subsequently, the excerpts have been rated by both researchers to be deemed appropriately embodying the researched construct. To increase the reliability of the analyses, the researchers conducted them independently, and discrepancies were resolved through discussion.

6.2 Results

Table 13 presents the results of study 3. Per team summaries are shown of anecdotes represent reoccurring or prevalent themes resembling the constructs of the research model. In the following paragraphs, we will summarize the contents and formulate general remarks on both bad and good lean practices.

6.2.1 Bad Lean Practices

6.2.1.1 Perceived lean adoption. It seems that in jobs where employees have structured routines, it is of utmost importance that they are being accounted for in the process of standardising their new routines. Multiple participants report feeling left out and hostile towards expecting new routines. Over a more substantial period, employees do report that the results speak for themselves, and making the customers happy makes them happy. During our interviews and observations, we did not encounter large malpractices rather unresolved issues or potential for improvement. Almost none of the organisations are making use of the entire span of lean tools and advanced options of seeking out other lean suppliers or organisation

6.2.1.2 Relational coordination. Frequent and timely communication is being named as a vital factor to inspire goodwill with employees. Also crucial in the process of acceptance seems to be the face to face contact with their peers and superiors. As announcing changes solely through an email update might spite some of the participants.

6.2.1.3 Employee well-being. Most participants report being at least moderately happy with Lean Practices in their organisation. Bear in mind that this organisation has quite recently

implemented the lean strategies and might, therefore, be less matured in Lean Practice Adoption.

6.2.2 Good Lean Practices

6.2.2.1 Perceived lean adoption. In the mature perceived lean operations, there were a lot of systems already in place and were commonly used. This might be the biggest difference we found in the interviews. The visual display of the systems was mentioned as a good reminder of the rewards that the organisation and its employee could yield form continuous improvement. Furthermore, the lack thereof has also been mentioned by employees as being a reason not to feel appreciated by management or their team leaders and not being seen.

6.2.2.2 Relational coordination. In good lean practices, the transparency of the work processes contributes to the overall understanding of the workload and the operational processes of colleagues. Interviewees being this up as a reason to help them understand the position of their peers and team leaders. The overall accountability and responsibility of the employees regarding the quality of the process and its products seem to have great benefit of this transparency.

6.2.2.3 Employee well-being. With very few exceptions, almost every participant noted feeling better either mentally or physically using lean practices. They favoured the increase in structure they had and with this base layer of stability and structure, there was room to take a step back and evaluate the part of their job they did not enjoy as much. Uppon being asked to rate their own experience with lean everyone interviewed, even in suboptimal or bad lean practices, rated working with lean higher than a 6 and mostly around 8 (see interviews 1 through 10).

Table 13.

Exemplary excerpts of transcripts Critical Incident Interviews Sorted by Good and Bad Lean Practices and Constructs

Lean Practices	Construct	Excerpts
Bad	*Perceived Lean Adoption*	Employees in this team perceive lean an effort to "make them produce more". Because they "sometimes do things double and those are unnecessary"(ID_11). "That is my take on lean you really try to do more things, at the same time and not to let the patients suffer from it but structurer it smartly"(ID_12). Others report it to be a bit vague, but if it tends to work out, it makes me happy. We can help patiënts better(ID_13). When the kanban is full, we have to stop working. We just don't always do that (ID_7). However, other operational personnel might not be acquainted with lean meeting and argue to dislike all the mandatory meetings. "Sometimes you can gain some time,but that does not impress me much." (ID_13)
	Relational Coordination	I get more emails than before, so I know what going on, but I don't get to see my collegues mor often or something. (ID)4
	Leadership Behaviour	"Without enough or any consent, they started the procedure and reported afterwards; this is what we have done." (ID_14)
	Employee Well-being	I am not for it not against it, I guess I see the value of it, yet I don't feel involved (ID_1).
Good	*Perceived Lean Adoption*	This team "reports being happily surprised when things get taken care of or get done." (ID_12) Lean and continous improvement gives me the extra tools to get a grip on my work(ID_
	Relational Coordination	Through lean, the "lines of communication have become shorter" making it easier to communicate with your peers and superiors. (ID_11) "A lot of the procedures are being changed via a short email commending it to be so." (ID_14) We have always been very open with each other, but now more than ever. You get to see eachother, and that makes stepping up to someone a lot easier (ID_8)
	Leadership Behaviour	The combination of having the opportunity and resources and the encouragement and recognition from your team leaders allow you to explore new non-traditional work-processes and problem solutions (ID_6). [I like it] because lean helps me control three operations quite easily (ID_4). We are mainly here to coach people and encourage ideas. (ID_ 3)
	Employee Well-being	I feel like lean is saving me a lot of time, energy and I feel better because of it (ID_5). Lean helps us keeping work safer, and that keeps me at ease (ID_3)

