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A psychological Study of Team Effectiveness and Leadership in Scrum Teams

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Abstract

The implementation of Scrum in companies as an agile software development methodology is increasing rapidly. According to the Scrum guide, Scrum is a framework that—among others—consists of a Scrum team with certain roles (Scrum Master, Product Owner, Developers). The Scrum team is seen as self-organizing and, as a consequence, Line Managers often experience a feeling of unnecessary. This psychological thesis aims to give Line Managers hands-on advice about their leadership role. This is done through the examination of team effectiveness of Scrum teams and the understanding of what leadership is, who the leading roles are and what responsibilities they have. Team effectiveness is examined on the basis of Hackman's model of team effectiveness (2002) and assessed with the Team Diagnostic Survey (Wageman et al., 2005). Leadership was assessed using aspects such as: the role of the team leader in Scrum teams, the understanding of what leadership is, and the roles (Scrum Master, Product Owner, Developer, Scrum team, Line Manager) associated with leadership. 24 Swiss Scrum teams participated in the online study. The results show that the leadership of a Scrum team is shared among the members themselves, including the leadership role of the Line Manager and the other Scrum roles. Leadership profiles for Scrum roles and the role of the Line Manager as well as recommendations for future actions for Scrum practitioners are given.

Key words: Scrum teams, team effectiveness, self-organizing teams, shared leadership

Zusammenfassung

Scrum, als agile Softwareentwicklungsmethodologie, wird in immer mehr Unternehmen eingeführt. Gemäss dem Scrum Guide bildet Scrum ein sogenanntes Rahmenwerk, welches u.a. aus einem Scrum-Team besteht. Innerhalb dieses Scrum-Teams besitzen die Teammitglieder verschiedene Rollen: Scrum Master, Product Owner und Entwickler. Dadurch, dass Scrum-Teams sich selbst organisieren, fühlen sich Linienmanager oftmals überflüssig und nicht gebraucht. Diese psychologische Masterarbeit unterstützt Linienmanager darin, ihre Führungsrolle (neu) zu entwickeln. Zum einen wird dabei die Teameffektivität von Scrum Teams untersucht und zum anderen das Führungsverständnis sowie die führenden Rollen inklusive ihrer Verantwortlichkeiten im Rahmen von Scrum. Das Model der Teameffektivität wird dabei mithilfe des Team Diagnostic Surveys empirisch erhoben. Führung dagegen ist durch Aspekte wie z.B. die Rolle der Teamleitung in Scrum-Teams, das Führungsverständnis oder auch die mit Führung assoziierten Rollen (Scrum Rollen und die Rolle des Linienmanagers) operationalisiert. An der Onlineumfrage nahmen 24 Schweizer Scrum Teams teil. Die Ergebnisse zeigen, dass Führung im Rahmen von Scrum geteilt ist, d.h. sowohl von den Scrum-Rollen als auch vom Linienvorgesetzten übernommen wird. Zum einen werden Führungsprofile für alle Scrum-Rollen und die Rolle des Linienvorgesetzten vorgestellt, zum anderen auch Handlungsoptionen für Scrum-Praktiker gegeben.

Schlüsselwörter: Scrum-Teams, Teameffektivität, selbstorganisierende Teams, geteilte Führung

A Psychological Study about Team Effectiveness and Leadership in Scrum Teams

This thesis is written within the context of software development. Unlike industrial product development, software development is not about mass production, but about creating unique solutions for special problems or concerns (Dirbach, Flückiger, & Lentz, 2011, p. 1). Certain characteristics make software development a highly demanding procedure: there can be a lack of knowledge about the output, the goal is unclear, there are different solution possibilities that need to be balanced out, a compromise must be found or the context of software development is dynamic (Dirbach et al., 2011, p. 17).

Approximately every two years, The Standish Group provides an overview of the causes of successful and failed software development projects. Their research started in 1994 and is seen as one of the largest longitudinal studies in project management. In 2013, 365 respondents said that only 16.2 % of all projects were successful¹, whereas 52.7 % were challenged² and 31.1 % were cancelled, as was summarized by Project Smart³ (2014, p. 4). In order to find out why software development projects either succeed or fail, The Standish Group developed success and failure project profiles. According to them, the three major reasons why projects succeed are (a) user involvement, (b) executive management support and / or (c) clear statement of requirements. The corresponding reasons why projects are challenged or impaired are (a) lack of user input, (b) incomplete or changing requirements and specifications as well as (c) lack of resources (Project Smart, 2014, pp. 8–9). Based on this data, more attention and greater caution should be paid to the appropriate design of a software development project.

¹ (project completed on-time, on-budget, all features included)

² (project completed but not on-time, not on-budget, fewer features included)

³ Project Smart is an institution that offers professional insight in project management for managers via their website <http://www.projectsmart.co.uk/>.

The following chapter introduces the subject area of Scrum teams and self-organizing teams as their psychological equivalent. The methodologies of software development are introduced first but with the focus on Scrum. Scrum teams will then be analyzed under two psychological aspects: *team effectiveness* and *leadership*. Therefore, the model of team effectiveness developed by Richard Hackman (1987; 2002) and an overview of adequate leadership theories is presented. Based on these theoretical analyses the research questions and hypotheses of this thesis are stated, considering the vested interest of the practice partner. The second chapter presents empirical methods, such as a questionnaire to collect data, and the appropriate methods of data analysis. The third chapter presents the results which are interpreted in the fourth chapter. This last chapter also includes a methodological discussion as well as recommendations for future action.

Software Development Methodologies

Around the turn of the millenium, there was a change in how software development projects were run. Before the change, all time-relevant, financial and organizational aspects had to be defined clearly and decisively at the beginning of a project in order to accomplish the software development projects (Wieczorrek & Mertens, 2011, pp. 104–105). The result was a schedule that showed the product, budget and personnel requirements as well as additional resources and deadlines. According to this fixed schedule, every project team member (individually) executed his or her tasks and responsibilities in order to deliver a product that should meet the client's expectations. This traditional style of project management is called *Waterfall*. It has its roots in Taylorism (Dirbach et al., 2011, p. 7) and describes the linear, sequential and plan-driven project management methodology, and because software development was seen more as an engineering process, it made sense to use it (Tripp, 2012, p. 1). According to Takeuchi and Nonaka (1986) this sequential approach itself is comparable

to “a relay race with one group of functional specialists passing the baton to the next group. The project went sequentially from phase to phase: concept development, feasibility testing, product design, development process, pilot production, and final production” (p. 137). Winston Royce (1970), the father of Waterfall project management (Wieczorrek & Mertens, 2011, p. 105), emphasizes that besides keeping to a certain sequence of steps, the proper management of software development projects is also about extensive documentation in order to control the process and minimize mistakes (pp. 332–333).

However, since external and internal contexts change continuously, it is necessary to adapt and be able to easily change goals and processes (Wieczorrek & Mertens, 2011, p. 104). Having a fixed procedure can then lead to abnormally large expenditures for the changes which can take on a life of their own and escalate into absorbing many important organizational resources. Above all, people working with a set procedure almost never meet the agreed objectives (Keil, 1995, p. 421), and if they do, the business value is only realized at the end of the project (Tripp, 2012, p. 2). Additionally, software development teams are expected to deliver business value as quickly as possible due to greater competition and faster technical innovation within the software development branch. Hence, such teams should be highly adaptive to a quickly changing market, higher user expectations and technical modifications (Tripp, 2012, p. 2). Besides the dynamic markets being a source of unpredictability and uncertainty, Jeff Sutherland (2012) adds the human factor: “its [Waterfall’s] great strength is that it is supremely logical – think before you build, write it all down, follow a plan, and keep everything as organized as possible. It has just one great weakness: humans are involved” (p. 12).

As a result of this contradiction between dynamic, complex markets, on the one hand, and linear project management methods on the other, today’s projects are challenged (Wieczorrek & Mertens, 2011, p. 106) or can even fail (see also Project Smart, 2014).

Therefore, linear project management is now being criticized as the correct way to develop software and, as a result, more and more companies⁴ are implementing *agile* methodologies as their new way to manage the requirements of highly complex knowledge work, which is software development.

In Switzerland, the University for Applied Sciences and Arts Northwestern Switzerland and the Zurich University of Applied Sciences researched the dissemination of agile methods and produced The Swiss Agile Study. In 2014, approximately 101 IT-companies and 128 IT-professionals participated. The results show that 70 % of the participating firms and 83 % of participating IT-professionals use agile software development (Kropp & Meier, 2015, p. 9). Furthermore, both IT-companies and IT-professionals are significantly more satisfied with agile methodologies than with the traditional, plan-driven software development management (Kropp & Meier, 2015, p. 11). More than 49 % of all IT-companies use agile methodologies in more than half of their teams and some 19 % use it for all teams (Kropp & Meier, 2015, p. 14). In addition, the Suisse Agile Study that was conducted in 2012 revealed that 83 % of all IT-companies implemented agile software development methodologies in order to enhance their ability to manage changing priorities and 67 % use them to reduce risk (Kropp & Meier, 2013, p. 23). Most frequently, IT-companies use the agile methodology Scrum, which is used by 59 % of all sample respondents (Kropp & Meier, 2015, p. 10). Being able to plan iteratively is supposed to be the main success factor of software development. This aspect happens to be one of the main criteria of agile methodologies (as will be shown later using the example of Scrum) (Kropp & Meier, 2015, p. 23) and is also supported by the results of The Chaos Report (Project Smart, 2014, p. 16).

⁴ The implementation of agile methodologies is not advisable for all software development team. Both Waterfall and agile methodologies can be found in software development companies (Kropp & Meier, 2012, p. 11).

In addition, Jahnke, Ruf, and Ziegler (2012) explain how agile methods increase the product acceptance of both users and developers: agile methods belong to the light weight software development methods which means that project goals are not firmly set at the beginning of a project, thus leaving room to adapt and concretize product requirements throughout the development process. Short and repeated development cycles as well as regular testing with the user provide customers and developers with more control and flexibility to react to changes. As a result, user acceptance increases.

There are several methodologies to develop software with more agility: eXtreme Programming, Scrum, Feature Driven Development and Kanban. In 2011, practitioners of agile methodologies met to create the Agile Manifesto, which is the philosophical underpinning of every agile methodology and can be seen Figure A1. As a result of these principles, agile workers should be enabled to more easily deal with complexity than software developers who use the linear approach (Wieczorrek & Mertens, 2011, pp. 110–112). Additionally, agile methodologies emphasize less documentation, earlier and continuous delivery of software, the cultivation of empowered teams and the creation of simple solutions (Tripp, 2012, p. 2).

Gaining Agility through Scrum

In order to describe Scrum, there is only one source that can be referred to: The Scrum guide, even though it is only 16 pages long provides plenty of room for various interpretations of Scrum. Hence, there is no one right way to perform Scrum and there is abundant secondary literature on how Scrum should be understood. The Scrum guide, though, is the foundation of all of them and therefore, will be introduced in the following chapter, all other literature will be excluded.

The authors, Ken Schwaber and Jeff Sutherland, conceived Scrum in the early 1990s and first published their idea in 2010. This thesis is based on the third version (2013). Therein, Scrum is seen as "a framework within which people can address complex adaptive problems, while productively and creatively delivering products of the highest possible value" (Schwaber & Sutherland, 2013, p. 3). To do so, teams are designed, so-called Scrum teams, which include certain roles (Scrum Master, Product Owner, Developers), artifacts and events. However, the original idea for Scrum as teamwork came from Hirotaka Takeuchi and Ikujiro Nonaka and was developed within the context of product development. In their paper, they adapt the Scrum method from rugby which uses a Scrum to restart play. Two rugby teams face each other, each team standing in three rows. As soon as the referee gives a certain signal, the two teams intertwine and push against each other with the heads of the first row players meshed together. The teams then form a tunnel with their heads at thigh-level, almost lying on the ground. At this point, one team throws the ball into this tunnel. Both teams now try to take possession of the ball by using only their feet to kick the ball backwards into their half of the field. In this process, both teams form a pack, move as a pack and stay as a pack. Takeuchi and Nonaka (1986) claim this teamwork to be of great relevance for product development and state that the sequential approach of software development "may conflict with the maximum speed and flexibility. Instead, a holistic or 'rugby' approach—where a team tries to go the distance as a unit, passing the ball back and forth—may better serve today's competitive requirements" (p. 137).

Sutherland himself refers to Scrum as a *compression algorithm* and refuses to use the terms like *development method* and *formal process* (Sutherland, 2012, p. 5). Komus (2014), in addition, refuses to call Scrum *project management* because it is not limited in time and the goals as well as resources are not as definite as they would be in traditional project management (p. 14). Hence, Scrum is used in the context of software development projects

but it does not fulfill the definition of project management. Therefore, this thesis uses two terms when referring to Scrum: (1) Scrum as a *framework*—the original wording according to the Scrum guide—and (2) Scrum as a specific *methodology*, which is “a set of methods and principles used to perform a particular activity” (Hornby, 2000, p. 803). With this definition, Scrum is understood to be a bundle of several methods which includes principles, such as the Agile Manifesto, and is not limited in time or to similar aspects such as resources.

Every action that takes place within the Scrum framework serves three principles: transparency, inspection and adaptation. In short, everything that is of importance for the production process and its contributors needs to be shared and made transparent. Inspection and adaptation are the two main tools to identify the potential for improvement (Schwaber & Sutherland, 2013, pp. 3–4). To do so, Scrum practitioners can use three instruments: the roles in a Scrum team, the events and the artifacts which build the Scrum framework. These instruments will be explained in the following section.

The roles in a Scrum team.

There are three roles in a Scrum team: a Scrum Master, a Product Owner and Developers (Schwaber & Sutherland, 2013, p. 4). Depending on the complexity of the team’s purpose, there can be more Developers and also more than one Scrum Master and one Product Owner per team. A fixed constellation of roles does not exist, but all roles have to be fulfilled. It is also possible (and in small teams sometimes even necessary) that one person has several Scrum roles. Additionally, a team member can have a Scrum role and an organizational role (e.g. as a Line Manager) at the same time.

Scrum teams in general are self-organizing and cross-functional teams. This means that the team decides on its own how to accomplish its work best. There is no other person to direct them. Cross-functionality provides team members with all competencies needed to

accomplish the work without depending on non-team members (Schwaber & Sutherland, 2013, p. 4). A Scrum team has between three and nine members. The Scrum Master and the Product Owner are included in this number only if they work on the Sprint Backlog⁵ (Schwaber & Sutherland, 2013, p. 6).

Generally speaking, the "Product Owner is responsible for maximizing the value of the product and the work of the Development Team" (Schwaber & Sutherland, 2013, p. 5). To fulfill this role, the Product Owner is the representative of the customer and, therefore, is the only one responsible for the Product Backlog⁶. It is still important, though, that the tasks of the Product Owner are executed under his or her order—whether he or she personally executes them, or delegates them to the Development Team is unimportant. Hence, the Product Owner is always accountable for the management of the Product Backlog. The organisation itself has to respect the decisions of the Product Owner and is not allowed to direct the Development Team without having received permission from the Product Owner (Schwaber & Sutherland, 2013, p. 5).

"The Development Team consists of professionals who do the work of delivering a potentially releasable Increment of 'Done'⁷ product at the end of each Sprint" (Schwaber & Sutherland, 2013, p. 5). The Increment of a product is the sum of all the product requirements that have already been developed. At the end of each Sprint, this Increment needs to be usable. Although a Scrum team can have specialists working on subthemes and task areas, the

⁵ A Sprint Backlog is a list of specific product requirements, which are also called *items* that have to be developed within a certain period of time, which is called a Sprint. It will be explained in more detail during the course of this chapter.

⁶ The Product Backlog is the overall list of product requirements that includes all the Sprint Backlogs for the entire period during which the software is being developed. It will be explained in more detail during the course of this chapter.

⁷ The Scrum team needs to have a shared understanding as to when work is considered completed. If it is completed, it is "Done" and the team knows that they have accomplished their Sprint goals from the Product Backlog (Schwaber & Sutherland, 2013, p. 15).

whole team remains responsible for the Increment they produce during one Sprint (Schwaber & Sutherland, 2013, p. 6).

The Scrum Master is the person who makes sure that Scrum is understood and performed well by each team member. To do this, he or she “serves” the Product Owner, the Development Team and the organization and is, therefore, called a servant-leader. The Scrum Master’s service to the Product Owner, for example, is to support him or her leading the Product Backlog. The Scrum Master’s service to the Development Team is to eliminate impediments and to protect the team from interruptions so that they can work undisturbed. The Scrum Master’s service to the organization is to make everybody understand what Scrum is and how it works (Schwaber & Sutherland, 2013, pp. 6–7).

The Scrum events.

In Scrum, the work process is structured during several meetings which take place during one Sprint, a time-box of two to four weeks. During a Sprint, the Scrum team produces a usable and potentially releasable product Increment. Each meeting is time-boxed, which means that the length of any meeting is set in advance (Schwaber & Sutherland, 2013, pp. 7–8).

At the beginning of each Sprint, there is a Sprint Planning Meeting during which the Development Team decides what will be delivered after the Sprint and how the work will be executed (Schwaber & Sutherland, 2013, p. 8). The Development Team makes the final decision about the Sprint Backlog based on their capacities. However, this Backlog is dependent on the Product Owner’s Product Backlog and the Scrum Master’s moderation which is why every role is present at this meeting. After the items⁸ have been selected, the Scrum team sets a goal for the Sprint which specifies the Increment of the product and guides

⁸ Items are product requirements that will be developed within a Sprint.

the team through the Sprint. The Sprint goal functions as a milestone throughout the entire software development process. Additionally, the team agrees on how to accomplish the aims of the Sprint (Schwaber & Sutherland, 2013, pp. 8–10).

Every day at the same time and place, a 15-minute Daily Scrum takes place. During this meeting, everybody on the Development Team gives a quick update about the work they have done since the last meeting, their next tasks and / or potential obstacles. Due to the Daily Scrum, everybody knows what is going on within the team and the need for help is revealed. Therefore, some team members often continue discussing about their problems after the meeting (Schwaber & Sutherland, 2013, pp. 10–11).

At the end of each Sprint, there is a Sprint Review "to inspect the Increment and adapt the Product Backlog if needed" (Schwaber & Sutherland, 2013, p. 11). This meeting provides both the complete Scrum team and the stakeholders (e.g. the client) with feedback and can help to improve collaboration. In general, the Product Owner states which items are "Done" and which are not. Then, the Development team talks about any problems during the Sprint and their solutions (if they were solved). Budget, timeline and potential capabilities are also reviewed. The Scrum Master, again, functions as the keeper of the time-box and the moderator. During the meeting, the Product Backlog can change, and becomes the basis for the next Sprint Planning Meeting (Schwaber & Sutherland, 2013, p. 11).

Given that the Sprint Review is more product- rather than Increment-focused, the Sprint Retrospective focuses on the people, the process as well as the tools and the relationships. The participants are the Development Team and the Scrum Master who is in this case an equal team member. The Scrum Master's task, again, is to maintain the time-box and to ensure that everyone understands the purpose of the meeting. The Scrum Master also encourages the team to find better ways or possibilities to improve themselves personally during the next Sprint (Schwaber & Sutherland, 2013, pp. 11–12.).

The Scrum artifacts.

In general, artifacts are documents that ensure transparency so that everyone is kept up-to-date and has access to the same information. This is necessary to enable inspection and adaption according to the Scrum theory (Schwaber & Sutherland, 2013, pp. 3–4).

The Product Backlog, the first artifact, is "an ordered list of everything that might be needed in the product and is the single source of requirements for any changes to be made to the product" (Schwaber & Sutherland, 2013, p. 12). The content, availability and ordering of it is the sole responsibility of the Product Owner. The Product Backlog can never be complete, as Scrum addresses the impossibility of predictions. Therefore, it is dynamic and changes can be made throughout the developing process. As a consequence, it only contains product items that are valid for the first Sprint(s) (Schwaber & Sutherland, 2013, pp. 12–13).

The second artifact is the Sprint Backlog which contains the selected product Increment items for the upcoming Sprint plus the delivery plan. In more precise words, the Sprint Backlog emerges during the working process, as it states what kind of work the Development Team will do in order to have developed the product Increment at the end of a Sprint (Schwaber & Sutherland, 2013, p. 13).

The third artifact is the product Increment which is the sum of all items that have met the "Done" requirements from the past Sprints. The product Increment, therefore, is always a usable product (Schwaber & Sutherland, 2013, p. 14).

To sum up, during the developing process, responsibilities are distributed among the three roles: the Scrum Master, the Product Owner and the Development Team. In traditional software development, it is the Line Manager or project manager who is in charge of the product development and who assigns tasks to his or her team members. With Scrum, however, this conventional model changes.

The following section introduces a psychological model that allows a better understanding of Scrum teams.

Psychological Review of Scrum Teams

To start with, the author was interested whether there was any (psychological) research on Scrum teams that provided a better insight on how these teams work. Several psychological databases were searched: OvidSP (including PsycINFO, PsycARTICLES and PsycARTICLES Full Text) using keywords such as “Scrum” and “teams” in all search fields⁹ as can be seen in Table A1. 24 studies were found, of which 14 were excluded because they were written in the context of text mining techniques, neuroinformatics or rugby, as examples and had no connection to this thesis. All the studies that were related to Scrum teams have one thing in common: they only focus on individual aspects of Scrum teams such as control mechanisms. To the author’s knowledge, no existing study has explored Scrum teams using a psychological theory or model that pays attention to multiple aspects of teams. This thesis, though, provides a broad understanding of Scrum teams and focuses on multiple aspects of a team. Although all the articles were found in psychological databases, only one study had been published in a psychological journal (Oertel & Antoni, 2013) and the only connection between this article and Scrum were the references. Even though Scrum teams are of interest to multiple disciplines, contributions by psychological research are lacking.

⁹ Searching for „Scrum team“ led to one result in the context of recommender systems. Searching for “Scrum” and “team” showed 20 results which were also among the results of the search for “Scrum” and “teams”.

The model of team effectiveness.

Since the mining of psychological databases did not lead to useful results, the author looked for already existing psychological models of team work in order to see, whether they could serve as a basis for this thesis. The result was the normative model of team effectiveness by social psychologist, Richard Hackman (1987; 2002). This model uses variables that are (a) *powerful*, they are able to significantly differ between effective and non-effective teams, (b) *manipulable*, they can be changed and (c) *assessable*, they can be understood and used (Hackman, 1987, p. 322). As a consequence, those variables can be used for research and for organizations in order to analyze the strengths and weaknesses of their work teams. Hackman (1987) broadly defines the relevant teams that can be addressed with the model: teams need to be real which means that they truly exist as a social system and have boundaries as well as a clear role division among team members. They need to work on at least one task that results in a certain product and be embedded in an organizational context (Hackman, 1987, p. 322). In 2005, Hackman and his colleagues published the final model (Wagemann et al.) which is the basis of this thesis. To explain it, though, the author refers to Hackman's extensive model overview in his book *Leading Teams: Setting the stage for great performance* (2002). As can be seen in Figure 1, the model of team effectiveness consists of three variables which are core conditions: creating a real team, giving the team a compelling direction and an enabling structure. Additionally, a supportive organizational context and the availability of expert coaching can help a team benefit from those core conditions. All five conditions affect the overall team effectiveness. In addition, the model assesses certain process criteria. However, the model is not an input-process-output model and does not state any causalities. Since there is no assumption what kind of influence process criteria have, they are not included in the model (Wageman et al., 2005, p. 375). All aspects—the five conditions, the process criteria and the team effectiveness—will be described in detail in the following section.

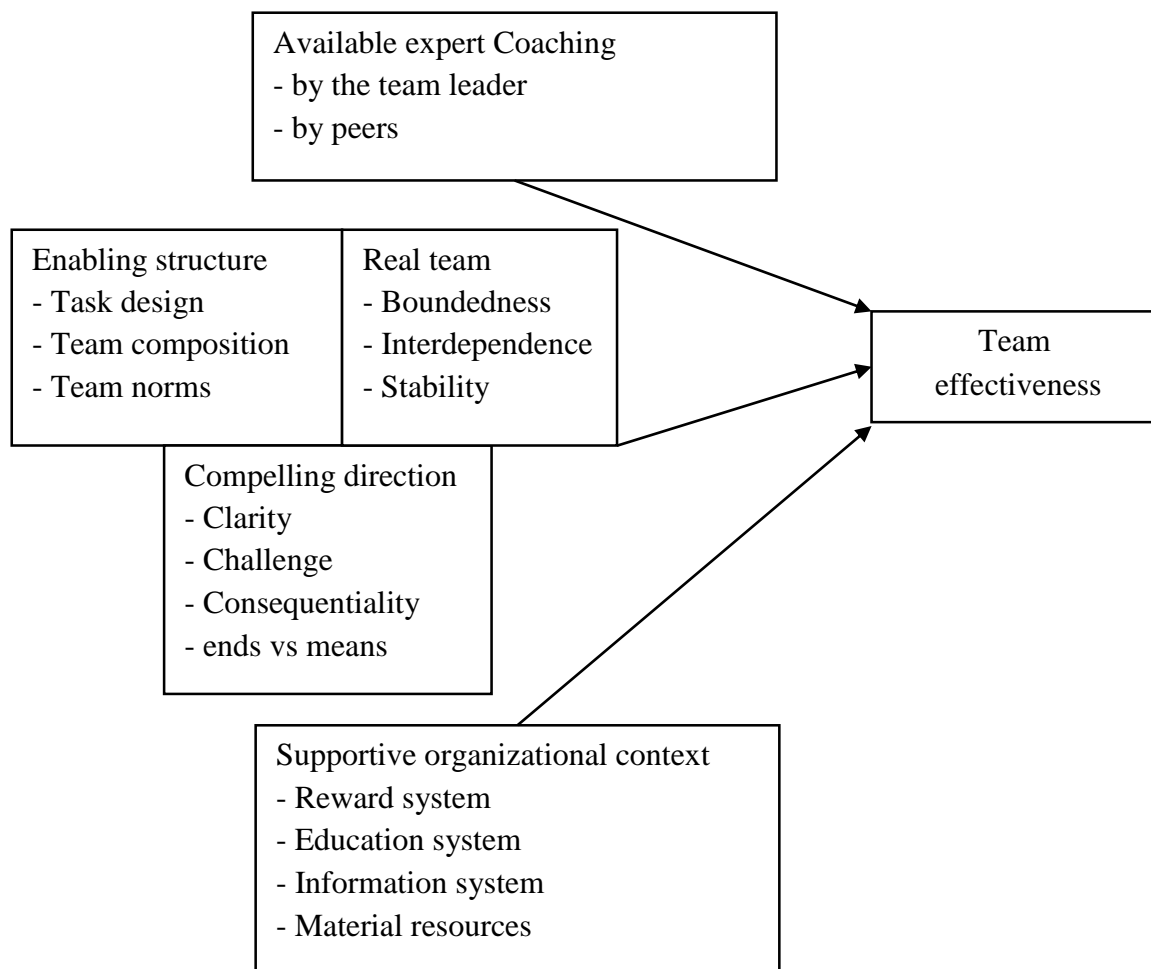


Figure 1. The model of team effectiveness by Wageman et al. (2005).

Real team.

According to Hackman (2002), a *real team* has the following features: the team task, clear boundaries, membership stability over a specific period of time and finally, clearly specified authority.

To be a team means someone is able to make a list with all the definite members of the team. Everybody on this team needs to clearly know who shares the responsibility and the accountability for the product and who, in contrast, helps out in some way but only sometimes belongs to the team. Teams that are too bounded or not bounded enough have either not

enough clarity about their members or too rigid borders with other departments. Both extremes lead to an instable team basis and for this reason, a team needs *clear and moderately open boundaries* that are clearly marked by everyone (Hackman, 2002, pp. 44–50).

Stable teams maintain their composition for a longer period and are able to develop familiarity among each other which makes it possible to focus on working together rather than getting to know each other. Furthermore, familiarity contributes to a team mental model of the performance situation that is positively related to team effectiveness (Mohammed, Ferzandi, & Hamilton, 2010, pp. 891–894). In addition, a stable team quickly learns how to utilize each other's strengths to be (even more) effective and to deal with weaknesses to avoid process losses (Hackman, 2002, pp. 54–56).

The *extent of a team's authority* rounds off the features of a real team. The authority of a team must be correctly clarified, adequately formalized and made transparent. Once a new team has been built, the manager has to make clear, which decisions are team decisions and which are not. However, both the manager and the team will experience anxiety and fear, when a certain extent of authority is transferred from a manager to a work team. Hackman observed an underuse of authority in newly formed teams and an overuse of authority in experienced and successful teams which overestimated the extent of their authority. To find the most appropriate level of authority for a team, Hackman introduces an authority matrix, which has four different kinds of decisional power combinations on the x-axis: (1) manager-led teams, (2) self-managing teams, (3) self-designing teams, (4) self-governing teams. On the y-axis, there are four core functions that need to be fulfilled: (1) the execution of the work, (2) the monitoring and management of the work process, (3) the designing of the team as a performing unit and the arranging of the needed organizational support and (4) to setting of the team's direction. Manager-led teams, i.e., are teams with the lowest decisional power and

decide only on the execution of their work. Self-governing teams, on the contrary, decide on all four functions (Hackman, 2002, pp. 50–54).

Compelling direction.

Providing a *compelling direction* for a team means setting goals and purposes in a competent and convincing manner (Hackman, 2002, p. 63). There are three attributes of direction setting, each serves a different function: (1) *challenging* team purposes are energizing, which enhance the motivation of the team; (2) *clear* purposes orient and link the performance strategy to the purpose; and (3) *consequential* purposes engage to foster full utilization of knowledge and skill (Hackman, 2002, pp. 63–72). Wegge (2004) offers further explanations for how goals can be set and how they affect a teams' effectiveness (pp. 261–340). Furthermore, direction setting can mean defining either the ends (e.g. the team's goals), the means (e.g. the performance strategy and methods to achieve the goals), both or neither of them (Hackman, 2002, pp. 73–83). According to Hackman (2002), setting a compelling direction belongs to the responsibilities of an authority, which is why this will be discussed later in the leadership part of this thesis.

Enabling structure.

The third core condition stresses the importance of making adequate decisions about the correct *extent and form of the team's structure* and advises “to differentiate wisely between critical and unnecessary structural features” (Hackman, 2002, p. 95). Both too much and too little structure can cause a team to fail, even if it is a real team and has a compelling direction. In order to provide an enabling structure it is important to take care of (1) the design of the

work of the team (the team task), (2) the core norms of conduct and (3) the composition of the team.

There is a clear distinction between tasks that are made for individuals and tasks that are to be solved by teams. Sometimes, groups who are called “teams”¹⁰ perform tasks that were originally meant for individuals. Hackman (2002) calls these groups “co-acting groups” because members often work in proximity to one another, but one member does not rely on the completion of another member’s work, e.g. in call-centers. Team members do not need to cooperate in order to perform well (p. 42). In contrast, real teams depend on each other and are collectively accountable for their product. If one member does not fulfill his or her task, the consequences will affect the entire team and the work process. Therefore, before a manager decides to design a team, he or she must be sure the task is a *team task*. If the team has already been established, then the task has to be designed as a collective responsibility (pp. 41–44). To be more precise about the team task, Hackman (2002) refers to the Job Characteristics Model that he developed with Greg R. Oldham (1974). It states that people need to know and learn that they have personally performed well on a task that they care about. The internal work motivation is then high and will reinforce them to continue to perform well (Hackman & Oldham, 1974, p. 8). Hackman adds that if the internal work motivation is a given in a team, then it will often set a team onto a course of continuous improvement (Hackman, 2002, p. 205). Internal work motivation is achieved through three psychological states: (1) experienced meaningfulness (e.g. “I care about the task.”), (2) experienced responsibility (e.g. “I performed the task.”) and (3) knowledge of results (e.g. “I know if I perform well or poorly.”). To achieve these states, a task has to be designed in a

¹⁰ The scientific discussion about the difference between groups and teams is very intense. In this thesis the term *team* is used since the authors of the Scrum guide and the model of team effectiveness both use it. Generally speaking, teams are regarded as a more intimate kind of group (group definition: Wegge, 2004, p. 16) that especially has a positive quality and high team togetherness (Kauffeld, 2001, p. 14; Wahren, 1994, p. 28).

specific way. First, a team task must allow the team members to use a *wide variety of knowledge and skills*. Second, the entire task itself must be a meaningful piece of work with a clear beginning and ending so that the task is clearly *identifiable*. Third, the work and especially, the performance of the team on the task must have a significant *impact on third parties*, e.g. clients, the organization or society as a whole (Hackman, 1987, p. 324). These three task characteristics evoke experienced meaningfulness. Experienced responsibility, on the other hand, happens when team members have *decisional autonomy*. Team members gain knowledge of results, the third psychological state, if the task supplies the team members with *continuous feedback* about the work in progress (Hackman & Oldham, 1974, pp. 8–12). However, the team task, as described in Hackman's model, only includes *task identity*, *autonomy* and *knowledge of results* in the team task condition (Wagemann et al., 2005, p. 377). Both the use of multiple skills and the impact on third parties are assessed in other aspects of the model.

In addition to the features of the team task, having enabling structures, also consider *team norms*. Team norms define the behavior that is accepted or not accepted and which is agreed to by every team member. This behavior can basically refer to anything such as being late or being impolite. Appropriate behavior is rewarded, inappropriate behavior is chastised. If there is agreement on the norms among all the team members, then these norms will have a consequential effect and will change a team member's behavior quite effectively. Hackman differentiates between secondary and primary norms: Secondary norms are more internal, like listening, information sharing, respect and trust which are important to work together. However, primary norms which directly connect a team and its performance context, are more important. Such norms not only stress the validity of social rules, but also suggest ways to work together more effectively to achieve performance goals (Hackman, 2002, pp. 105–115).

The third feature of an enabling structure is the *team composition* which includes the team size, and team members' diversity and skills. An inappropriate *size* can mean that a team is too big or too small. Hackman (2002) considers the first to be more harmful. One could conclude that adding more manpower to a project would enhance productivity, but actually the contrary seems to be true. Even though it is true that every additional person adds resources to a team, the productivity gain will decrease due to the increased coordination effort. Hackman states that a team might perform better if there were slightly fewer members than the task actually required. All in all, research does not provide practitioners with a simple rule on how many members a team should have. Instead, the size has to be appropriate for the task but Hackman still recommends not more than six members (pp. 116–118).

A mixed team profits from the aspect of *diversity* among team members. A neither too homogenous nor a too heterogeneous team is advisable. Again, it is primarily a question of which talents, knowledge and skills are required to solve the task and, in a second step, it is recommended to have them in a balanced mix. However, both homogenous and heterogeneous teams have their own advantages and disadvantages. Homogenous teams are able to communicate and coordinate quicker and smoother, but may not have the necessary diverse skills to be productive. Due to shared perceptions and similar behaviors, a team can develop a shared mental model more quickly. Heterogeneous teams have multiple perspectives and skills. As a consequence, coordination and collaboration can be quite challenging but also more creative than in homogenous teams. Whereas the learning process is supposed to be more supported in mixed teams, these teams can have difficulties at the beginning becoming a unit. But, once those difficulties have been solved, a diverse team is capable of coming up with products that are significantly more creative than those of a homogenous team (Hackman, 2002, p. 122–125). The Categorization-Elaboration Model by van Knippenberg, De Dreu and Homan (2004) can help explain the connection between

diverse work teams and their team performance. It says that besides diversity more aspects have to be taken into consideration such as social categorization processes or elaboration processes of task informational and decisional requirements (pp. 1009–1020).

The fourth feature of designing enabling structures states that to work in a team always requires a basic level of *interpersonal skills*. If a person does not have a minimum of social skills, he or she will often be excluded as a result of various psychological processes. Hackman, though, advises not to exclude them, but to first try to include them, support them with peer coaching and in the end, if nothing else has helped, to redefine the connection between that person and the team. In most cases, the teams need the skills of that person, so perhaps a more loose connection, such as an external expert, could solve the social conflicts (Hackman, 2002, pp. 125–128). However, the skills presented in the final model by Wagemann et al. (2005) are of a technical nature (p. 377). This, however, can be referred to the Job Characteristics Model that claims skill variety to be one of the contributors to experienced meaningfulness, and hence, can lead to internal work motivation (Hackman & Oldham, 1974, p. 9).

Supportive organizational context.

Hackman (2002) describes the *supportive organizational context* of a team as follows: “if a well-designed work team is a seedling, then the organizational context is the soil in which it is planted, the milieu that provides the nutrients for it to grow and bear fruit” (p. 133). The organizational leverages to enhance team effectiveness are the reward system, the information system and the educational system.