7. Cross-study Analysis

This chapter will be build-up by means of answering the following three questions; firstly, *How do good and bad lean practices differently related to Employee Well-being?;* secondly, we look at our conceptual model and its hypotheses and answer; *What are the relationships between the constructs: Perceived Lean Adoption, Relational Coordination, Leadership Behaviour, Employee Well-being and Job Performance?* and thirdly, *Which team leaders display effective lean leadership behaviour?"*

7.1 Lean Practices; Good and Bad

How do good and bad lean practices differ in Employee Well-being? We see across the entire sample a wide variety of approaches to adopt the lean principles and implement it to their practices. Our observations, self-rated questionnaires and interviews show a divide in two general factions of lean practices, defined by their adoption.

7.1.1 Perceived Lean Adoption: bad. Firstly, the cause and countermeasures of all problems are not accurately identified through evidence-based methods of problem-solving, therefor reoccurring problems might not be entirely eradicated. Secondly, not all organisations use visual screens for process monitoring and poka-yoka systems to stop or interrupt the work processes. This may result in the primary work processes being found to be more important, or in other words, more "top of mind" and the lack of responsibility towards continuous improvement." But this is what I am hired to do here, improving our work processes is something extra that I am not getting paid extra for". Thirdly, the lack of new innovative products being brought on the market through collaborating with a strategic partner. Almost no participating organisations report contemplated or being engaged with strategic partners working on the innovation of their products — finally, the lack of making thorough use of technology to collaborate with suppliers. There is a large gap in technological systems with these organisations that allow them to collaborate with suppliers. The two main underlying themes we see here are the *lean systems*; lack of evidence-based measures and solutions, inadequate system monitoring and visual management and the *use of lean partnerships*: too little synergetic relationships with partners making use of the available technological innovations available.

From the study 3, we found that the variety upon which employees were learning about innovations on the work floor highly differ between organisations. At the organisations that had adequate recording systems in place team members reported to "*know where to look, but not really check the system regularly, or at all*", as many improvements would become

apparent if a colleague or team leader would point them out upon arrival. Furthermore, in the companies where we saw the lack of physical visual management (e.g. kaizen overview, improvement or A3 sheets displayed for the rest of the department to see), the team members reported to *"feel less valued"* or *"no appropriately seen and rewarded by top management for their efforts"*. This suggests a direct tie to the Employee Well-being, in which an employee that feels valued for its input reflects that back upon its overall perception of the workplace and its leadership. This ultimately results in decreasing interest or participation in continuous improvement initiatives or endorse other team members endeavours.

7.1.2 Perceived Lean Adoption: good In organisations further advanced in their Lean Practices, clear systems are in place that gives structure to the workplace and the work processes. This can be seen in the use of visual screens for process monitoring and poka-yoka systems. The workers have integrated continuous improvement in their daily routines and all individually lean minded ambassadors of their work strategies and with that the lean paradigm. This show by their responsible attitude towards continuous improvement and their work processes. An aforementioned step can be to elevate and seek out lean partnerships that will provide prosperous synergetic relationships. Furthermore, the third study suggests that employees that work at organisations with more systems in place rate their approval of lean high, and report to be "happy with the change", implying a positive indirect effect on their well-being.

7.2 Relationships Between Constructs

"In our conceptual model; What are the relationships between the constructs: Perceived Lean Adoption, Relational Coordination, Leadership Behaviour, Employee Well-being and Job Performance?" We will dissect the hypotheses by their support from the data.