A suitable *reward system* “should provide recognition and reinforcement contingent on excellent team performance” (Hackman, 2002, p. 134). It empowers the collective team motivation and stresses the collective commitment rather than the individual. Recognition and

reinforcement are synonyms for describing operant conditioning. If a certain positive behavior is shown and should be shown again, then it must be rewarded. As a result, the possibility arises that a team member might behave in the same way again. In contrast, punishment will lower the possibility of a repeated behavior and enable the appearance of different behavior. Therefore, rewards need to be something positive for teams – something that they perceive as being encouraging. Not only does the reward need to be favorable, it also needs to be part of the financial framework. Hackman states that non-monetary rewards will never equal financial rewards. He explains this with the effect of acknowledgement. As soon as a company is willing to show appreciation for a team's performance in their budget, the team is then organizationally accepted and becomes a part of the system. The single reward alone is not enough, though. The relationship between the reward and the expected outcome also needs to be clearly understood by the team. As long as the performance indicators or – in other words – the leverages to achieve the expected performance are not clear to the team, they will not be able to bring outstanding results. Once they have understood the indicators to performance and rewards, they will need to have the power to use these indicators as leverages to be even more effective (Hackman, 2002, pp. 134–147).

The organizational *information system* should provide teams with all the necessary data to competently plan and execute their work. This information always needs to be accessible, trustworthy and up-to-date. Only then can teams take full advantage of their core team features and develop excellent performance strategies. If a team knows what the people they serve expect, they can fulfill those expectations better. In addition, no valid plans can be made without knowing some trustworthy aspects about the future (including knowing which aspects are not definite and, therefore, could change). Information about money, time, space and equipment are critical to a team's performance strategies, especially if they could probably change. Hackman also states that it is unfortunate that the best information is kept

secret because of the fear of losing power and control. Furthermore, information providers can speak a different language than those who receive the data. Although it is nice to have a great deal of information, it is annoying if it cannot be read and used. The situation is even worse, if there is much too much information and the team suffers from information overload (Hackman, 2002, pp. 147–156).

An *educational system* needs to be accessible if and when the current knowledge and skills are insufficient to execute the task. Training and technical assistance have to be available at any given point of the work process. Although a team may possess an appropriate mix of expertise, team members still share their own talents and experiences and, therefore, expand their collective pool of knowledge. Hackman (2002) observed that adequate training is usually available in organizations when the consequences of too little training, and therefore, mistakes and wrong decisions are regarded as potentially severe. Yet, the first step to provide a team with enough training is to know their demands to work effectively. Then, the responsible persons or groups, who can supply them, must be identified. Finally, some kind of delivery system must be in place to enable teams to have access to the needed training courses, technical assistance or any kind of knowledge (Hackman, 2002, p. 156–161).

The last part of a supportive organizational context are *material resources*. Even a perfectly designed team with ideal information, educational and reward systems, cannot function without sufficient material resources. Hence, materials like space, equipment, money, staff and time are critical for teams, too (Wagemann et al., 2005, p. 378).

Available expert coaching.

Throughout his book, Hackman (2002) only differentiates between two organizational roles outside of a team: a manager and a coach. However, in order to provide coaching for a team, Hackman (2002) designates that both the team leader and the team members themselves are

responsible for it. The roles of the manager, the team leader and team members will be discussed in the section about leadership in Scrum teams. The following section examines the mechanism of available expert coaching.

Hackman (2002) emphasizes the importance of proactive coaching, which, no matter who gives it, acts like preventive maintenance and can make a team aware of serious problems or even provide a team with helpful resources. He also describes coaching as a direct interaction with team members throughout the work process and as a leverage to handle group processes. How proactive coaching can be provided to a team is shown by three examples: (1) by leading a launch meeting before the team task is executed, (2) by giving feedback on how the team handles problems, and (3) by raising questions that cause team members to reflect on the decision making process. It is interesting that the first example resembles a Daily Scrum or even a Sprint Planning Meeting, whereas the second and the third example resemble Sprint Retrospectives. All in all, “coaching is about building teamwork, not about doing the team’s work” (Hackman, 2002, p. 167).

Since there are no limits to aspects which can be addressed by coaching, Hackman (2002) points out the three kinds of team member interaction that can be leveraged to enhance team effectiveness: (1) the amount of effort a team makes to achieve its goal, (2) the suitability of the performance strategy and (3) the amount of knowledge and skills a team has. These interactions offer great chances for process gains and process losses. Process gains are regarded as absolutely new internal resources that developed because of enhanced collective motivation and commitment, more appropriate and innovative strategies or more skilled team members who have learned from one another. These gains push a team. In contrast, process losses prevent a team from working as effectively as they theoretically could. They can occur due to the social loafing of team members, uncritical sticking to

routines or inappropriate acknowledgement of a team member's contributions (Hackman, 2002, pp. 169–175)¹¹.

As already mentioned, the purpose of coaching is to decrease process losses and increase process gains. Coaches can achieve this by implementing motivational, consultative and educational coaching strategies at the right moment. Coaching in order to foster collective motivation aims at increasing everyone's effort and ensures shared collective commitment to the team task among team members. Consultative coaching is appropriate when a team is about to work out the necessary performance strategy to best achieve their goals. Work routines should be questioned to find the best fitting performance strategy that combines task features and means. Educational coaching is required to avoid the inappropriate weighting of a team member's contribution and to learn from successes and failures. Hackman states that these kinds of coaching "can be done by anyone (including rank-and-file team members, external managers, and outside-consultants – not just by a person officially designated as 'team leader'") (2002, p. 177). Hackman (2002) points out that all three of these kinds coaching types should be provided at certain times within a team's life cycle: at the beginning of such a cycle, motivational coaching is needed. Since performance strategies are made rather at the midpoint of a team's life cycle, consultative coaching should take place then. At the end of a team's life cycle, results are shown and the team members receive their feedback about whether they did a great job or performed poorly. A coach, then, can support the reflection and learning procedures with educational coaching. Unfortunately, in daily business, teams usually skip this very last aspect of coaching since they either celebrate their success or suffer from their failure. In both cases teams do not want to invest more time on thinking and reflecting. However, only if the reflection procedure is a habit, will learning

¹¹ Further advantages and disadvantages of motivational factors and information elaboration within teams are explained in detail by Wegge (2004, pp. 30–91).

from one another and expanding the collective knowledge and skills be possible and turn a team into an outstanding performance unit (Hackman, 2002, pp. 176–186). Oertel and Antoni (2013) provide some very broad insight about how teams learn and how this is connected to team performance. They especially focus on learning potential and on situational incidents as sources of learning besides the regular working process (pp. 139–140).

Between the beginning, the midpoint and the end of a team's working process, interventions that "selectively recognize and reinforce competent team behaviors that spontaneously occur" (Hackman, 2002, p. 187) also support a team's performance. These are even regarded to be among the most powerful interventions a coach can use (pp. 186–192).

Besides all these helpful interventions a coach can do, there are also some a coach should never use such as changing the performance strategy when the team is already working on it or doing all the work by him- or herself (Hackman, 2002, p. 191).

Although Hackman (2002) does not suggest one particular way of coaching, he adheres to one coaching belief: a coach focuses on the team's task performance and not on the members' social interactions or interpersonal relationships. Hackman continues by saying that it is possible that the perception of interpersonal relationships is shaped by how a team performs rather than vice versa (p. 192).

Process criteria of team effectiveness.

The model of team effectiveness is based on a proposition: team effectiveness is seen as a joint function of three process criteria (Hackman, 1987, p. 323), which should appear naturally and are influenced by the five conditions of team effectiveness (real team, compelling direction, enabling structure, supportive, organizational context, and available expert coaching) (p. 324). These process criteria are: (1) the level of *effort* each team member is willing to put into the fulfillment of the task. (2) The amount of *knowledge and skills*

members use to carry out the team task. (3) The suitability of *performance strategies* the team uses to accomplish its goals. However, Hackman does not mention a causal relationship between the conditions of team effectiveness and the process criteria.

Criteria of team effectiveness.

Assessing team performance or team effectiveness is a challenge just as it is a task with no clear right or wrong answers. Hackman regards effectiveness as a conglomerate of three parts: (1) the productive output, (2) the state of the team as a performing unit as well as the probability of the team continuing to work as a team and (3) the effects of the team's work on individuals (1987, p. 323; 2002, p. 23). The criteria of a team's *productive output* is not an objectively standardized criterion valid for all kinds of teams. Since a team always serves certain people who receive the product in the end, it should at least meet their expectations. Hence, the team's performance measurements depend on these people and can be regarded as task significance, which is one influencing factor of experienced meaningfulness that leads to higher internal work motivation when it is present (Hackman & Oldham, 1974, p. 10). If a team also has a satisfying productive output but the working process was rather harmful for *the team as a performing unit*, then the possibility that the team will choose to work together again is rather small. Therefore, team effectiveness includes also the way a team achieves its goals. Not only are the needs of the team important, but also the needs of *team members as individuals* need to be more satisfied than frustrated (Hackman, 1987, p. 323). This means that team work serves to expand everyone's knowledge and skills, it enables feelings of belonging and satisfies the needs for interpersonal relationships (Hackman, 2002, p. 29).

These three subparts of team effectiveness should be considered simultaneously, but not necessarily equally (Hackman, 2002, p. 30).¹²

Connection between the model of team effectiveness and Scrum.

The final model of team effectiveness by Wagemann et al. (2005) assumes a certain conglomerate of conditions that can lead to team effectiveness, if they are present. The target groups are teams of whatever kind, but mostly those focusing on self-managed groups.

According to the Scrum guide (2013), Scrum teams are self-organizing because the team members themselves decide on how to examine their work and no one else. According to Hackman's matrix of team types (2002, p. 52), though, the teams that execute their task as well as monitor and manage their progress in order to be able to change the performance strategy, if necessary, are called self-managed teams (2002, p. 52). As with all self-managing teams, the purpose should be clear but the means should be up to the team itself. This strongly resembles the Scrum guide's description of Scrum teams (Sutherland & Schwaber, 2013, p. 4). Furthermore, there are several aspects of Scrum teams that are connected to the model of team effectiveness and, hence, can be psychologically analyzed in the future¹³.

Hackman (2002) continues on saying that self-managing teams "are able to respond immediately and flexibly to unexpected problems, information, or opportunities. They don't have to follow the letter detailed rules of procedure or hope that prescribed processes make adequate provision for any surprises that occur along the way" (p. 76). However, software development faces exactly these unexpected problems, information or opportunities quite often. As mentioned earlier, there are multiple sources of changes such as the societal

¹² Support for these subparts as measures of a team's output can be found in Brodbeck (2007, pp. 417–420).

¹³ The interested reader is referred to the Table A2 for a deeper insight.

environment or the user, to which software developers must quickly respond (Dirbach et al., 2011, p. 17). Sociotechnical system theory as a psychological paradigm picks up those work systems that are characterized by fluctuation and disorder (Schüpbach, 2013, p. 38). This theory proclaims that there is a technical system (e.g. software development and its equipment) and a social system (e.g. the Scrum team). These two systems are connected by a primary and a secondary task. The first one is the core task of a team (such as developing software) and the latter summarizes all tasks that are necessary to maintain and regulate the system so that the primary task can be fulfilled (Schüpbach, 2013, pp. 38–39). In regard to Scrum teams, the secondary task can be a properly designed team, the available information and material, or clearly specified product requirements, etc.. In the context of the sociotechnical system theory among others, semi-autonomous work teams are regarded as adequate units to examine work (Bungard & Antoni, 2007, p. 455; Schüpbach, 2013, p. 43). These work teams are supposed to be self-regulating, assume holistic tasks and are mainly designed in companies of the industrial production branch. Team members have direct / primary and indirect / secondary tasks and manage themselves within the agreed boundary (Antoni, 2000, p. 26). This, again, is similar to the description of Scrum teams according to the Scrum guide (Schwaber & Sutherland, 2013, p. 4).

In conclusion, Scrum teams resemble certain psychological team types. This thesis refers to them as self-organizing teams which can be regarded as self-managing teams (Hackman, 2002) or as semi-autonomous work teams (Antoni, 2000). Various authors and researchers agree that all the previously mentioned conditions of team effectiveness influence a team's output (Arrow, McGrath, & Berdahl, 2000; Maus, 1993; Pietruschka, 2003; Rosenstiel & Nerdinger, 2011; Wahren, 1994; Wegge, 2004; Zölch, Weber, & Leder, 1999). Since there is so much research on self-organizing teams, it is impossible to review it within the scope of this thesis.

Leadership within Scrum

The conditions of team effectiveness have been explained earlier and some responsibilities for leaders and managers in particular points have been revealed (e.g. setting a compelling direction for a team). This is the reason why this section first describes Hackman's view of leadership. Additional suitable research is included which has partially been written by psychologists. Then, the Scrum guide will be analyzed for information about leadership.

Generally, Hackman regards leaders as responsible for managing the sustained realization of the five conditions of team effectiveness (1987, p. 339; 2002, p. 204). From his point of view, "no one person has sole responsibility for team leadership. Leadership is provided by anyone who helps create and maintain the performance-enhancing conditions, regardless of whether or not that person happens to hold a formal leadership role" (Hackman, 2002, p. 33). Hence, leadership is not about one individual having all the responsibility to manage the entire work process. On the contrary, leadership is done collectively. The phenomenon that there is one single leader for a team is, according to Hackman (2002), due to the *leader attribution error*—the tendency to unjustifiably attribute failures and successes of a team to its leader. Hackman concludes by saying that because the leader attribution error is so strong, there is much research and many diagnostic instruments focusing on a leader's character and traits. Then, he gives several reasons why this research cannot be applied to examine leadership (Hackman, 2002, pp. 199–204).

Yet, Hackman points out that in order to set a compelling direction the involvement of one person is required who was given the legitimacy and authority by the team. Despite the notion that a team always has to find a consensus collectively, Hackman (2002) advises that someone has to have the legitimate authority to set a compelling direction: "effective team self-management is impossible unless someone in authority sets the direction for the team's

work” (p. 62). This person has to be wisely chosen and he or she must be able to set the direction competently, convincingly and consequently (pp. 62–73).

Another great impact of Hackman’s model on leaders can be found in the condition of available expert coaching. As already mentioned, coaching does not need to be provided by only one person. In fact, “coaching often is done by a number of individuals, sometimes different ones at different times for different purposes (. . .). What is critical is that competent coaching is available to a team, regardless of who provides it or what formal positions those providers hold” (Hackman, 2002, p. 194). Later on, Hackman (2002) connects coaching to leadership while describing leadership processes within an orchestra: “There is abundant shared leadership and peer-to-peer coaching in this unusual orchestra, but it is far from a one-person, one-vote democracy.” (p. 195). He implies that leadership as well as coaching is done collectively because every team member brings different talents, strengths or disinterests into a team, which will be used by all in order to work together effectively. Hackman (2002) ends by saying that team members are not treated equally, since they are not equals (p. 195).

According to Hackman (2002), the idea that several people lead is supported by many scholars. Although there are multiple names for this leadership construct—shared leadership, collective leadership or distributed leadership—they all say that leadership is not the responsibility of one single person, it is a collective one. Friedrich, Vessey, Schülke, Ruark, and Mumford (2009) define collective leadership as a “process in which a defined leader, or set of leaders, selectively utilize skills and expertise within a network, effectively distributing elements of the leadership role as the situation or problem at hand requires.” (p. 932). Moreover, they add that leadership is regarded more as a role, and that it can be selectively distributed among team members depending on their expertise (p. 933). Yet, having multiple people performing leadership is not enough. It is the sharing of information, collaboration, and joint-decision making among leaders, that is important, a fact which reinforces the idea of

leading as a network function (p. 935). Furthermore, they present an extensive framework of key collective leadership constructs, base-line leadership and team processes and outcome variables to understand collective leadership (p. 937). They also support Hackman's idea that certain organizational structures have to be present to favour the emergence of collective leadership (p. 953). Contractor, DeDulich, Carson, Carter, and Keegan (2012) agree with Friedrich et al. (2009) that leadership is a network function. As a consequence, they used network analysis to empirically explore the nature of collective leadership and named these three dimensions of leadership: team members, roles and time. Each dimension can be high or low, which results in a continuum that has one member performing one leadership role at one particular point of time at one end of the continuum, and all team members performing all leadership roles at any given point of time at the other end (pp. 999–1000). Leadership, then, can be regarded on the individual, dyadic, triadic, group or network level (pp. 1004–1005). Small & Rentsch (2010) also used network analysis and discovered a positive relationship between shared leadership and team performance (p. 209). Liu, Hu, Li, Wang, and Lin (2014) even showed whether, when and how shared leadership can lead to learning behaviors both on the team level and on the individual level. Since job variety moderates this relationship between shared leadership and learning behaviors, they advise managers to ensure enlarged and enriched job categories (p. 292). In conclusion, this short digression on shared leadership shows that the leadership construct, as it is discussed by Hackman (2002), is strongly supported by other leadership scholars¹⁴.

Hackman (2002) does not proclaim one correct way of leading, in contrast, he also introduces how leaders can fail. One example is *command and control* leadership, which means that it is inappropriate to command what needs to be done. This kind of leadership is

¹⁴ For a closer look at the background and effect mechanisms of shared leadership, Piecha, Wegge, Werth, and Richter (2012) is recommended.

helpful only when an immediate reaction is needed, the solution is clear and / or the leader was given the team's approval. Command and control can either result in over- or undercontrolling of a team and both can be very harmful. However, it is most confusing if leaders continuously change between over- and undercontrolling. This makes it impossible for a team to have stable working conditions (pp. 220–221). The concept of command and control strongly resembles the construct of management-by-exception, which is regarded to be one aspect of transactional leadership. This kind of leadership aims at the successful exchange between the leader and the follower. The leader tries to find out what the follower wants in order to motivate him to work and in exchange, rewards him or her for a good performance (Bass, 1995, p. 469). Therefore, expectations and goals need to be clarified and the work progress monitored, which can be done by active or passive management-by-exception. When using the active form a leader proactively informs him- or herself about the work progress and only intervenes when necessary. The passive form, on the other hand, implies that the leader is in reserve and only becomes active when there are problems. Management-by-exception, then, is considered to be harmful for employees; only laissez-faire leadership is even worse (Felfe, 2006, p. 63). In other words, active management-by-exception can lead to too much control and passive management-by-exception to too little control. This question about the appropriate amount of control of Scrum teams has also been of interest to Scrum researchers. Hodgson and Briand (2013) found that it is quite difficult for leaders to manage the range between autonomy and control of a team. Therefore, they advise leaders to differentiate between decision-managing power and decision-making power and, then, to create their own team leadership model (pp. 318–319)¹⁵.

¹⁵ Harris, Webb Collins, and Hevner (2009), Maruping, Venkatesh, and Agarwal (2009) and Persson, Matthiassen, and Aaen (2012) give more advice on how to examine the appropriate use of control in Scrum teams.

As a provisional conclusion, Hackman's view on team leadership is in line with other scholars, and means that leadership is shared and should promote the conditions of team effectiveness. Anyone who contributes to this, including external managers or team members who have no formal leadership role, can be considered a leader. However, responsibilities need to be clarified in order to find the right degree of control. Basically, it is important that the key leadership functions are fulfilled (Hackman, 2002, p. 231).

The research done by Mohrman, Cohen, and Mohrman (1995) will be presented now to examine what the key leadership functions can be. These authors believe that an organizational design perspective on how leaders and managers can support their teams is still missing (p. 133). Therefore, they first identified four kinds of management functions: *task management* (e.g. task assignment, work scheduling, coordination among members, facilitation of meetings), *boundary management* (e.g. connecting with other teams, suppliers and customers), *technical and discipline leadership* (e.g. mentoring, coaching, cross-training) and, finally, *performance management* (e.g. team development, the evaluation of individual effectiveness and team effectiveness, recommendations for improvement) (p. 136). Second, they examined which management functions were fulfilled by the team, and which ones by people in managerial roles (e.g. Line Managers). In conclusion, actually all management functions can be fulfilled by the team members themselves. Therefore, according to Mohrman et al. (1995), team members can be called team *leaders* (pp. 147–151). Team leader roles and additional managerial roles are especially necessary, when the information-processing demands for a team become more challenging, which is, according to the authors, due to the complex environment of knowledge workers. In addition, if a task's complexity exceeds the team's capacities, team leaders or managerial roles can help (p. 138). Besides the complex environment, there are even more issues that need to be considered in order to identify the need for management and leadership. For example, if the team members' interdependence is

very high, if a team has many members and / or if team members are very diverse in terms of their disciplines or even personalities, a designated team leader can help coordinate and integrate the diverse points of views in order to make the best decision (pp. 143–144). In addition, Mohrman et al. (1995) emphasize that, although there are team leader roles within a team which can fulfill the four management functions, a managerial role is still needed. The person with this role, then, embeds the team within the organization, links it to the organizational needs, and controls the adequacy of a team's performance (p. 147). Furthermore, team managers have positions of power and, therefore, are “able to use their authority to help teams become as self-managing as feasible” (p. 152). Besides task and boundary management, which is important to support their teams, team managers are also responsible for encouraging the team itself to assume more and more managerial functions (p. 152).

In the Scrum guide, the word *leadership* is mentioned only when the Scrum Master is described, who is a servant-leader for the entire Scrum team. He or she serves the Product Owner, the Development Team and the organization through particular activities (Schwaber & Sutherland, 2013, p. 6). Those activities always ensure that the Product Owner, the Development Team and the organization can execute their tasks properly, without outside interference. The term *management* is only used in reference to the Product Backlog management which includes the clarification and prioritization of product requirements that are to be developed by the developers. Product Backlog management also includes making the Backlog visible and transparent so that everybody can see and understand the items (Schwaber & Sutherland, 2013, p. 5).

Connection between leadership and Scrum.

In order to examine the leadership processes within Scrum teams, Hackman pays particular attention to the leadership in self-managing teams such as Scrum teams. He advocates a leadership that is shared and done collectively. However, there are also certain aspects of leadership which require a single leadership role, e.g. direction setting. Mohrmann et al. (1995) support the idea of shared leadership and call all team members team leaders. Yet, they also see a need for a team manager who links the team to the organization. Hence, leadership is both a team and an individual responsibility. This goes along with the psychological definition of leadership, which says that leadership is a team phenomenon which includes interactions and communication processes among several people. In addition, the social influence of one person on another is intended in order to achieve certain goals (Nerdinger & Rosenstiel, 2011, p. 325, Wegge, 2004, p. 98). In general, research on leadership focuses on different aspects such as the personalities of leaders and followers and the leader's behavior (Rosenstiel & Wegge, 2007, pp. 479–503). The leadership of work teams, though, is considered to be more complex than the leadership of individuals (Wegge, 2004, p. 200). Basically, there is a great deal of research on leadership in general and about work teams in specific and thus, it is impossible to provide a detailed overview within the framework of this thesis.

Research Questions and Hypotheses

As shown previously team effectiveness and leadership in and of self-organizing teams are closely intertwined. The research questions and the hypotheses were developed to serve the interests of the contracting partner, pragmatic solutions gmbh, a consulting firm in Zurich which helps teams, departments and even entire companies to become (more) agile. As a result, its consultants often work with Scrum teams. When supporting their clients, they

regularly encounter a specific challenge: since Scrum teams are self-organizing teams, the tasks of product development and the responsibility for the outcome are shared by the Scrum Master, the Product Owner and Developers. However, the Line Managers who were often responsible for the work process and the outcome, now feel that their key task has been taken away from them and that they are unnecessary and redundant. This can become even more dramatic when hierarchical levels cease to exist due to the organizational changes that take place when teams are implemented in an organization. These very common observations by the practice partner have become the starting point of this thesis. Agile movement representatives, Scrum practitioners and the practice partner consider the Line Managers to be highly important and much needed – but they have a different function. This is in contrast to the subjective experience of the Line Managers.

The following section first presents the hypotheses about team effectiveness and then the research questions and the hypotheses about leadership in Scrum teams.

Hypotheses about team effectiveness of Scrum teams.

The model of team effectiveness by Hackman (1987; 2002) was operationalized with a questionnaire by Wageman et al. (2005), called the Team Diagnostic Survey (TDS).

Wagemann et al. (2005) suggest a positive relationship between the conditions of team effectiveness, process criteria and team effectiveness itself. This relationship does not need to be causal, though, because it is the probability of team effectiveness that rises when team effectiveness conditions are present. Hence, there is no guarantee that teams will work effectively even if all conditions are positively fulfilled. However, Wagemann et al. (2005) calculated correlations only for the relationships between the five conditions ranging from

$r = .19$ (real team with coaching availability) to $r = .59$ ¹⁶ (supportive, organizational context with coaching availability). Therefore, Hypotheses 1 to 3 examine the relationship between the conditions of team effectiveness, process criteria and team effectiveness itself in order to close this research gap. Since the positive characteristics of the team effectiveness conditions should be positively related to the process variable and team effectiveness, all hypotheses are directional.

- H1 There is a significant positive relationship between each single condition of team effectiveness and the process variable of team effectiveness on a team level.
- H2 There is a significant positive relationship between the process variable of team effectiveness and team effectiveness on a team level.
- H3 There is a significant positive relationship between each single condition of team effectiveness and team effectiveness on a team level.

Research questions and hypotheses about leadership within Scrum.

Hackman's model of team effectiveness (2002) emphasizes the role of a team leader.

According to Wageman et al. (2005), a team leader has a certain *attention focus* and performs certain *activities as a coach*. In actual fact, the role of a team leader is not mentioned in the Scrum guide (Schwaber & Sutherland, 2013). Therefore, this thesis explores which role (Scrum Master, Product Owner, Developer, Line Manager) functions as a team leader which

¹⁶ No information about the degrees of freedom and the level of significance was given by Wageman et al. (2005).

includes his or her attention focus and coaching activities. The Line Manager was included here because of the special interest of the practice partner to find out more about this role.

Research Question *a*: What kind of focus does the team leader have and which activities does he or she perform the most and least frequently, when there is a team leader?

As could be shown previously, there is no current scientific research on how Line Managers or Scrum team leaders define their roles. Several scholars, though, support the idea of shared leadership. Furthermore, according to the practice partner, Line Managers are having problems finding their place within the product development process. Therefore, this thesis explores the understanding of leadership in and of Scrum teams in an exploratory way (Research Question *b*). Research Question *c* was developed to see which particular roles are associated with leadership. Again, both the Scrum roles and the role of the Line Manager were assessed. Lastly, in order to address the Line Managers' problems and to generate options for future action, Research Question *d* was developed.

Research Question *b*: What kind of leadership leads to success?

Research Question *c*: What does the leadership of the Scrum Master, the Product Owner, the Developer, the entire Scrum team and the Line Manager look like?

Research Question *d*: What kinds of challenges do Line Managers have to deal with whilst working with Scrum?

According to Hackman (2002), Scrum teams can theoretically be regarded as self-organizing teams, therefore, there should be shared leadership among all the team members. Still, a

managerial role was considered to be necessary by both Hackman (2002) and Mohrman et al. (2005). This thought lead to Hypothesis 4.

- H4 The leadership of a Scrum team is assumed by all the relevant roles whether it be the Scrum Master, the Product Owner, the Developers, the entire Scrum team or the Line Manager.

Mohrman et al. (1995) discussed shared leadership and argued that four management functions have to be fulfilled. This can be done by the team members themselves or also by the team managers such as the Line Manager. In addition, the practice partner was interested in clarifying who assumes additional responsibilities (e.g. the provision of information as well as material, or the responsibility for success or failure). Although Mohrman et al. (1995) assumed that these aspects were somehow implied in the management functions, the practice partner wanted them specifically examined:

- H5 It is possible to assign the roles of the Scrum Master, the Product Owner, the Developer, the Scrum team, and the Line Manager to the four management functions by Mohrman et al. (1995) and to additional responsibilities.

Scientific relevance of this thesis.

Hackman (2002) and Wagemann et al. (2005) claim that their model of team effectiveness is valid for any kind of team but especially for self-managed teams. Since the TDS is the basis for the empirical part of this thesis, both the models and the questionnaire's generalizability for Scrum teams are examined. Furthermore, Hypotheses 1 to 3 try to close a research gap since the underlying relationships of the variables of team effectiveness have not yet been studied. This should provide future researchers who want to analyze work teams with an

instrument that is empirically secure. Furthermore, this thesis will empirically categorize Scrum teams as self-organizing teams, so that the already existing findings about them can be applied, modified and improved. Moreover, no previous study has yet undertaken a psychological review of Scrum teams. Based on the database search, this is the first study that psychologically explores Scrum teams in terms of their team effectiveness and leadership.

Practical relevance of this thesis.

This thesis benefits multiple target groups. First, the practice partner will have answers for their questions and scientific grounding for their consulting observations. Second, the teams that have participated in this study will receive feedback about their team effectiveness so that they can develop and improve it. Third, Line Managers will receive a theoretical input about how Scrum teams work as self-organizing teams. They will also be provided with hands-on advice on how to fulfill their role best in order to support their teams and, in effect, the department's or even the organization's effectiveness. Fourth, this thesis is written for the international Scrum community, therefore, it is written in English. Lastly, it can provide some general insight into the self-organizing teams of knowledge workers.

Method

The first part of the following chapter deals with data collection for the two variables of this thesis: team effectiveness in Scrum teams and leadership in and of Scrum teams. After that, the invitation process and survey procedure are presented. Methods to analyze the quantitative data in terms of team effectiveness and both quantitative and qualitative data in terms of leadership in Scrum teams form the final part of the chapter.

Methodology of Data Collection

Development of a questionnaire to assess team effectiveness in Scrum teams.

On the whole, the questionnaire for team effectiveness is based on the Team Diagnostic Survey (TDS) by Wagemann et al. (2005). Their questionnaire was developed to be used for research purposes and to diagnose the effectiveness of real teams. Therefore, it should fit both scientific and practical criteria. The theoretical basis of the TDS is Hackman's model of team effectiveness (e.g. 1987, 2002) which has already been described in detail in the introduction. The five conditions of team effectiveness, their process criteria and the criteria of team effectiveness are presented using 33 scales. Each one has at least two items in the latest version, which was completed by 140 teams in the knowledge sector (e.g. management teams). The statistical measures, as can be seen in Tables B1 and B2, are sufficient with the exception of Cronbach's Alpha of the majority of subscales on the individual level (Schermelleh-Engel & Werner, 2007, p. 129). This coefficient is of little interest on the individual level as teams are diagnosed on the team level. In addition, selectivity values on single scales such as *size*, *diversity*, *challenge*, *whole task* are not entirely satisfying according to the selectivity criteria (Kelava & Moosbrugger, 2007, p. 84).

However, in some aspects it has not been possible to use the TDS without modifying it. First of all, the TDS is an English survey but the participants of this study are German speaking. Second, 16 out of 33 scales consist of only one or two items. Whereas this might be enough for the validated TDS, it is not sufficient for the German version, which was developed specifically for this paper. According to Bühner (2011, p. 167) and Panayides (2013, p. 694). Cronbach's Alpha, as one indicator of reliability, would be higher if there were more items. Third, the response scale to rating questions is a 5-point-scale ranging from 1 (*highly inaccurate*) to 5 (*highly accurate*). Therefore, a neutral answer is also possible. Since the author aimed for explicit answers, participants were either forced to take a clear

position or to say "don't know / no answer". Last but not least, Wagemann et al. (2005) refer to the role of a team leader when it comes to the availability of expert coaching for teams. In the Scrum guide, there is no such role for a team leader. Thus, Scrum teams were first asked to state whether or not there was an officially declared team leader. If there was one, then items by Wagemann et al. (2005) were used to examine the attention focus of the team leader and his or her coaching activities. These items will be explained on page 52. If there was no officially announced team leader, it was then necessary to assess which role (Scrum Master, Product Owner, Developer, Line Manager) would most likely fulfill the attention focus and coaching activities of a team leader according to the TDS. As a result, the section which referred to the team leader had to be adapted to the Scrum context. Still, in terms of all the other scales and items, the TDS was used as the questionnaire template for this thesis.

Berg (2010) reviewed German instruments to analyze teams and team work by following specific criteria: First, the instruments should be able to diagnose the current state of the teams and their work, including their strengths and weaknesses. As a result, the reflection processes could start, for example among team members or between members and their Line Managers, and thus lead to changes in the perception of team work in the long term (Kauffeld, 2001, pp. 49–51). Second, through such feedback the team and organization would have access to a broad variety of interventions. These interventions for team development (to increase team effectiveness) should affect several levels: the individual level, the team level, the organizational level and the societal level. Every intervention should always combine these four levels simultaneously (Bungard & Antoni, 2007, pp. 446). Therefore, an instrument to assess team effectiveness should provide relevant information. Berg (2010) concluded that no German instrument fit those requirements, but the TDS did. In order to validate the German version, he translated the original questionnaire and tested it on four samples. Since Berg's sample of 2010 included chemical production, machine construction and metal

processing workers, some of the wordings were not appropriate for knowledge workers. After in-depth inspection of the German items in terms of proper translation and suitability to the Scrum guide, the author decided that more modifications were needed. In addition, the sections referring to team leaders were left in as in the original TDS. Moreover, the response scale for most of the items was the same as in the English version and hence, not useful for the purpose of this thesis. Berg's addition of extra items is noteworthy, because most scales now have at least three items. As a result, most of the German items could be used, even though some sounded inapplicable and needed to be retranslated by the author. Tables B1 and B2 show a comprehensive overview of the statistical measurements of Berg's (2010) latest sample which was satisfying but needed to be handled carefully as they only characterized a sample of production workers and hardly resembled the present sample. Both Wageman et al. (2005) and Berg (2010) exclude the assessment of the productive output of a team because, according to the first, a self-report is not trustworthy. However, since the productive output of team effectiveness belongs to the original criteria of team effectiveness, the author included it (Wagemann et al., 2005, p. 376). The productive output was measured through the question "Wie nehmen Sie persönlich den Erfolg des Scrum Teams wahr?". Participants, then, were asked to rate whether their results were within the financial frame, meet the time frame of the client, and meet the quality and quantity standards. These aspects of the productive output were created in reference to Wagemann et al. (2005, p. 376), Brodbeck (2007, p. 417) and the practice partner.

The first draft of the questionnaire to assess team effectiveness in Scrum teams was pretested on five Scrum workers¹⁷ in a Suisse insurance company to identify items with needed to be improved. Participants filled out the paper questionnaire while the author was present in case there were questions. Participants needed between 30–45 min to fill out the

¹⁷ (two developers, two Scrum Master and one Product Owner, distributed over two Scrum teams)

questionnaire. Afterwards, the author asked the participants whether they thought the questionnaire assessed team effectiveness. According to Jonkisz and Moosbrugger (2007), this is a valid method to test a provisional questionnaire (p. 70). Although all participants agreed that the questionnaire assessed team effectiveness and its conditions, there were parts of the questionnaire that were not fully understood or regarded as unnecessary (e.g. items that obviously assessed the same thing, but were worded differently). Feedback about certain words, wordings, items, length and sequence of questions was noted. After the pretest, the author calculated descriptive measures such as means, frequencies and item variances of all items (Kelava & Moosbrugger, 2007, pp. 79–82). If, for example, team members from the same team varied strongly in their ratings, or if answers of both teams varied widely, this item was revised. An exhaustive overview of all the final items, their origins and the change documentation including variables for statistical calculations can be seen in Table B3. The final version of the current online survey to assess team effectiveness consists of 34 questions, although the number of items per participant depends on his or her answers to questions about the team leader (different questions are shown depending on whether there is a team leader).

Despite the modifications of the original questionnaire, the usage of the TDS in the context of Scrum teams and also in reference to both scientific and practical goals of this study still seemed acceptable. According to Kauffeld (2001), the TDS belongs to the structural analytical approaches if instruments of team diagnosis need to be categorized. This approach is mainly operationalized through questionnaires that assess subjective perceptions of team members, are highly standardized and can be used for longitudinal comparisons such as benchmarks (pp. 56–58). Compared to other types of questionnaires used for team diagnosis, the TDS matches classification grids and organizational diagnostic instruments the most. Classification grids are used to assess and describe specific criteria such as autonomy and framework conditions in order to compare certain types of teams. This description seems

to be limited to industrial teams, though. Organizational grids, in comparison, provide a rather general insight into teams from an organizational point of view. Whereas classification grids can be used to develop teams, organizational diagnostic instruments give no information about team development interventions. Still, the TDS picks up organizational aspects such as work satisfaction or aspects of the Job Diagnostic Survey by Hackman and Oldham (1974) (Kauffeld, 2001, pp. 58–62) and claims to be useful for the development of team interventions (Wagemann et al., 2005, p. 375).