7.2.1 Hypotheses Supported

For hypotheses category 1; direct relations regarding and independent and dependent variables, in our general model, we found support for *Hypothesis 1c.* The Perceived Adoption Lean Practices positively relates to a score of Relational Coordination (Both the Relation and Communication dimension). In our specific model, we also found the same outcome with greater detail om the correlations per the shared communication, ($t=2.94$, $p=.003$) and the share relationships dimension, ($t=1.99$, $p=.047$).

For hypotheses category 2; mediating relations, in our general model, we found support for *hypothesis 2a.* Relational Coordination relates positively to employee well-being. However, our specific model does not support this evidence.

For hypotheses category 3; direct and moderating relationships of Leadership Behaviours, in our general model, we found support for *hypothesis 3a.* Perceived Adoption Lean Practices has a positive relationship with the Leadership Behaviours (Task-, Relations-, Change-oriented). Moreover, the specific model gave us that Perceived Adoption Lean Practices specifically had significant correlations with both *Task-Oriented Leadership Behaviour* and *Relation-Oriented Leadership Behaviour.*

7.2.2 Hypotheses Not Supported

For hypotheses category 1; direct relations regarding and independent and dependent variables, in both models, we could not find support for *Hypothesis 1a.* The Perceived Adoption of Lean Practices relates positively to Employee Well-being and *Hypothesis 1b.* The Perceived Adoption of Lean Practices relates positively to Job Performance. This means that we did not find any evidence in favour of supporting a direct relationship between the independent and dependent variables.

For hypotheses category 2; mediating relations, although we found support for the general hypothesis in our general model, in the specific model, we could not find support for either *Hypothesis 2a;* Relational Coordination relates positively to Employee Well-being or *Hypothesis 2b;* Relational Coordination relates positively to Job Performance.

For hypotheses category 3; direct and moderating relationships of Leadership Behaviours, although *Hypothesis 3a;* Perceived Adoption Lean Practices has a positive relationship with the Leadership Behaviours, has been met in the general model. Only the relation between Perceived Adoption Lean Practices and Task-oriented Leadership and Relations-oriented Leadership Behaviours have been positively supported. *Hypothesis 3b;* Leadership Behaviours (Task-, Relations-, Change-oriented) have positive relations with the Relational Coordination among team members and *Hypothesis 3c;* Leadership Behaviour(s) (Task-, Relations-, Change-oriented) will have a positive moderating effect on the Relationship between Lean practices and Relational Coordination, have not been supported.

7.3 Leadership Behaviour

"Which team leaders display effective lean leadership behaviour?" Study 2 showed that the perceived Lean Adoption correlates significantly positive with the leadership behaviour of the team leaders being Task-oriented and Change-orientated. This can be found interesting as the theoretical background of the profile of a lean leader, does not directly support these findings. Study 3 showed in organisations with Lean Adopted practices; practically everyone questioned reported their team leader to be a "*positive influence"* or *"an agent supportive of*

continuous improvement within the organisation". This is congruent with the finding of the specific teams' leader's behaviour observed in study 1. As the leader plays a more facilitating role, they empower the employee to solve problems. This contributes to their sense of worth within the organisation, thus improving the employees' Job Satisfaction and in turn, its Well-being.

8. Discussion

The goal of this study was to investigate the relation between Perceived Lean Adopting and Employee Well-being. We did this through a multitude of three studies, as we believe that this mixed-method approach adds on to the strength of this thesis. Firstly we assessed leadership behaviour by video observations looking into effective leadership behaviours (Van Dun et al., 2017). Secondly, we determined the relationships between Perceived Lean Adoption, employee well-being and job performance, and how Leadership Behaviour and Relational Coordination moderate and mediate this relationship. Thirdly we investigated the aspects of good and bad lean practices, assessing the themes Perceived Lean Adoption, Relational Coordination, Leadership Behaviour and Employee Well-being.

Which team leaders display effective lean leadership behaviour? Predominantly team 6 showed the most relation-oriented behaviours, which consisted mostly out of active listening and individualised consideration-personal interest. To conclude, showing theses supportive relation-oriented behaviours are favourable to the environment of the day- or week-start in which we have filmed them. They result in over more active participation from operational personnel during the meetings. A possible weakness of this study is that we have chosen not standardised the data of study 1 because trying to standardise a session of 30 minutes to a mean of that of a meeting of 5 minutes would hurt the integrity of the data. For future research, we would recommend that all day starts would either be filmed for the same amount of time or that this variable that is at the core of the identity of the meeting is taken into account differently.

What are the relationships between the constructs: Perceived Lean Adoption, Relational Coordination, Leadership Behaviour, Employee Well-being and Job Performance? The Perceived Adoption Lean Practices positively relates to a score of Relational Coordination, both the Relation and Communication dimension (*Hypothesis 1c)*. Relational Coordination relates positively to employee well-being in our general model (*Hypothesis 2a)*. This claim gets support of the numerous quotes from study 3 in which people draw the following relation: having, transparent systems and guidelines to work by, that ensure that they communicate with

their fellow employees, getting enough face-time and interpersonal communication, allowing them to bond on a personal level, results in a better working environment, which enables them to communicate freely with people they now feel comfortable with instilling a deep appreciation for the work, colleagues and with that life itself, i.e. the Employee's overall Well-being. Yet, our specific model does not support this claim. The lack of significance might be due to lack of statistical power and could be solved by a larger sample of participants.

Furthermore, even though we did not find a significant relationship between relational communication and Job Performance *(hypothesis 2b)* in study 2. In study 3, participants describe that the adoption of Lean Practices, either to "*do more in a day*" (ID_12) or to provide the oversight and clarity to see what their contribution is doing for the team and the organisation. It can be suggested that having a daily reminder of what needs to be done and what has already been done inspires the employees to be more emerged in their work, and again, take more responsibility for their performance and work outcomes.

Our general model also found that Perceived Adoption Lean Practices has a positive relationship with the Leadership Behaviours (Task-, Relations-, Change-oriented). Moreover, the specific model gave us that Perceived Adoption Lean Practices specifically had significant correlations with both *Task-Oriented Leadership Behaviour* and *Relation-Oriented Leadership Behaviour.*

The hypotheses that could not be supported were: *Hypothesis 1a.* The Perceived Adoption of Lean Practices relates positively to Employee Well-being and *Hypothesis 1b;* the Perceived Adoption of Lean Practices relates positively to Job Performance. It can be explained that The Perceived Adoption of Lean and Employee Well-being do not have a direct relationship. Many studies have denounced such a relation (Bouville & Alis, 2014; Genaidy & Karwowski, 2003; Hasle, 2014a; Lindsay et al., 2014; Mathew & Jones, 2013; Parker, 2003; Robinson et al., 2012)

The Perceived Adoption of Lean and Job Performance, however, can be less easily explained as previous studies found a sufficient body of knowledge supporting this hypothesis (Camuffo & Gerli, 2018b; Dani, 2010; Davenport, Allisey, Page, La Montagne, & Reavley, 2016; Womack et al., 1990). It might be that the Perceived Adoption of Lean is not a good predictor as it only measured the perceived lean maturity of an organisation. If this could be the case if the perception of the bias of the employee partaking in the study ("Lean research? Hey, we use lean, a lot!" ID_2), is suggested to be bypassed by having an external objective measure added to the research.

Although *Hypothesis 3a;* Perceived Adoption Lean Practices has a positive relationship with the Leadership Behaviours, has been met in the general model. Only the relation between Perceived Adoption Lean Practices and Task-oriented Leadership and Relations-oriented Leadership Behaviours have been positively supported. *Hypothesis 3b;* The positive relationships between Leadership Behaviours and Relational Coordination among team members and *Hypothesis 3c;* the moderating effect of Leadership Behaviour(s) are have supported. Relationship-Oriented Leadership was expected to appear in lean leaders as earlier found by (Van Dun et al., 2017). The correlation with Task-Oriented Leadership is not directly supported by theory as lean leaders are to be expected to (continuously) challenge traditional approaches; to strive to an continually improving performance, having knowledge-based operations, enabling and promoting teamwork and promoting mutual respect (Liker & Convis, 2012) trades not completed in line with those of Task- and Leadership. We initially did not expect a relationship between the variables *Task-Oriented Leadership Behaviour* and *Relational Coordination,* as it does not find an apparent theoretical basis. However, Van Dun and Wilderom (2019) allude to the possibility that that lean leaders evolve in their task- versus relations-orientation over time, to maintain high team performance.