Development of a questionnaire to assess leadership in Scrum teams.

Research Question *a* (p. 45) asks about the attention focus and coaching activities of a team leader. According to Wagemann et al. (2005), the items to assess the focus of team leader are (a) coaching individual team members, (b) helping team members learn how to work well together, (c) getting the team set up right—clarifying its purpose, picking members, structuring the task, or (d) running external interference for the team such as getting resources, securing outside assistance, removing obstacles. Participants were asked to rank them according to how frequently the team leader fulfills them (the most frequently fulfilled focus was ranked first, etc.). Coaching activities of a team leader, on the other hand, can be task-focused (6 items), operant (3 items), interpersonal (3 items) or even be unhelpful directives (3 items). All coaching items can be found in Table B3.

This thesis serves as a pilot study to assess how Scrum teams and Line Managers define leadership. Mayring (2010) refers to pilot studies as an excellent method to research new areas. Since there is no research on the market that scientifically assesses the definition of leadership among Scrum workers, this thesis can be regarded as a pilot study and, furthermore, it can even serve to suggest hypotheses for later research (pp. 22–23). Therefore, the questionnaire on leadership includes an open question which invites participants to state

their own opinions: “Was ist für Sie Führung, die zum Erfolg führt?”. The answers to this question, later, serve as an answer to research Research Question *b*. They also serve as a basis for the creation of hands-on advice for Scrum workers which is why participants should recall a positive / successful kind of leadership which is worth striving for.

The following semi-open question was a unique link between (Scrum) roles and leadership: “Wer übernimmt in Ihrem direkten Arbeitsumfeld Führung?”. The answers that could be given are the Scrum roles in particular as well as the whole Scrum team and / or the Line Manager. Participants could add roles, if not all were covered. This question answers Hypothesis 4. In order to answer Research Question *c*, participants were additionally asked to describe the kind of leadership that is performed by the previously chosen role.

The practice partner was most interested in the scientific examination of their frequent observation that Line Managers face certain challenges when Scrum is implemented and / or Scrum teams are designed. These challenges center around their former role as the main person responsible for success or failure. To access these challenges that affect Line Managers due to the implementation of Scrum teams, the second open question is “Mit welchen Herausforderungen muss eine/r Linienvorgesetzte/r bei Scrum umgehen können?”. This question operationalizes Research Question *d*.

According to the Scrum guide, each Scrum role has a different task profile (Schwaber & Sutherland, 2013). Mohrman et al. (1995) favour a leadership model that is based more on management functions than on the person or job profile of a leader. They introduce four management functions that were now being tested for suitability. Therefore, the Scrum roles (Scrum Master, Product Owner, Developer, the entire Scrum team) and the role of the Line Manager are supposed to fulfill certain management functions. The following request, operationalized with a semi-open question, was asked “Bitte geben Sie an, wer für die nachfolgenden Bereiche und Aufgaben verantwortlich ist.”. Since the original management

functions were in English, the German translation by Katharina Wurst (2001) was used: “Management der Aufgabe” (Task management), “Management der Grenzen” (boundary management), “Management der Leistung” (performance management) und “Führung im eigentlichen Sinne” (technical and discipline leadership) (pp. 99–103). In addition to these four functionalities, further responsibilities were added such as “Bereitstellung von relevanten Informationen und Arbeitsmitteln, Verantwortung für Anreize und Entlohnung” as well as “Übernahme der Verantwortung für Erfolg“ and „Übernahme der Verantwortung für Misserfolg“. These were of special interest to the practice partner. The question about both management functions and additional responsibilities provide a basis to the answer of Hypothesis 5.

Structure of the survey and its online implementation.

The online survey used a tool developed by onlineumfragen.com. At the beginning of the survey, all participants were asked to provide some general information about themselves and their role(s). The second part of the survey was the modified TDS. All participants followed the same questionnaire linearly up to the question about the presence of an officially announced team leader. Participants with an officially announced team leader had to state which Scrum role most likely fit that role and then they continued with the original questionnaire in accordance with Wagemann et al. (2005). Participants without an officially announced team leader had to assign a team leader’s attention focus and his or her coaching activities to the roles of Scrum Master, Product Owner or the Line Manager, or nobody (according to Wagemann et al. (2005)). Afterwards, the frequency of the executed tasks and the helpfulness in terms of team effectiveness of the team leader respectively the Scrum roles or the Line Manager were assessed. The third part contained questions dealing with leadership and the final part of the survey was a lottery, which offered 6x CHF 50.00 to the winner.

To guarantee anonymity several methods were used: first, certain information was either not assessed (e.g. (team / participants') names, the name of the company's department, company name, town) or only asked in a standardized way (e.g. age which was answered in multiple choice steps of 10) or optional (e.g. gender). Second, each participant received his or her own password, so everybody had an individual survey access. Third, most of the data was used on a team level implementing the anonymity guarantee offered by onlineumfragen.com. As a consequence, the author only saw data from teams with at least three team members.

Since certain questions had many items, some items always came at the end of the list. Therefore, there was a certain probability that those items were not answered and left out by the participants. As a solution, questions with at least five items were randomized.

Survey procedure.

In order to take part in the survey to assess team effectiveness and leadership in Scrum teams, participants had to register by taking part in a pre-survey. This registration included a confirmation of working with Scrum according to the Scrum guide (2013), the setting up of a standardized team code and the entering of the e-mail-addresses of all team members. Afterwards, everyone received an individualized link to the online survey.

The survey was online from 13 August–27 October 2014. Participants were personally recruited by the practice partner and also by publishing the link to the pre-survey on the social media (facebook and Xing). The practice partner sent the pre-survey invitation to 111 respondents and the author herself to another six respondents. During the field phase, three reminder e-mails were sent to increase the response rate.

Participants.

Participants in this study were Suisse Scrum workers¹⁸, including Line Managers and all the Scrum roles. Approximately 44 teams (251 people) registered in the pre-survey to take part in the survey and then they received the invitation to take part in the survey on team effectiveness and leadership in Scrum teams.

Since participants were asked to evaluate the conditions for and the criteria of team effectiveness in their particular Scrum team, only the values of those individuals were included in the data analysis, if at least three members of a team answered the question. This was done for reasons of anonymity and to follow the recommendations in the Scrum guide (Schwaber & Sutherland, 2013, p. 6).

Methodology of Data Analysis

The data first needed to be prepared for further calculations by using IBM SPSS Statistics 22. This preparation included the deletion of dropouts, the recoding of inverse items of rating questions (1 = 4, 2 = 3, 3 = 2, 4 = 1), the recoding of missing values (99) and the recoding of answers like “Weiss nicht / keine Angabe” as a missing value to exclude them from further calculations.

In order to compute correlations on the team level, the individual data needed to be aggregated. In advance, though, tests of agreement among members of a team were calculated as a reliability indicator. The Intra-Class-Correlation (ICC) was used for this purpose since

¹⁸ Since all participants had to confirm working with Scrum in the pre-survey.

this method is especially applicable for interval scaled data¹⁹ and for more than two raters²⁰.

The model used was the ICC_{just}, because only variances of the team member's values were of interest and had to be similar –their absolute values were not necessary. Therefore, differences in a team member's absolute values were not regarded as an error variance and thus do not affect the reliability (Wirtz & Casper, 2002, pp. 159-160). Since alle team members answered the same questions, the two-factorial model could be used. Raters were regarded as fixed for several reasons: (1) all members of a team had been assigned to their teams in advance and were not randomly assigned for the purpose of this thesis, (2) the level of agreement is a characteristic of the teams in order to be able to aggregate the individual data from the team members on the team level and (3) the agreement of one team cannot be generalized for another one (Wirtz & Casper, 2002, pp. 172–173). ICC values were calculated in reference to Wirtz and Casper (2002, pp. 213–218).

In a final step, variables on the scale and subscale level were created in both the individual and the team sample for further calculations. Most of the scales and subscales were arithmetic means of the relevant items. However, three subscales (size, diversity and helpful team leader coaching) were computed differently according to Wagemann et al. (2005, pp. 383–384 for size and diversity; p. 386 for helpful team leader coaching). The latter variable is a square root of the product of *coaching availability* and the average of *leader helpfulness* scores and the team leader's *attention focus* and *coaching activities*. This equation implies that coaching is provided only by team leaders. As for Scrum teams, this cannot be assumed since Scrum teams are often supported by external Scrum coaches who introduced

¹⁹ Technically seen, the response scale ranging from 1 (*highly inaccurate*) to 4 (*highly accurate*) is ordinally scaled. According to Wirtz & Caspar (2002), equidistance is assumed which is why data can be interpreted as intervally scaled (pp. 123–124).

²⁰ Note that only the values of team members were indicated when at least three team members answered the particular item.

Scrum to the department or company. For this reason, the overall condition *available expert coaching* is subdivided into three aspects: coaching availability, helpful team leader coaching (if there is an official team leader; average of team leader helpfulness scores and the team leader's attention focus and coaching activities) and the extent of coaching provided by peers. In their equation, Wagemann et al. (2005) exclude interpersonal coaching as one scale of coaching activities of the team leader without explaining the reason. In this thesis, it is included.

Validation of the questionnaire about team effectiveness.

Kelava and Moosbrugger recommend an item analysis to check the questionnaire's quality, only then can a final test version be developed (2007, p. 74). Therefore, within the framework of this thesis, a representative sample of people answered the questionnaire to assess team effectiveness and leadership in Scrum teams for the first time. Certain descriptive, statistical steps of item analysis have been drawn: After the data was prepared, values of skewness and kurtosis were calculated on both the individual and team level to have a first impression of the sample distribution. Afterwards, descriptive measurements (e.g. mean and standard deviation) were computed (Kelava & Moosbrugger, 2007, pp. 90–91; Zöfel, 2003, pp. 26–28) to describe the distribution in more detail and to have a basis to evaluate item difficulty (Zöfel, 2003, pp. 241–242). The difficulty index for rating scales states that if people agree with an item, it implies that the aspect of the item is strongly present, or vice versa. Reliability values such as Cronbach's Alpha and Cronbach's Alpha if an item was deleted were calculated for subscales with at least three items (Field, 2009, pp. 676–681; Bühner, 2011, pp. 166–169). Hence, the internal consistency of items can be evaluated, providing insight about whether the items of the same scale are related to each other and, therefore, measure the same aspect (Schmermelleh-Engel & Werner, 2007, p. 128). Finally, selectivity values for subscales with

at least three items were calculated (Kelava & Moosbrugger, 2007, pp. 82–84) to analyze how well a particular item measures the characteristic the variable represents and how well it distinguishes between high and low characteristics.

In terms of validity, only face validity was assessed during the pre-test and can be regarded as satisfactory.

Data analysis regarding team effectiveness of Scrum teams.

According to Hackman (1987; 2002) and Wagemann et al. (2005), team effectiveness is supposed to be higher, but not guaranteed to be present, if all conditions and process criteria of team effectiveness are positively present. Seen statistically, this indicates a positive correlation between each condition, the process variables and criteria of team effectiveness. Therefore, in order to test Hypotheses 1 to 3, the Pearson product-moment correlation was calculated on the team level (Zöfel, 2003, pp. 149–154). Only scales were included, not their subscales. Additionally, one-tailed t-tests were calculated with an alpha error of $\alpha = 5\%$ for significance of correlations. According to an a priori sample size planning, computed for a one-tailed t-test to test for significant correlations with GPower 3.1.9.2, the required sample size to detect a medium effect size of $\rho = .30$ is $n = 111$ ($\alpha = 5\%$, $1 - \beta = .95$). For a large effect of $\rho = .50$, the sample needs to consist of $n = 34$. Since the model of team effectiveness targets teams and not individuals and the assumed relations are strongly present, at least 34 teams are needed.

Data analysis regarding leadership within Scrum.

Regarding the leadership of and within the Scrum teams, two open questions, one semi-open question and two closed questions were asked.

If there was an officially designated team leader (Research Questions *a*), participants were shown four possible attention foci from the team leader (e.g. provides individual coaching), which they had to rank according to the most frequent one. The next question deals with concrete coaching activities of the team leader and participants were asked to say how frequently the team leader fulfills them. As for the attention focus of the team leader, answers per attention focus were summed up to a score and then ranked: Answers like “is shown least often” were assigned one point, answers like “is shown most often” four points. The percentage of each attention focus and the number of participants per attention focus were also calculated. Missing values were excluded from the calculations. As for the concrete activities, answers like “sometimes”, “often” and “(almost) always” were included to sum up the most frequent ones and answers like “(almost) never” were included to sum up the least frequent ones.

To analyze open and semi-open questions text data were imported into a tool called QDA (*Qualitative Data Analysis*), which facilitates the creation of categories, top categories and has quantitative measurements such as frequencies and rankings. As for the data analysis of the two open questions, there was no underlying model or theory to guide the evaluation. Thus, the author followed the technique of inductive categorization, a method of qualitative content analysis (Mayring, 2010, p. 67). The analyzing process had the following structure: With the help of text processing psychology, data was approached ascendingly. This means that the participants’ answers were first viewed simply as words and as collections of letters. Ascendingly, these plain text elements were supplemented with interferences and additional meaningful elements, such as the knowledge of the Scrum guide (2013). If answers were directly connected to the question or, in other words, if the answer of a participant could be fully understood as a valid answer, then this data was used for categorization. Categorization was done by keeping to the original meaning of the text as concrete as possible and naming

categories like parts of the text. After approximately 30 % of the data was categorized, the categories were then revised and subsumed and served as the basis for the categorization of the remaining data (Mayring, 2008, pp. 10–13). The process of building categories, which are tightly linked to the original answers, is called inductive categorization (Mayring, 2010, pp. 69–70). During categorization, the author created too many categories than too few but attention was still paid to ensure that categories were still selective (Früh, 2011, p. 87). These categories were built on both formal-syntactic and content-semantic levels, since the answers sometimes were single words and sometimes longer text segments (Früh, 2011, pp. 92–95). The category creation was done in German to avoid using wrong vocabulary and to avoid the falsifying the original meaning. In a next step, the author looked for similar categories in order to create main categories. Afterwards, an evaluation was done to see if the original answers could be also represented by those main categories. Finally, the categories and main categories were ranked and translated into English, which were then reviewed by a native English speaker.

In order to answer Research Questions *b* and *d*, all the categories were ranked according to their frequencies, and afterwards, the main categories were created inductively if the categories were similar.

For the semi-open question referring to who overtakes leadership in Scrum teams (Hypothesis 4) and what kind of leadership is performed by those chosen roles (Research Question *c*) absolute frequencies and the percentage of answers of 100 % were first calculated. After that, the statements from participants were coded in a manner similar to the qualitative content analysis described earlier. This time, though, the analyzing software (QDA) could not be used due to technical problems and the coding had to be done in Excel. Since the answers for each role were very heterogeneous, more than ten categories for each role could be found. In order to reduce complexity even more and to make the interpretations

easier, all categories were merged inductively into main categories, if they were similar.

Finally, if the leadership-aspect was considered to be independent from the Scrum activities, then, each role was marked separately. Afterwards, the categories were translated into English and reviewed by a native English speaker.

In order to answer Hypothesis 5, absolute frequencies per role were calculated to show the distribution of the management functions (Mohrmann, 1995) and additional responsibilities of the Scrum roles and the Line Manager.

Results

To begin with, the final data sample will be introduced, followed by an analysis of the psychometric properties of the questionnaire on team effectiveness. Then, the results referring to the hypotheses about team effectiveness and the ones about the research questions and the hypotheses about leadership in Scrum teams will be presented.

Final data sample

12 dropouts as well as those participants, whose team did not have at least three members who answered the survey ($n = 19$), were excluded from the analyses. This resulted in 120 valid participants and 24 teams at the beginning of the survey. At the end, there were only 57 valid participants forming 11 teams as there were always dropouts, and thus missing values, throughout the survey. For calculation purposes on the individual level, 139 participants could be included. On average, participants needed 52 minutes to complete the survey.

Of those 139 participants, 102 were Developers, 26 Scrum Masters, 20 Line Managers, 18 Product Owners (and 3 dropouts). Some participants had more than one role: 12 people had two roles, 6 participants had three roles and 2 participants even had four roles. 116

participants had only one role. On the team level, there were 12 teams whose members fulfilled several roles. This is 50 % of all the teams that answered this question.

About 105 participants worked only in one team, and 21 people were members of at least two teams. The majority of the participants (60 %) considered him- or herself to be advanced, 23 % were beginners and 18 % experts, when their experience with Scrum was examined. 89 % of the participants were men and 11 % women. Because age was standardized in steps of 10, the actual age distribution can only be estimated: the participants were between 21 and 60 years old (response scale was from 1 = max. 20 years to 5 = 51–60 years, $M = 3.30$, $SD = .90$).

In order to calculate the results on the team level, the levels of agreement among team members of all teams on the team level were computed in advance. ICC values were calculated for 24 teams and can be seen in Table C1. All teams have satisfying values between $ICC_{\text{just}} = .48$ ($F_{(8;24)} = 1.93$, $p = 1.02$) and $ICC_{\text{just}} = .91$ ($F_{(92;644)} = 11.61$, $p = .00$). However, four teams' ICC values are not significant (team 4: $ICC_{\text{just}} = .48$ ($F_{(8;24)} = 1.93$, $p = 1.02$), team 10: $ICC_{\text{just}} = .69$ ($F_{(8;8)} = 3.18$, $p = .061$), team 12: $ICC_{\text{just}} = .37$ ($F_{(8;8)} = 1.59$, $p = .26$), team 21: $ICC_{\text{just}} = .26$ ($F_{(7;14)} = 1.36$, $p = .30$)).

Psychometric Properties of the Questionnaire about Team Effectiveness

The developed questionnaire to assess team effectiveness was evaluated for certain psychometric properties both on the individual and the team level. In this chapter, only the most important results are presented due to the limited scope of this thesis and because the focus lies on the Research Questions and Hypotheses which were introduced on pages 43-46²¹.

²¹ For further details, the interested reader is referred to the Tables C2 and C3.

Psychometric properties on item level.

Most items on both the individual and the team level are negatively skewed and are either too flat or too peaked to fit a normal distribution (Kelava & Moosbrugger, 2007, p. 91).