Future research needs to focus on a larger sample size to yield the desired statistical outcome. Moreover, it would be of great benefit if the researchers could have a measuring of actual adoption, not just a limiting perceived adoption measure. We also must consider that the work performance is a self-perceived measure and can, therefore, be subject to a self-observational bias. Although this is being countered by the anonymity of the study, this countermeasure does not adequately ensure validity. For future research, the beforementioned enlargement of the sample size might equalise this. Another measure of “lean management” would provide the complete validity of the construct as it has been measured in this current study only by the perception of the operational employees.

During study 2, we chose a 2-factor moderation approach over the Product Indicator approach. This approach uses the latent variable scores; these are saved and used to calculate the product indicator for the second stage analysis that involves the interaction term in addition to the predictor and moderator variable (Chin, 1995). In the Product Indicator Approach, all possible pair combinations of the indicators of the latent predictor and the latent moderator variable are being made. These product terms serve as indicators ("product indicators") of the interaction term in the structural model. This latter is an incredibly heavy moderation analysis which could greatly benefit the reliability of the results. Yet the data set

does not meet the requirements nor size to harness such statistical power that we chose for the former approach.

Practical advice we can take away is that leadership behaviour plays an essential part in both implementations of lean but also in sustaining and growing a transparent environment in which share goals and shared relationships, ease employees into conversation with one another. We are convinced that ultimately will this will yield the most significant benefit for both to employee wellbeing and job performance.

"How do good and bad lean practices differ in Employee Well-being?" We found that the combination of having the opportunity and resources, and the encouragement and recognition from your team leaders allow you to explore new non-traditional work-processes and problem solutions. In all organisations that we interviewed people reported being happy with lean, just the way it was introduced or sustained was commented on. When lean is reinforced by team leaders and managers that do not "sell" lean by using the initiatives of the operational personnel. They are not incorporating lean into their company culture, and it is instead seen as an unnecessary burden on top of their actual job. Schein (2010) describes the importance of leaders' behaviour in shaping organisational culture: what leaders pay attention to how they react to critical incidents, how they model for and coach others. This solidifies the importance of a leader that understands the lean paradigm and adopts lean leadership behaviour as described by Van Dun et al. (2017) Lean practices create a transparent environment in which every participating actor is under great scrutiny by the collective. In hostile working environments, this can be confrontation; in the beginning, the employees might not want to facilitate the Lean Practice Adoption from these premises. Among the practical implications of this current study could have been the potential single interviewer bias, as one researcher was assigned per organisation. This could probably only come to fruition during study 3, in which some margin of interpretation was possible due to the nature of the CIT. This could be limited in the future by means of more elaborate interview script.A strength of study 3 was the ease of transcribing and analysing the rich data in natural: "can-you-tell-me-about-your-day?"-Type of questioning. A practical takeaway here is that the forecast for lean implementation is rather good. Even if the practices do not reach its full potential yet, the overall employee wellbeing will benefit.

This study helps us understand more about the relationships between team members and their perception of lean practices and their team leaders. A common point of feedback that employees had was the implementation time of the improvement initiatives. Employees much appreciate being seen and recognised for their efforts. Therefore, visual signs and boards of

improving systems are not only helping to subconsciously nudge their peers to be creative and inspire others to contribute in the same fashion, but it also reinforces the desired behaviour of your employees.

Overall leaders can take away from this study that maximising their positive, supportive behaviours can inspire their employees to find innovative solutions that they later fully endorse and become the ambassador of within an organisation due to their involvement. They can hereby limit their own efforts, i.e. "*Lean makes me lazy; I mean I listen more and do less.*" (ID_12) and fully harness the extent of the knowledge that their workforce possesses. This indicates to produce more output, and as it engages employees more it will attribute to the longevity and well-being of everyone working with lean practices.

Furthermore, we found that major opportunities await many companies as they embark upon a new era of technological advancement, which will allow for new innovative products being brought on the market through collaborating with a strategic partner. The only limiting factors being their willingness to cooperate and openness to inter-organisational cooperation lean practices.