Regarding the team level means, all values are at least equal to the mean of the response scale, and range from 1 to 4 ($M_{\text{scale}} = 2.5$, $M_{\text{min}} = 2.66$, $M_{\text{max}} = 3.71$). In contrast, on the individual level, two items (EAC_TL10: $M = 2.37$; TEK14: $M = 2.17$) are below the mean of the response scale. Means ranged from $M_{\text{min}} = 2.17$ to $M_{\text{max}} = 3.81$.

Standard deviations on the team level are between $SD = 0.25$ and $SD = 0.69$ indicating that all standard deviations are below one response scale point. On the individual level, though, standard deviations are on average higher, ranging from $SD = 0.49$ to $SD = 1.10$.

On the team level, the difficulties range from 38.1 (very difficult items) to 94.3 (rather easy items), however, most values (68.3 %) are between 59.9 and 79.9 ($M = 69.9$). The difficulties are very similar on the individual level, ranging from 39 to 93.6 ($M = 70.5$).

Selectivities, computed as a corrected item-scale-correlation, range from $-.35$ to $.95$ on the team level, and from $-.30$ to $.78$ on the individual level. On average, the values on both levels are very heterogeneous but are higher on the team level.

Psychometric properties on scale level.

In terms of reliability, Cronbach's Alpha ranges from $-.29$ to $.94$ on the team level and from $-.27$ to $.84$ on the individual level. Tables C2 and C3 show that many scales have acceptable values because they are greater than $.70$, respectively $.80$ (Field, 2009, p. 675), especially on the team level.

Key Findings about Team Effectiveness

According to this survey's 4-point-rating scale, high values stand for effective teams and low values for ineffective teams. All surveyed teams are effective because every mean is between $M = 2.78$ and $M = 3.60$. Almost all teams, with one exception ($M = 2.26$), also show positive process criteria of team effectiveness. This one team has the lowest effectiveness value ($M = 2.78$) and is also the only one with team effectiveness values below 3. Table 1 shows the correlations between the conditions, the process variables and the criteria of team effectiveness.

Table 1

Correlations between the five conditions of team effectiveness, process criteria of team effectiveness and team effectiveness

Mea- sure		1	2	3	4	5	6	7	M	SD
1. RT	<i>r</i>	-							3.33	0.25
	<i>p</i> <i>n</i>	23								
2. CD	<i>r</i>	.06	-						3.20	0.16
	<i>p</i> <i>n</i>	.40 22	22							
3. ES	<i>r</i>	.71**	.31	-					3.19	0.29
	<i>p</i> <i>n</i>	.00 17	.13 16							
4. SOC	<i>r</i>	.42	.41	.56*	-				2.92	0.37
	<i>p</i> <i>n</i>	.07 14	.08 14	.02 13						
5. AEC	<i>r</i>	.32	-.22	.67*	.68*	-			2.95	0.33
	<i>p</i> <i>n</i>	.18 10	.27 10	.02 10	.03 8					
6. TEP	<i>r</i>	.36	-.11	.65*	.37	.76*	-		3.09	0.31
	<i>p</i> <i>n</i>	.11 14	.36 14	.01 12	.12 12	.02 8				
7. TEC	<i>r</i>	.50	.11	.81**	.71*	.74*	.85**	-	3.24	0.23
	<i>p</i> <i>n</i>	.06 11	.38 11	.00 11	.01 10	.03 7	.00 10			

Note. RT = real team, CD = compelling direction, ES = enabling structure, SOC = supportive, organizational context, AEC = available expert coaching, TEP = process criteria of team effectiveness, TEC = criteria of team effectiveness.

* $p < .05$, ** $p < .01$, one-tailed.

Furthermore, participants were asked to state whether the ends, the means, neither or both were set by others or by themselves, as can be seen in Table 2. This section presents findings which are not relevant for the answering of the Hypotheses 1 to 3 but will be discussed later.

Table 2

Setting direction about ends vs. means in absolute and relative values on the individual and the team level

Direction setting	Individual level		Team level	
	<i>n</i>	%	<i>n</i>	%
Ends by others, means by team	90	62.9	15	55.6
Ends by team, means by others	2	1.4	1	3.7
Both ends and means by others	11	7.7	2	7.4
Neither ends nor means by others	21	14.7	3	11.1
Total	124	86.7	22	81.5

Key Findings about Leadership

The data to assess leadership in Scrum teams is both quantitative and qualitative. First, the results of the closed (Research Question *a* and Hypothesis 5) and semi-open question (Research Question *c* and Hypothesis 4) will be analyzed, followed by the results of the open questions (Research Questions *b* and *d*).

Attention focus and coaching activities of the team leader.

The attention focus of the team leaders and their most frequent coaching activities as team leaders were included in the questionnaire about team effectiveness in Scrum teams. The majority of participants ($n = 83$) has an officially designated team leader. In most cases, this role is held by the Scrum Master ($n = 39$) or Line Manager ($n = 28$), less often the Product Owner ($n = 15$) and rarely by a Developer ($n = 1$).

Although the four attention foci seem to be almost equally valued at 25 %, “up the team” and “dealing with external barriers” are by far the most frequently mentioned attention foci ($n = 70$). In addition, they had the highest scores indicating that they are performed most often. Table 3 also shows that the third attention focus, “providing coaching (consulting and support) individually” is performed less often, although it is mentioned almost as often as the first two attention foci.

Table 3

Distribution of scores, percentage and participants over all foci

Team leader's attention focus ($N = 80$)	Score	%	n
Deals with external barriers, e.g. provides the team with resources, guarantees external support, removes impediments.	202	32.4	70
Sets up the team, e.g. clarifies team's goals, chooses team members, structures team task, formulates expectancies.	201	32.3	70
Provides individual coaching (consulting and support).	128	20.5	61
Provides assistance to the team members in order to teach them to work together effectively.	92	14.8	48
Don't know / no answer	-	-	8

In order to find out which coaching activities were fulfilled most frequently by team leaders, all 15 activities were ranked according to the frequency of answers. In Table 4, the most frequent coaching activities are shown. It is noteworthy that all coaching activities are mentioned by more than half of the sample ($n = 41$), except for “providing undeserved approval and / or inappropriate criticism” ($n = 14$).

Table 4

Ranking of the team leader's most frequent activities

Team leader's activities ($N = 82$)	n^a
The team leader...	
... works together with the team to find the best performance strategy.	80
... gives positive feedback, if the team performs well.	80
... gives (negative) feedback when necessary in order to correct mistakes.	75
... encourages team members to learn from each other and to learn from work experience.	74
... encourages togetherness among team members.	74
... encourages the team to have a high goal commitment.	73
... encourages the team to keep the motivation of all members high.	73
... helps the team to notice the talents of each team member and to use them optimally.	67
... keeps the team on the alert for eventualities that require a performance strategy change. .	64
... supports the team in problem solving, if there is a problem.	59
... interferes strongly in content and process of team discussions.	55
... tells the team how to solve their problems.	50
... helps the team members with their interpersonal relationships.	50
... tells the team everything that was done wrong.	50
... gives undeserved approval and / or inappropriate criticism.	14

^a n = Participants answered "sometimes", "often" and "(almost) always". Multiple answers were possible.

Table 5 supports the previous results because participants very often answered “(almost) never” to those coaching activities that were listed at the end of the ranking in Table 4. Again, “giving undeserved approval and / or inappropriate criticism” is the coaching activity that is rarely performed.

Table 5

Ranking of the team leader's most infrequent activities

Team leader's activities ($N = 82$)	n^a
The team leader...	
... gives undeserved approval and / or inappropriate criticism.	62
... tells the team everything that was done wrong.	29
... tells the team how to solve their problems.	28
... interferes strongly in content and process of team discussions.	22

... helps the team members work on their interpersonal relationships. 20

^a n = participants answered "(almost) never". Multiple answers were possible.

More than ten participants did not know how to answer the following three activities: "supporting the team in problem solving, if there is a problem" ($n = 14$), "helping the team members with interpersonal relationships" ($n = 12$) and "keeping the team on the alert for eventualities that require a performance strategy change" ($n = 15$).

Lastly, participants were asked whether their team leader was helpful in terms of enhancing their team effectiveness. 32 participants said "very helpful" (40 %), 43 participants said "rather helpful" (53 %), 5 participants said "rather unhelpful" (6 %) and one participant answered "very unhelpful" (1 %).

Management functions within Scrum.

According to Mohrmann et al. (1995), the leadership of self-organizing teams can be divided in four management functions: task management, boundary management, performance management and technical and discipline leadership. Table 6 shows how those four management functions are included in the given roles.

Table 6

Overview of which roles perform which management functions

Management functions	Scrum Master	Product Owner	Line Manager	Developer	Scrum team	<i>n</i>
Task management	12	30	2	12	34	90
Boundary management	14	33	15	3	19	84
Performance management	19	6	17	4	31	77
Technical and discipline leadership	14	2	52	1	13	82
Total	59	71	86	20	97	

Note. $N = 103$.

In general, every role except for the Scrum Master and the Developer has at least one maximum value in one of the functionalities. The values of the Scrum Master, in contrast, are the ones most equally distributed. Developers are the least mentioned, while the Scrum team itself is the most mentioned.

Additional responsibilities within Scrum.

Participants were asked to state which additional responsibilities were performed by which role. The results are shown in Table 7.

Table 7

Overview of which roles perform which additional responsibilities

Additional responsibilities	Scrum Master	Product Owner	Line Manager	Developer	Scrum team	<i>n</i>
Provision of relevant information	18	52	13	1	17	101
Provision of work equipment	38	4	47	3	9	101
Incentives and payment	7	3	80	1	6	97
Responsibility for success	4	6	7	4	80	101
Responsibility for failure	4	8	7	4	78	101
Total	71	73	154	13	190	

Note. *N* = 103.

Again, except for developers, every role has to fulfill clear responsibilities. In addition, the developers were the ones mentioned least often. Line Managers and Scrum Masters, on the other hand, are mentioned the most.

Leadership roles within Scrum.

The semi-open question raised the question about the roles associated with leadership in the context of Scrum. According to the sample, leadership can be divided into several roles as seen in Table 8. Project managers and product managers are grouped “Others”.

Table 8

Overview of the roles associated with leadership in the context of Scrum

Associated leadership roles	<i>n</i> ^a	%
Scrum Master	59	25.5
Product Owner	51	22.1
Line Manager	49	21.2
Entire Scrum team (Scrum Master, Product Owner, Developers)	38	16.5
Developer	30	13.0
Others	4	1.7
No answer / don't know	8	–

Note. *N* = 108.

^a Answers such as “no answer / don't know” were excluded in the calculations for the percentage of answers. Multiple answers were possible.

Leadership profiles within Scrum.

Participants should describe the leadership style by using the previously chosen roles which are associated with leadership. As a result, categories were created that described the leadership style of the Scrum Master, the Product Owner, the Line Manager, the Developer and the entire Scrum team. All original role categories are shown in Tables C4 to C8. In order to reduce complexity and facilitate interpretation, several categories were merged into main categories only if they were similar. Tables 9 to 13 show the results of the merging process which resulted in leadership profiles for each role.

Table 9

Leadership profile for the Scrum Master

<i>n</i>	Main category	Includes the categories
41	Makes sure that meetings take place and leads them.	conducting / leading / moderating meetings; Daily Scrum; Sprint Planning; retrospective; Scrum-ambassador
23	Provides guidance and support if problems occur.	helps / supports / coaches; eliminates obstacles
16	Guarantees that work is coordinated and organized.	Backlog; administration / organisation / coordination
13	emphasizes the team as a (social) unit	moderating / conflict solving; team development; representing the team; team togetherness; influences collaboration; across teams; team setting up
12	participates in technical matters	participates in process design; Monitoring / controlling; clarifies, e.g. requirements, technical
8	provides orientation	takes care of setting goals and achieving them; provides orientation, motivates

Note. $N = 59$.

Table 10

Leadership profile for the Product Owner

<i>n</i>	Main category	Includes the categories
38	Responsibility to prioritize tasks to define the work scope.	prioritizing of the Backlog / tasks; writing of Backlog / tasks / User Stories; clarifying requirements; defining work scope
15	goal clarification and monitoring	clarifying (functional) goals; (monitoring) of target achievement
4	knowing / solving of problems / conflicts	
3	decision-maker	
2	external responsibility	
1	budget responsibility	

1	coaching
---	----------

Note. $N = 51$.

Table 11

Leadership profile for the Developer

<i>n</i>	Main category	Includes the categories
11	responsibility to deliver Increments	technical responsibility; realizing User Stories; solutions
10	responsibility for quality and improvement	quality; improvements; knowledge exchange
3	one Developer leads	
3	commitment & engagement	
2	self-organization of the team	team coordination; self-organizing
2	helping (technical, human)	
2	questioning	
1	feedback to the Product Owner	

Note. $N = 30$.

Table 12

Leadership profile for the Line Manager

<i>n</i>	Main category	Includes the categories
16	responsible for personnel matters	personnel matters; employee appraisals; personnel development; individual employee management; personnel decisions
7	Is concerned that the Scrum Team has a proper framework for effective team work.	supply of resources; framework
7	only has administrative tasks.	
6	helps the team and intervenes if necessary.	Management by Exception; help / support; removing obstacles
4	goal setting	
3	leading / organizing meetings	
2	task planning & distribution	
2	budget responsibility	

1	Line Manager & Scrum Master are one and the same
1	Line Manager & Scrum Master & Developer are one and the same
1	coordination across teams
1	Operative concerns
1	unconventional thinker
1	Strategic concerns

Note. N = 49.

Table 13

Leadership profile for the entire Scrum team

<i>n</i>	Main category	Includes the categories
24	The Scrum team plans and decides on their tasks themselves.	team makes decisions - implementation; self-organization; team makes decisions; team plans everything, planning; team makes decisions - process & method; team plans tasks; effort estimation
7	Roles of Scrum team work as a team & as a help for each other.	Scrum Master supports the team; team motivation; trust in the Product Owner; Product Owner prioritizes; giving help to each other; working together
6	The Scrum team follows the given process to generate solutions.	adhere to the process & improve it; solution generation
4	feedback & reviews	feedback; reviews

Note. N = 38.

Additional statements referring concretely to the leadership aspect, by having the word “leader” or “leadership” in the statement without Scrum-relevance across all roles are shown in Table 14.

Table 14

Statements of "leader" and "leadership" across all roles

Role	<i>n</i>	Category	Examples
Scrum Master	13	team leader / leadership	"Leitung der Software-Entwickler", "Als Teamleiter."
Product Owner	5	technical leader	"fachlicher leader", "Fachlichkeit", "Führung bei produktspezifischen Unklarheiten"
	2	team leader	"Führt das ganze Team.", "Leitung des Scrum teams inkl. deren Ziele und Visionen"
Developer	4	technical leader	"Technische Entscheide", "technischer leader"
	3	one developer leads	"Bei einzelnen Themen übernimmt oft ein bestimmter Entwickler den Lead, z.B. wenn dieser in diesem Gebiet über mehr Fachwissen verfügt als die anderen Entwickler oder der Team-Leader.", "Senior Entwickler Erstellt hauptsächlich Tasks (aber in Absprache)"
Line Manager	4	administrative / formal leadership	"Administrative Führung", "Als formeller Vorgesetzter."
	3	leadership of employees	"Führung des Entwickler-Teams", "Personalführung"
	2	team leader	"Teamleiter bei uns"
	1	Department head	"Leitung der gesamten Abteilung"
	3	classical role not present	"Der Linienvorgesetzte ist gleichzeitig Mitglied des Scrum Teams und Scrum Master. Die Rolle Linienvorgesetzter wird fast nicht wahrgenommen.", "Ist in der täglichen Arbeit eher ein Mit-Entwickler als ein Vorgesetzter."
Scrum team	2	self-leadership	"Das Team führt sich selber.", "selbständiges Durchführen der Aufgaben (unter obengenannten Einschränkungen)"
	1	everybody's a leader	"Jeder darf sich einbringen und den Lead übernehmen."
	1	servant leadership	"Servant leadership"

Note. N = 108.

The understanding of leadership within Scrum.

Participants were asked to write down their opinion about what kind of leadership leads to success. The answers were very diverse and 48 original categories resulted (Table C9). The author looked for similarities between those categories and merged most of them into main categories, which are shown in Table 15. In order to give the reader more understanding about the main categories, the table includes all the original categories with their description as well. In general, successful leadership is the ability to build a team which acts as a self-organizing unit and to support it with multiple possibilities. Some participants also mentioned concrete characteristics of a leader, although most of the statements referred to leadership in general.

Table 15

Main categories of leadership that leads to success

<i>n</i>	Main category	Includes categories	Description
112	team support	to support the team; to motivate team members; to remove barriers; to protect the team; to trust the team; management by exception; goal-orientation; control of progress; approval; being able to openly talk about problems & be solution-oriented; to give regular and constructive feedback; communication; to identify and promote talents; to promote safety; to have an overview; to give honest criticism; individual leadership; interpersonal relationships; to integrate the team as an organizational unit	Statements that include tasks or leverages of leadership that can help and support the team as a working unit.
67	Basic conditions	to have clear / high / reachable goals; to provide a framework; provision of current information and purpose; appropriate staff assignment; personal & personnel development; to have a vision; task planning; supply of resources; team design; autonomy	Statements that refer to conditions that have to be present so that the team can work as a self-organizing unit.
33	team as a unit	to enhance self-organization; self leadership; team togetherness; participation; team is responsible; to have team goals	Statements that describe the team as a unit and include

			what they have to do.
11	personal characteristics of a leader	to be a role model; to be open to criticism; the leader is part of the team; to be engaged / show interest; to be open-minded; to be self-confident	Statements that refer to the personal characteristics of a leader, if the participants had a particular leader in mind.
8	Other	leadership is in the background; transformational leadership; servant leadership; to loyalty building; continuous improvement; to adapt to new circumstances; balancing between command & control and self organization	Statements that could not be matched to the above categories without distorting the exact meaning of the category and without allowing too much interpretation.

Note. $N = 85$.

Challenges of Line Managers within Scrum.

Participants were asked to describe the challenges faced by Line Managers after the implementation of Scrum. All participants answered this question, not just Line Managers. The analysis of these answers resulted in 35 original categories (Table C10) which were then merged into main categories and are shown in Table 16. It includes the merged original categories and a description of the main category as well. In general, changes which were perceived as challenging could be seen in the tasks and responsibilities of the Line Manager. Three participants mentioned that the traditional Line Manager was no longer needed.

Table 16
Main categories of challenges of Line Managers

<i>n</i>	Main category	Includes categories	Description
65	Through Scrum, new options for action and tasks emerge, which are challenging.	accept self-organization; trust; delegating responsibility; delegating competence; provide resources; framework; support the team; protection; knowledge; to lean back; no command	Now that the Scrum team is a performing unit and are responsible for the product Increment, the Line Manager has new tasks. Performing them is challenging.
19	Traditional tasks are more challenging now than before Scrum.	individual personnel development; personnel selection; performance assessment; team management; team development & team building	Tasks, a Line Manager always had to perform, are now perceived as being more challenging due to Scrum.
17	Reasons for the challenges of the Line Manager	distance; multiple levels of leadership; Scrum Master and Line Manager are separate people; Scrum Master and Line Manager are one and the same; ambiguity of roles; many employees; no Scrum role; connection; agile; no nr. 1, uncertainty & unknowingness; staff turnover	This category includes reasons why Line Managers experience challenges.
12	Traditional tasks are either limited, or no longer allowed to be fulfilled any more. This is challenging.	loss of control	This category does not include concrete tasks, but a loss of control has been perceived.
5	Areas, in which the tasks of the Line Manager are now limited.	administrative function; HR & personnel; strategy	Some participants limit the tasks of the Line Manager to these areas.
3	No need for a traditional Line Manager	no need	The Line Manager is considered to be unnecessary or the traditional role of a Line Manager is no longer needed.

Note. *N* = 77.

Interpretation and Discussion

The following chapter first interprets the results in order to answer the hypotheses about team effectiveness. After that, research questions and hypotheses about leadership in Scrum teams will be answered. Finally, methodological limitations are discussed and recommendations for future action are given.

Team Effectiveness in Scrum Teams

To begin with, the ICC-values are interpreted. The calculation of the ICC values was necessary to justify the data aggregation on the team level in order to calculate results for team effectiveness on the team level. The ICC_{just}, as a method to measure the relationship between the member's ratings, resembles the Pearson's product-moment-correlation and can be interpreted similarly: values of 0 indicate no relationship between the ratings of the team members, whereas a value of 1 indicates the strongest relationship and, therefore, a very high reliability (Wirtz & Casper, 2002, pp. 157). According to Table C1, all the teams have satisfying ICC values indicating that the variance in the output (team effectiveness) can be explained by team characteristics and not by an error variance within the team. However, the four teams with non-significant ICC values were still included in the further calculations because the focus of this thesis is on their team effectiveness values and not on their reliability. Besides, their ICC values are still satisfying. In conclusion, the individual team member's data from the 24 teams could be aggregated on the team level because the agreement on the evaluation of their team effectiveness was satisfying.

Hypotheses 1, 2 and 3 assume a positive relationship between the conditions, process criteria and team effectiveness (pp. 43–46). However, not every hypothesis can be approved. Hypothesis 1 cannot be fully approved because the process criteria of team effectiveness correlates positively with only four conditions. The correlation between the process criteria

and compelling direction was even negative. Of all the positive correlations, only two were significant (the process variable with enabling structure and available expert coaching). Hypothesis 2, in contrast, can be accepted because of the very high and significant positive correlation between process criteria and team effectiveness. Hypothesis 3 can only be partially approved. Team effectiveness is positively related to all five conditions, but only significantly to enabling structure, available expert coaching, and supportive organizational context. Summed up, the assumptions by Hackman (2002) and Wagemann et al. (2010) that the conditions, process criteria and team effectiveness, are positively related cannot be fully supported by this sample. However, despite the very small sample size, some correlations were significant which is surprising, according to the a priori sample size planning. Therefore, the found significant correlations can be interpreted as very large effects. To prove if the assumed, but non-significant, correlations can be statistically found, the sample size should be at least $n = 34$ (see also page 65).

According to Wageman et al. (2005) all five conditions correlated positively with each other. However, this cannot be supported by this thesis because one correlation was negative (compelling direction with available expert coaching) and one relationship almost does not exist (real team with compelling direction). This is probably due to the small sample size.

In the introduction of this paper, Scrum teams were theoretically categorized as self-organizing teams. Several findings indicate an empirical proof for this assumption: First, Scrum teams had to say whether the ends, the means, neither nor or both were decided by themselves or others. 15 out of 22 teams answered that others decide on the ends, but they decide on the means (Table 2, p. 67). Second, regarding the management functions by Mohrman et al. (1995), the Scrum team is responsible for task management since they themselves assign tasks and schedule meetings. In addition, the Scrum team is the only one that does performance management (e.g. with Scrum Retrospectives) such as “defining,

reviewing, and recommending improvements to performance” (p. 134). Finally, looking at the results of both open questions makes it clear that participants regard themselves as members of a self-organizing team. In conclusion, this thesis provides empirical proof that Scrum teams are self-organizing teams in a psychological sense.

Hackman published his first paper on the model of team effectiveness in 1987. Until today, the model has never been tested to see if it can be statistically proven²². In other words, Hackman does not regard the model as an input-process-output-model. Methodologically speaking, this would indicate that the conditions of team effectiveness are the independent variables that affect team effectiveness, the dependent variable. The process criteria would seem to moderate or mediate this relationship. However, Hackman (2002) proclaims a positive relationship between the conditions, process criteria and team effectiveness. To test if this assumption is valid or—despite Hackman’s assumption—if even causalities between the conditions, the process variable and team effectiveness exist, the model should be tested. A first step could be doing a factor analysis to statistically prove the scales and subscales that belong to conditions, process criteria or team effectiveness. In this thesis, though, the focus was on the connection between leadership and team effectiveness within Scrum in order to give hands-on advice to Line Managers. If, however, the relationships or even causalities among and between the conditions, process variables and team effectiveness are to be analyzed, a method to test this model needs to be applied in advance. Otherwise, the results could lead to misinterpretations. Nevertheless, particular subscales can be used to diagnose certain aspects of team effectiveness due to their satisfying psychometric properties.

Lastly, this thesis explored team effectiveness in a particular kind of team: Scrum teams. Wagemann et al. (2005) posited this model and the TDS to be valid “to assess any type of work team that operates in an organizational context.” (p. 375), e.g. in a team of flight

²² At least it is not known by the author despite extensive research.

attendants (Hackman, 2002, pp. 6–22). Therefore, it would be interesting to compare those findings with other agile teams or even self-organizing teams in (knowledge work) branches other than software development.

Leadership within Scrum

Research Question *a* will first be interpreted. The majority of participants have an officially chosen team leader, which is not in accordance with the Scrum guide since this role is not even mentioned. Furthermore, the role of a team leader is most frequently fulfilled by the Scrum Master, but also by the Line Manager and the Product Owner (p. 67). This is the first evidence that Line Managers are still needed because they assume the team leader role in multiple teams. The two main attention foci of the team leader, setting up a team and dealing with external limits and barriers, are both mentioned by 70 out of 80 participants. They had highest scores which implies a strong relevance for the tasks of a team leader (Table 3, p. 68). Additionally, the first attention focus resembles the enabling structure condition which includes the task design and team composition in the team effectiveness model (Wagemann et al., 2010, pp. 377–378). Hackman (2002) comments: “effective leaders attend first to the basic conditions of team effectiveness – the features of the team” (p. 204). According to the sample, setting up a team is the first attention focus of a team leader, which is supported by Hackman (2002). The second attention focus is not directly mentioned in the conditions of team effectiveness. However, it strongly resembles the Scrum Master’s services to the Development Team: “removing impediments to the Developer Team’s progress” (Schwaber & Sutherland, 2013, p. 6). This supports the fact that the role of the team leader is most often fulfilled by the Scrum Master. The most frequent team leader coaching activities²³ belong to

²³ An overview of all coaching activities can be seen in the Table B3.

task-focused coaching which refers to working out the best performance strategy with the team and operant coaching e.g. giving positive and negative feedback when necessary. This shows that the team leader plays an important role in developing an effective way to achieve the team's goals. Thus, the team leader needs to provide occasional positive and negative feedback. With regard to the Scrum guide, such feedback is necessary to inspect and adapt the work process which is a basic aspect of Scrum theory (Schwaber & Sutherland, 2013, pp. 3–4). Interestingly, unhelpful directives (e.g. instructing the team on how to solve their problems) were mentioned by 50 participants. With this scale, Wagemann et al. (2005) examined if team leaders act in a non-supportive way, i.e. they do not let a team organize itself but instruct it and intervene in the working process. The fact that unhelpful directives are said to be present by more than half of the sample may mean that team leaders have problems letting the team work by themselves. Because this can be annoying for a self-organizing team, teams should rate their leader's helpfulness as low. However, 80 out of 90 participants judged their team leader as being between rather helpful and very helpful (p. 70). This implies that perhaps some kind of management-by-exception active is also required by the team. However, this assumption has to be proven in the future. Let me conclude by saying that the necessity of a team leader is supported both by Wagemann et al. (2005) and the Scrum guide, although the latter refers to a Scrum Master and not to a team leader. If the Line Manager is a team leader, he or she will receive helpful advice on how to fulfill his or her role best in this thesis.

Hypothesis 5 implies that all roles (the Scrum Master, the Product Owner, the Developer, the Line Manager and the Scrum team) can be assigned to the four management functions (Mohrmann et al., 1995) (page 46). The results support this hypothesis although the Developer and the Scrum Master do not have as clear a main function as the other roles (p. 70). One possible explanation could be that the Developers, even though they create the

product Increment according to the Scrum guide (Schwaber & Sutherland, 2013, p. 5), seem to need the Scrum Master and the Product Owner to produce the Increment collectively as the entire Scrum team. This corresponds with the findings because the Scrum team was considered to be responsible for the task management by 34 participants out of 97. It is interesting, though, that only a very few participants associated boundary management, performance management and technical as well as discipline leadership with the Developers. Together with the findings for Hypothesis 4, where Developers were also considered to be leaders, these contradicting findings need to be explored. Despite the idea that a Line Manager seems to be unnecessary within the context of Scrum, the results definitely prove the opposite to be true: the Line Manager seems to be the only one who mainly provides technical and discipline leadership. Mohrman et al. (1995) describe technical and discipline leadership as taking care that technical standards are met, the technical knowledge and skills of employees are developed, career paths and individual development are pointed out and new employees are selected (p. 34). This findings corresponds with the leadership profile of the Line Manager (Table 12, p. 74) because, there, the Line Manager is considered to be responsible for individual development and HR practices. If the Line Manager also coaches the team in technical matters, he or she is similar to the team leader according to Wagemann et al. (2005) (pp. 102–103). Additionally, the Line Manager is the only one seen to be responsible for the supply of work equipment and appropriate incentives and payment. These responsibilities are in accordance with Hackman (2002), who identifies the reward system as a high leverage to support teamwork and as one aspect of the supportive organizational context. The rewarding system should thus “provide recognition and reinforcement contingent in excellent team performance” (p. 134). Later, in terms of individual rewards, he even advises Line Managers to “exercise a little managerial authority and require that the team itself handle the distribution of rewards among members” because only they know best about

their individual contribution to team success (p. 143). Work equipment can be regarded as a material resource and it is also a part of the supportive organizational context (Wagemann et al. 2005, p. 378, p. 385), which the Line Manager should take care of.

Hypothesis 4 states that all relevant roles (Scrum Master, Product Owner, Developer, Scrum team, Line Manager) provide some kind of leadership. According to Table 8 (page 72), Hypothesis 4 can be accepted. Implied here again is the importance of the Line Manager's leadership because this role is mentioned as the third most frequently mentioned by almost 50 % of the sample. Regarding the leadership profiles of all roles, it is possible to see a connection to the Scrum guide and also to the model of team effectiveness. The *Scrum Master* should be responsible that meetings like Daily Scrum, Sprint Plannings and Sprint Retrospective take place and stay within a certain time frame. This is in accordance with Schwaber and Sutherland (2013): "facilitating Scrum events as requested or needed" (p. 7, 8, 10, 12). In addition, the Scrum Master makes sure that the work is organized and coordinated. If this can be understood in the Scrum context, then "the Scrum Master is responsible for ensuring Scrum is understood and enacted. Scrum Masters do this by ensuring that the Scrum Team adheres to Scrum theory, practices, and rules" (Schwaber & Sutherland, 2013, p. 6). Last but not least, the task of removing obstacles is mentioned here again as an aspect of leadership, which resembles an attention focus of the team leader (Wagemann et al., 2010, p. 385) and was previously rated second most frequently. The *Product Owner*, in contrast, is responsible for task management and the scope of work. This can be interpreted as a team task and, therefore, as one aspect of the enabling structure condition (Wagemann et al., 2010, p. 377). In addition, this is mentioned in the Scrum guide because "the Product Owner is responsible for the Product Backlog, including its content, availability, and ordering" (Schwaber & Sutherland, 2013, p. 12) which is basically the management of the task. The Developer's leadership is limited to examining the task, e.g. developing the Increment,

something which is also in accordance with the Scrum guide (Schwaber & Sutherland, 2013, p. 5). The role of the *Line Manager* has a rather diverse leadership profile. First, the Line Manager is responsible for traditional HR practices such as personnel decisions or performance assessments. Second, he or she performs more administrative tasks (which were not described in detail by the participants). Third, this role guarantees the basic framework for the team and sets the goal. Especially the latter aspect is in agreement with Hackman's view of Line Managers since they create the conditions that promote team effectiveness (2002, p. 211–213). As already mentioned in the introduction, a team also needs a compelling direction and this, sometimes, must be done by one legitimized person such as the Line Manager (Hackman, 2002, p. 62). Again, this proves the importance of the Line Manager's leadership role. Finally, looking at the statements of "leader" and "leadership", participants consider all roles to be leadership roles. Interestingly, leadership e.g. being a team leader, is provided by the Scrum Master, the Product Owner and the Line Manager. In conclusion, the findings for Research Question *c* support findings regarding Research Question *a*: that all three roles fulfill the job of the team leader. It also shows that all the roles are necessary to describe the concept leadership within the context of Scrum. This fact strongly resembles the leadership theory of Mohrman et al. (1995) and Wurst (2001). Wurst (2001) refers to the impossibility that one person can perform all management functions alone. Therefore, both scholars consider a leader pluralism to be a solid solution (Mohrman et al., 1995, pp. 146–164; Wurst, 2001, pp. 96–98). Finally, it also implies that all roles have to work together, especially if multiple roles claim to have the same leadership role.

Research Question *b* asked for a description of leadership that leads to success. Regarding the results on page 77, the team as a social unit is in the center of all the categories. It needs to be able to organize itself and be responsible for its product. Therefore, a team needs to be build first. According to Hackman, a real team and good team composition are of

great value: “moreover, a real team is the prerequisite for the other conditions. Managers who establish real teams have more choices, and better choices” concerning the other four conditions of team effectiveness (Hackman, 2002, p. 60). The category “to have the basic conditions” such as all the necessary resources, materials and information, was mentioned as a second main category. Since these basic conditions are mainly organizational, they should be provided by an organizational role such as the Line Manager. This advice is contingent to the leadership profile of the Line Manager (Table 12, p. 74). Hackman concludes by saying that “the most important contribution that leaders can make to the teams they create is to establish and maintain the handful of organizational conditions that foster and support competent teamwork” (p. 59, pp. 133–164). The third main category contains the options for actions and leverages that can be used to support the team as a working unit. The fact that this category is the largest shows how many tasks and leverages exist. These tasks strongly resemble the attention focus performed by the team leader (categories such as *remove barriers*). Furthermore, they resemble the activities performed by the team leader and the team itself (categories such as *to motivate team members, to openly talk about problems, to identify and promote talents* for task-focused coaching activities; categories such as *approval* and *to give regular and constructive feedback* for operant coaching activities and categories such as *interpersonal relations* for interpersonal coaching activities) (Hackman, 2002, pp. 165–196; Wagemann et al., 2005, pp. 385–387). Summing up, these three main categories imply a leadership model that emphasizes that the Scrum team is the center and all the other roles, including the Line Manager, are needed to establish a basic framework and to support the team. In conclusion, similarities to the psychological leadership definition (p. 42) emerge because leadership really seems to be a team phenomenon which implies interaction and communication among several people to achieve a goal (Nerdinger & Rosenstiel, 2011, p. 325; Wegge, 2004, p. 98).

The last research question looked at the challenges that Line Managers faced. The main categories, as shown in Table 16 (p. 78), suggest that the observations of the contracting partner of this thesis are valid: Line Managers indeed perceive difficulties that can come up when Scrum is implemented. The contracting partner, however, experienced the following aspects: first, Line Managers regard themselves as being unnecessary and second, they do not know / understand their tasks and responsibilities. The idea of being unnecessary was only mentioned by three participants, so this finding is to be interpreted with caution. In general, it is not the Line Manager per se who is regarded as unnecessary but the traditional way of looking at a Line Manager as the center of the working process and the bearer of the main responsibility. One participant summed it up perfectly: "Die fachliche Führung nimmt ab - die organisatorische Führung wird anders." Referring to the second aspect, participants are very aware of the Line Manager's options for action, e.g. the delegation of responsibility and competence to the team or providing them with resources. In general, the Line Manager still has an important role but needs to withdraw from the front line. Hackman (2002), therefore, claims that there has to be a different approach to leadership: Enhancing the conditions of team effectiveness and clarifying responsibilities means a change in leadership orientation (p. 230–232). A case study in a Suisse insurance company supports this finding, in which the authors examined leadership and personnel management after the implementation of Scrum (Gwerder, Arnold, & Erni, 2014). They found that several organizational changes in terms of the leadership roles needed to be made, e.g. more frequent performance assessments, short-term goals of employees and a different reward system (p. 68.)²⁴.

²⁴ The author of this thesis strongly recommends the reading of this case study since also job descriptions of Scrum Master, Product Owner, and Line Managers are included and, hence, can be used as a leadership guide for other organizations.

Methodological Discussion

Four major aspects limit the reliability and validity of the results of this thesis. First, due to the limited scope of this paper, no tests for unidimensionality were calculated to see whether the items could really be assigned to the proposed scales since Cronbach's Alpha cannot be used to evaluate this (Panayides, 2013, p. 688). Such a test for unidimensionality could have been done with a factor analysis (Zöfel, 2003, p. 221). Second, no validity tests were done, but the questionnaire was compared to the ones by Berg (2010) and Wagemann et al. (2010) (Tables B1 and B2). In terms of reliability, values of Cronbach's Alpha and the selectivity of some subscales are strikingly negative when compared to the other two versions of the TDS, e.g. size or knowledge of results. Since Cronbach's Alpha is a combined index that considers both correlations between items and the number of items (Cortina & Cortina, 1993, p. 103), single items which have low or even negative Cronbach's Alphas need to be revised.