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Appendix A. Letter of Consent (NL)

Individuele toestemming voor deelname aan ons team onderzoek
Overeenkomstig met de richtlijnen van de Ethische Commissie van de faculteit Behavioural, Management and Social Sciences van de Universiteit Twente, vragen wij u om akkoord te gaan met de volgende voorwaarden voordat u deelneemt aan het onderzoek:

1. Ik heb bovenstaande informatie over deze studie gelezen en begrepen, en heb de kans gehad om vragen te stellen aan de onderzoekers.
2. Ik begrijp dat deelname aan deze studie betekent dat ik: (1) zal worden gefilmd tijdens een regulier werkoverleg van mijn team, (2) een vragenlijst invul en (3) eventueel wordt uitgenodigd voor een kort interview met de onderzoeker.
3. Ik neem op vrijwillige basis deel aan deze studie en begrijp dat ik mij te allen tijde kan terugtrekken uit de studie zonder daarvoor een reden te geven.
4. Ik begrijp dat de verzamelde video-, vragenlijst- en interviewdata anoniem wordt verwerkt door de Universiteit Twente (niet herleidbaar naar mij of mijn team) en wordt gebruikt voor wetenschappelijke publicaties en geanonimiseerde feedbackrapportages.
5. Ik geef de Universiteit Twente toestemming om mijn gegevens op te slaan op beveiligde servers voor een periode van 10 jaar na publicatie, welke overeenkomt met de strikte regels van de Universiteit Twente voor het uitvoeren van wetenschappelijk onderzoek.

Mocht u vragen of bedenkingen hebben omtrent het onderzoek, neem dan contact op met onderzoekers David Charles van der Griend of Tanja van Dooren van de Universiteit Twente via d.c.vandergriend@student.utwente.nl of a.vandooren@student.utwente.nl
Het onderzoek wordt begeleid door dr. Desirée van Dun, van de vakgroep Change Management & Organizational Behaviour van de Universiteit Twente (www.utwente.nl/cmob).

Appendix B. Study 1: Code Book

The codebook used in this study has been validated and used by (Van Dun et al., 2017).

Table 14.

Video-coded Micro Behaviour Descriptions and Examples

Micro behavioural Codes	Description	Example Situation [a]
1. Correcting	Calling someone to order; telling someone not to do something	"No, you should not do it like that."
2. Delegating	Distributing obligatory tasks	"I want you to handle this improvement idea."
3. Task Monitoring	Checking the status or asking for clarification on the status; referring to visual dashboards	"How are we doing in terms of Job Performance ?"
4. Informing	Sharing factual information with team members	"I have called our customer to discuss her complaint."
5. Visioning	Sharing own opinion or determining a strategy	"In my opinion…" or "I foresee…"
6. Structuring the Meeting	Enabling an efficient and effective meeting	"Let me summarize our decision."
7. Executing Individual Tasks	Performing operational work tasks	During a meeting: Continuing daily work while the meeting already started; during daily work: Working behind his/her workstation/computer
8. Agreeing	Showing that he/she shares the same opinion	"I agree with you."
9. Individual Consideration	Showing a personal interest or giving individual attention	"So you are going on a holiday to Turkey, right?"
10. Intellectual Stimulation	Asking for root causes, ideas; inviting people to share views	"Why do you think this problem keeps nagging us?"
11. Active Listening	Showing that he/she is paying attention and hears you	Nodding, making eye contact while being in a conversation
12. Showing Disinterest	Responding impersonal, distant, or inaccessible	During a meeting: Turning his back to the team leader; during daily work: Watching away or not paying attention while a colleague is talking to him/her
13. Defending One's Own Position	Safeguarding his/her own interests and showing his/her own value	"Let me handle this. I know this person for quite some time, and I know exactly how to handle this situation"
14. Providing Negative Feedback	Responding unfavorably to someone or judging someone	"You are too late: you should be here around 10:00 PM."
15. Disagreeing	Showing that he/she does not share the same opinion	"I don't think that is a good idea."

[a] All example situations were taken from (Van Dun et al., 2017) study's video-based dataset.

Appendix C. Study 1: Post-Video Observation Questionnaire (NL)

Directly after every video recored meeting the following short questionnaire was either asked or dispersed on a paper handout.

Table 15.

Three-item post-meeting questionnaire (Dutch Version)

Vergeleken met vergelijkbare vergaderingen met uw team, hoe anders was …	Helemaal anders	Wel anders	Enigszins anders	Neutraal	Enigszins gelijk	Niet anders	Helemaal niet anders
1. deze vergadering?	O	O	O	O	O	O	O
2. uw gedrag gedurende deze vergadering?	O	O	O	O	O	O	O
3. het gedrag van uw collega's?	O	O	O	O	O	O	O

Table 16.

Three-item post-meeting questionnaire (English Version)

In comparison with similar meetings with your team how different was…	Completely different	Somewhat Different	Slightly Different	Neutral	Slightly the same	Somewhat the same	Completely the same
1. .. this meeting?	O	O	O	O	O	O	O
2. .. your behavior during this meeting?	O	O	O	O	O	O	O
3. .. the behavior of your colleagues?	O	O	O	O	O	O	O

Table 17.

Dagboek Onderzoekers (Diary Reserachers)

Item	Answer
Naam onderzoeker:	*David Charles van der Griend*
Datum:	
Organisatie:	

1. Hoe reageerden de teamleden vandaag op jouw aanwezigheid? Kun je daar een voorbeeld van geven?

2. Wat is jou vandaag opgevallen in de vergaderingen die je hebt bijgewoond?

Vergadersetting (1): Omschrijving:

Vergadersetting (2): Omschrijving:

3. Wat is jou vandaag opgevallen in de meeloopsessies die je hebt gedaan?

Meegelopen met (1): Omschrijving:

Meegelopen met (2): Omschrijving:

4. Welke opvallende momenten heb je nog meer gezien?

Appendix D. Product Indicator moderation

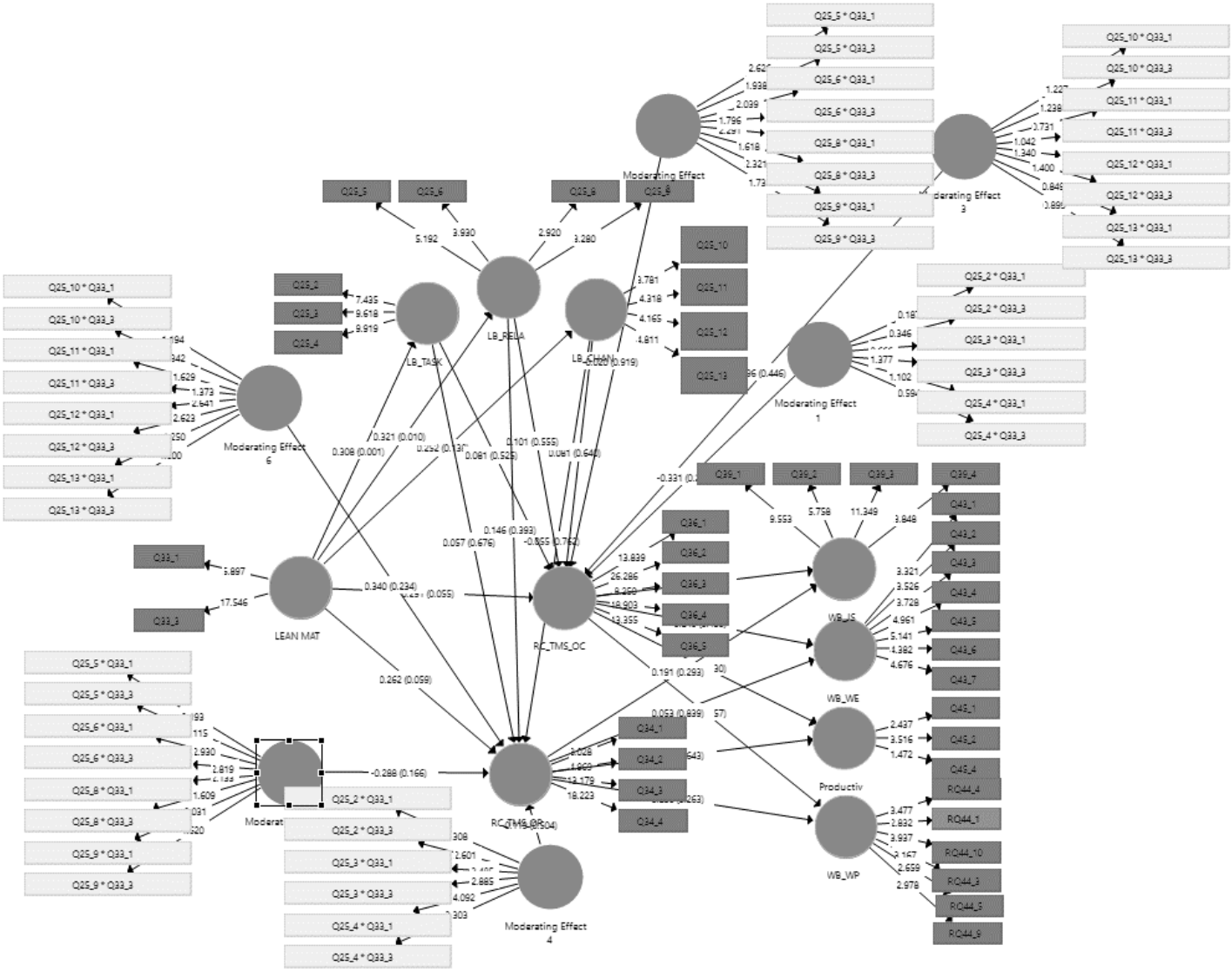

Figure 6 Specific Structural Model ran with Product Indicator Moderation

Appendix E. Invitation Materials

Figure 7 Invitation Flyer Lean Wellbeing Study (Dutch Version) First Page.

Figure 8 Invitation Flyer Lean Wellbeing Study (Dutch version) Second Page.

THE RELATIONSHIP BETWEEN LEAN PRACTICES AND EMPLOYEE WELL-BEING

Are you working with Lean or Continuous Improvement and do you want to improve the well-being of you employees? Do you want to receive thorough and scientifically based advice on how you can improve any further?

Then we are looking for your team or department!

For our research, two MSc students from the University of Twente, are looking for operational teams that are:

- **Working** with **lean/continuous improvement** for at least 1 year as part of their strategy,
- **Continuously improving** their way of working,
- Have had a **relatively stable year**,
- Achieving **results** with this approach.

When your organisation has been selected, we will visit your location for **two day for observations,** in return you will receive **free, scientifically based tailor-made advice** on how you can further optimize continuous improvement.

Would you like to participate or receive more information? Contact researcher David Charles van der Griend: d.c.vandergriend@student.utwente.nl or call: **+31 (0) 53 204 05 12**

Tanja van Dooren, Master student Business Administration

David Charles van der Griend, Master student Psychology

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Figure 9. Invitation Flyer Lean Wellbeing Study (English version) first page.

WHAT DOES RESEACH PARTICIPATION ENTAIL?

Investment: Upon approval, we'll visit your location for two days.
During our visit we will:

- Record (video) observation of regular work situations,
- Conduct short interviews,
- And distribute a questionnaire among your employees and managers.

Example earlier study (Researcher right):

During our visit we will remain in the background as much as possible, so the daily course of actions within your team can continue. The data collection meets the privacy guidelines of the General Data Protection Regulation (GDPR) and we process the results anonymously. Options to plan visitation dates are in the period **of May to August, 2019**.

Results: You will receive **free, independent, scientifically based advice** on how your team can further optimize and an insight into the performance of other lean teams. We offer a report that you can use in the development of your team.

Initials Findings: Previous research by research leader Dr. Desirée van Dun provided practically useful advice, and can be found here: https://tinyurl.com/y6q8xgvq

Sign Up: via d.c.vandergriend@student.utwente.nl of call:
+31(0) 53 204 05 12

Onderzoeksleider:
Dr. Desirée van Dun
https://www.utwente.nl/en/bms/cmob/staff/dun

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Figure 10 Invitation Flyer Lean Wellbeing Study (English version) Second page.