Appendix I provides an overview about items on the individual and the team level, including their psychometric properties, and suggests modifications. Future researchers are strongly recommended to modify items as proposed and run complete tests for psychometric properties. If the interested reader compares means and standard deviations of the author's questionnaire with Berg's (2010) and Wagemann et al.'s (2005), the values then need to be z-standardized due to the changed response scale.

The second and the third methodological limitations concern the method used to analyze the data. The present sample has a multi-level-structure, which means the variables were assessed on an individual level and later aggregated on a team level. In general, whenever research focuses on the relationship of variables, mathematical calculations (e.g. regressions) consider both levels to be independent of one another. However, variables on each level are influenced by certain level inherent factors that, again, influence the relationship between the considered variables (Nezlek, Schröder-Abé, & Schütze, 2006,

pp. 214–215). Traditionally, individual data is first aggregated and then regressions are computed on the team level. However, if two teams have the same mean, but one team's value distribution is low and the other's high, then the mean of the first team is a better indicator of the examined characteristic. Therefore, looking only at the means could lead to incorrect interpretations. Thus, those sources of error have to be statistically controlled as random factors, e.g. through weighted least squares-analyses which include the size and reliability of the measurements. Still, these analyses do not guarantee the appropriate consideration of the errors caused by random factors. That is why specific multi-level-analysis models were developed in line with appropriate software or even SPSS syntax templates (Albright & Marinova, 2010; Nezlek, Schröder-Abé, & Schütze, 2006, p. 216). As a consequence, to really test Hypotheses 1 to 3, the appropriate method of data analysis would have been multi-level models. The main focus of this thesis in terms of team effectiveness, though, was on the development of a questionnaire to assess team effectiveness in Scrum teams and a second focus on the testing of the existing relationships between conditions of team effectiveness, process criteria and team effectiveness by Hackman (2002) and Wagemann et al. (2005). No detailed description of the examined sample in terms of team effectiveness was intended, which would have indicated an analysis of the influences of the individual level on the team level. Furthermore, neither Wagemann et al. (2005) nor Berg (2010) used multi-level-methods. These are the reasons why correlations were computed only on a team level. Multi-level methods are recommended, if the questionnaire is to be used to diagnose real teams or even to do research.

Furthermore, qualitative content analysis was used to analyze text data. Categories and main categories were solely created by the author herself. There was no second coder involved, neither to repeat the inductive categorization nor to deductively confirm the (main) categories created by the author. As a consequence, the results are strongly subjective and do

not satisfy the statistical requirements of objectivity and reliability (e.g. Kelava & Moosbrugger, 2007, pp. 9–13).

Finally, the fourth methodological limitation is the small sample size. In several instances not all team members took part in the survey, which lead to the exclusion of many data sets. Therefore, one could argue that the results are only sufficient for a certain sample and are not necessarily representative of Scrum teams. Since there is no *the* Scrum team and all teams have their individual specifications, a large sample is needed to gain global representivity. In this thesis, though, some aspects of team effectiveness and leadership were explored which should be in every Scrum team making specific representivity a given (Goldhammer & Hartig, 2007, p. 187). However, further usage of the online survey should include a controlling mechanism to ensure that all members of a team participate. This can be easily done, if the survey is completed in a planned meeting such as the Retrospective Meeting at the end of a sprint.

Recommendations for Future Action

The purpose of this thesis was to scientifically explore the observations of the contracting partner who consults Scrum teams, departments and even entire companies when Scrum is implemented. They observed that once Scrum teams have been established, Line Managers often face challenges caused by their own management role. With their Scrum team organizing itself and being responsible for developing the product, Line Managers felt to be redundant.

This thesis provides support for the Line Managers (and for all other roles, too) on multiple levels. First, the Scrum teams as self-organizing teams have been analyzed using a psychological model of team effectiveness. This allows for a deeper understanding about how Scrum teams work and which aspects are important for their effectiveness. As a result, the

Line Managers can better understand their own teams and are provided with leverages to enhance team effectiveness. Second, Line Managers are regarded as unnecessary only if they stay in their original role. As a consequence, Line Managers must be open for change and accept the new expectations team members have from them.

This thesis confirms that a Line Manager is still very much needed and is an equal contributor to a team's success. Scholars who explore self-organizing teams (Wegge, 2004, p. 197) and Scrum teams (Friedrich et al., 2009, p. 954) support this. According to the sample, the Line Manager is a team leader and is responsible for setting up a team and clarifying goals. Moreover, as a leader, the Line Manager leads each team member in a unique way, takes care of personnel matters and supports the teams organizationally. Since the sample used participants experienced in Scrum, future Line Managers can profit from them. This thesis, therefore, functions as a knowledge and experience pool for Line Managers, who are struggling to find their (new) place in an organization. In reference to previous results, especially the leadership profile (Table 12, p. 74) and the additional responsibilities (Table 7, p. 71) Line Managers either already have or need to have the know-how to develop their own job descriptions and skills. According to Hackman (2002) team leaders have four skills: First, they know about conditions of team effectiveness. Second, they diagnose those conditions and execute resulting options for actions. Third, they have emotional maturity, especially in dealing with anxiety in order to make grounded decisions, and fourth, they have a good measure of personal courage. That means being able to focus on what will be best for the future and take risks, even though, people potentially like what the Line Manager is currently doing. Hence, Line Managers are working on the edge of acceptance (pp. 224–230).

Finally, this thesis encourages Line Managers to reflect on their roles, tasks and skills. To support them, leverages to enhance team effectiveness are shown and can serve as a starting point for team development.

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Hochschulverl.

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Appendix A–Introduction

Manifesto for Agile Software Development

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

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

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

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

Figure A1. The Agile Manifesto.

Table A1

Results of the search in the database OvidSP

No.	Author & title	Content	Useful for
1	Fang Chen, · Jay F. Nunamaker Jr., · Robert O. Briggs ,· Gail Corbitt, · James Sager, · Stanley C. Gardiner: An Application of Focus Theory to Project Management Processes	Developing a template to track project progress through using Focus Theory and Collaboration Engineering	Team effectiveness AND leadership in Scrum teams <ul style="list-style-type: none"> - Team members as well as Line Managers were asked to evaluate the template and both of them found it useful. - BUT: no connection to Scrum teams → maybe Sprint Backlog, Product Backlog is already sufficient then
2	Damian Hodgson & Louise Briand: Controlling the uncontrollable: 'Agile' teams and illusions of autonomy in creative work	Team leaders did not regard themselves as leaders, rather guides and coaches, p. 317 SM are not anyone's boss and are seen as facilitators, their concern is the project and their job is to protect the team e.g. from last-minute changes from top mgmt, p. 318 However, despite flat hierarchies the team did only have limited self-organizational power and team leaders still interfered – both teams and organizational roles had difficulties to clear responsibilities. Solution were three hierarchical levels: decision-making power (Developer), decision-managing power (TL), no reference to power † (experts), pp. 318-319	Leadership in Scrum teams <ul style="list-style-type: none"> - Autonomy and control of a team can be difficult to empower and to facilitate - LM / team leader sometimes have to create their own definition and levels of power

- | | | | |
|---|---|---|---|
| 3 | Rasmus Oertel & Conny H. Antoni: Wann und wie lernen Teams? Ein integriertes Modell des Teamlernens mit Berücksichtigung zeitlich-situativer Einflussfaktoren | Die Relevanz von Teamlernen stützt sich zum einen auf das Konzept der Teameffektivität und zum anderen auf Forschung zum organisationalen Lernen.
Ziel = ein zeit- und situationsbasiertes Modell von Teamlernen als Prozess zu entwickeln | Team effectiveness of Scrum teams
- Peer coaching?! |
| 4 | John Stouby Persson, Lars Mathiassen & Ivan Aaen: Agile distributed software development:enacting control through media and context | Case study / Control in agile and distributed software development teams through 4 elements: measurement, evaluation, rewards and sanctions, and roles and relationships and two kinds of control: formal (performance evaluation strategy) and informal (social and people strategy)
→ Qualitative case study to analyze how those 8 possibilities of control are enacted | Leadership of Scrum teams
- If LM experience loss of control, they can see multiple kinds of control in this study and options for actions
- Note: case study was done with distributed teams – also valid for non-distributed teams? |
| 6 | Saonee Sarker & Suprateek Sarker : Exploring Agility in Distributed Information Systems Development Teams: An Interpretive Study in an Offshoring Context | Aspects of which one need to take care of if agile teams are distributed: three categories of agility: resources agility, process agility and linkage agility. Resources agility includes the team design and provision of supportive technology for collaboration and communication | Team effectiveness in Scrum teams
- Team design (Enabling structure)
- Material resources (Supportive organizational resources) |

- | | | | |
|---|--|---|---|
| 5 | Janis Bragan Balda & Fernando Mora: ADAPTING LEADERSHIP THEORY AND PRACTICE FOR THE NETWORKED, MILLENNIAL GENERATION | Leadership that goes in line with Scrum and agile methodologies can help leading Millennials and understanding their kind of leadership. They are networkers and need flat hierarchies, and also have a wish to serve others –intrinsically motivated. | Leadership of Scrum teams
- LM need a new mindset, especially if Millennials are in their Scrum teams. |
| 7 | Michael L. Harris, Rosann Webb Collins, Alan R. Hevner: Control of Flexible Software Development Under Uncertainty | Connection between uncertainty of environment and flexible software development: the fewer or weaker the boundaries of a team, the more necessary feedback becomes.
Two categories of emergent outcome
Controls (= leverages): scope boundaries and dynamic feedback. | Leadership of Scrum teams
- If LM experience loss of control, they can see multiple kinds of control in this study and options for actions |
| 8 | Likoebe M. Maruping, Viswanath Venkatesh, Ritu Agarwal: A Control Theory Perspective on Agile Methodology Use and Changing User Requirements | interactions between control (again formal and informal), agile methodology use and change of requirements as influence on team performance (which is assessed through bug severity, component complexity, coordinative complexity, and dynamic complexity) → regression analyses | Leadership of Scrum teams
- If LM experience loss of control, they can see multiple kinds of control in this study and options for actions |

9	Richard Vidgen & Xiaofeng Wang: Coevolving Systems and the Organization of Agile Software Development	Analysis of 2 teams (one agile, one Waterfall) in terms of 3 principles: match coevolutionary change rates, optimize self-organization, and synchronize concurrent exploration and exploitation → Stretches the importance of self-organizing teams and supportive structures	Team effectiveness in Scrum teams - Self-organizing teams - Supportive organizational context Note: case study was done with XP-teams!
10	Deepti Mishra & Alok Mishra: Effective Communication, Collaboration, and Coordination in eXtreme Programming: Human-Centric Perspective in a Small Organization	The impact of appropriate work environment such as the office layout and tools such as boards to enhance the quality of software development projects (especially XP). Quality of those projects was operationalized through communication, collaboration and coordination.	Team effectiveness AND leadership of Scrum teams - Helpful material and environment (advice for teams and also LM) - LM can see progress through presented boards easier

Note. LM = Line Manager.

Table A2

Overview of links between the Scrum guide (Schwaber & Sutherland, 2013) and the model of team effectiveness (Wagemann et al., 2005)

Scrum guide	Model of team effectiveness	Further explanation
Transparency as one part of Scrum theory (p. 3)	Information system as one part of supportive organizational context	Both aspects recommend sharing critical information to those, who need them. It need to be made sure, that they are understood by those parties.
Inspection as one part of Scrum theory (p. 3)	Extent and focus of expert, available coaching	Both aspects regard both proactively searching for internal and external changes as well as refelcting on processes, increments and tools as necessary.
Scrum teams are self-organizing (p. 4 and 5)	Level of authority (means vs. ends) as one aspect of enabling structure.	Self-organizing teams plan, execute and also evaluate their work by themselves. They are given a direction, but can decide on the means themselves.
Scrum teams are cross-functional (p. 4 and 5)	Diversity and an appropriate bundle of skills as two aspects of the team composition (enabling structure)	All skills needed to execute the work need to be represented. In software development several skills are necessary (programming, designing, testing, etc.).
“Development Teams are structured and empowered by the organisation to organize and manage their own work.” (p. 5)	Supportive organizational context / the manager as the organizational role	What is implied here is the organizations responsibility to empower teams with whatever they need. The second aspect is, that this is mostly done by the manager, who as the representative of the organization takes care that the team is appropriately structured and embedded in the organization.
“Individual Development Team members may have specialised skills and areas of focus, but accountability belongs to the Development Team as a whole.” (p.6)	Interdependancy as one aspect of being a real team.	No matter how specialised some individuals are, the entire team always is responsible for success or failure of the outcome.

Development team size is between 3 and 9, not too small and not too large (p. 6)	Size as one aspect of team composition (enabling structure)	Both paper do not recommend a fix numer, but a rather appropriate number of members in order to perfectly execute the task.
Scrum master coaches Development Team in self-organization and cross-functionality (p. 6)	Coaching by the team leader	According to Hackman, it's the responsibility of the team leader to empower the team to be able to organize their work process themselves.
The Sprint Goal gives the Development Team guidance and causes team members to work together (p.10)	Compelling direction gives a team guidance and interdependency as one aspect of a real team	The Sprint goal has a central role as it sets ground of an interdependent team and offers the team a clear focus, where they are heading at.
Sprint Retrospective (p. 11)	Educational coaching as one kind of coaching by the team leader and team members themselves at the end of delivery	In order to learn how the team can achieve their goals best and most efficiently, they need to have fix-installed time frames, such as those Scrum retrospectives.
The Product Owner monitors the working process and compares it to the remaining ressources and product requirements. This information is made transparent.(p. 13)	Leaders shall gain information about the working process proactively. Necessary information needs to be shared with anyone who depends on it (information system)	Only if the team knows its status quo in terms of the working process, it is able to adapt and change performance strategies.
Sprints, Product Backlog and Sprint Backlog (p. 7 & 11f)	Task identity (Job Characteristics Model)	Both the time frame and the product requirements give a transparent overview about the beginning and ending of the working process, so that team members should have a clear orientation of their current status.
Transparency, inspection and adaptation as base of Scrum (p. 4)	Information system and learning through feedback	Both factors enable a continuous improvement cycle

The role, events and artifacts are practiced in order to develop software	Hackman recommends a task-oriented working process, not a focus on interpersonal relationships
---	--

Appendix B–Method

Table B1

Descriptive Measures of the TDS on the team level including the sample, number of items and means

Measures	<i>n</i>			No. of items			<i>M</i>			<i>SD</i>		
	1 ^a	2 ^a	3	1 ^a	2 ^a	3	1 ^a	2 ^a	3	1 ^a	2 ^a	3
Real Team	140	41					3.94		3.33	0.66		0.48
Boundedness	140	41	24	2	3	3	4.41	4.65	3.71	0.85	0.35	0.31
Interdependence	140	41	24	2	3	3	3.90	4.12	3.05	0.91	0.43	0.45
Stability	140	41	23	2	4	3	3.52	4.43	3.23	1.18	0.44	0.69
Compelling Direction	140	41					3.86		3.20	0.61		0.42
Clarity	140	41	23	2	3	3	3.64	4.04	3.21	1.09	0.42	0.43
Challenge	140	41	23	2	4	3	3.57	3.41	2.87	0.98	0.52	0.49
Consequentiality	140	41	22	2	3	3	4.38	4.01	3.53	0.84	0.67	0.34
Enabling Structure	140	41	17				3.64		3.08	0.59		0.36
Team Composition	140	41	21	7	10	9	3.71		3.13	0.68		0.45
Size	140	41	21	2	3	3	3.51	3.63	3.19	1.18	0.65	0.49
Diversity	140	41	22	2	3	3	3.88	3.68	3.30	0.79	0.68	0.34
Skills	140	41	21	3	4	3	3.74	3.89	2.90	0.87	0.48	0.53
Task Design	140	41		7	11	10	3.81		3.17	0.63		0.27
Whole Task	140	41	19	3	3	4	3.75	4.03	3.32	0.93	0.62	0.28
Autonomy / Judgement	140	41	21	2	4	3	4.09	3.57	3.18	0.77	0.65	0.25
Knowledge of results	140	41	17	3	4	3	3.59	3.72	3.01	0.87	0.55	0.28

Group norms	140	41	20	3	3	3	3.41	3.64	3.17	1.01	0.61	0.51
Supportive Organizational Context							3.33		2.95	0.73		0.47
Rewards / recognition	140	41	15	3	3	3	3.56	3.54	2.89	0.97	0.70	0.43
Information	140	41	18	3	3	3	3.32	3.69	2.96	0.90	0.49	0.45
Education / Consultation	140	41	16	3	3	3	3.45	3.49	3.00	0.88	0.58	0.53
Material resources	140	41	19	2	3	3	2.98	3.80	3.00	0.98	0.52	0.39
Available, expert Coaching ^b	140	41	11				3.09		2.84	0.69		0.49
Coaching availability	140	41	19	3	3	3	3.03	3.51	2.89	0.94	0.51	0.52
Coaching helpfulness	140	41	14	1		1	3.66		3.23	0.60		.40
Leader Coaching	140	41	10						3.12			.35
Task-focused Coaching	140	41	13	6	6	6	3.67	3.32	2.66	0.76	0.77	0.60
Operant coaching	140	41	14	2	3	3	3.63	3.43	3.28	0.79	0.79	0.38
Interpersonal coaching	140	41	11	2	3	3	3.12	3.25	2.76	0.92	0.78	0.68
Unhelpful directives	140	41	14	3	3	3	3.27	3.16	2.93	0.74	0.70	0.47
Peer Coaching	140	41						3.40	2.84		0.47	0.49
Task-focused Coaching	140	41	20	3	3	3	3.40		2.78	0.78		0.49
Interpersonal coaching	140	41	19	1	1	3	3.16		2.70	.94		0.58
Unhelpful interventions	140	41	19	1	1	3	2.65		3.03	.91		0.40

Process Criteria	140	41		9	9	9	3.63		3.09	.72		0.43
Effort	140	41	18	3	3	3	3.80	3.40	3.13	.89	0.68	0.48
Performance Strategy	140	41	16	3	3	3	3.58	3.82	3.01	.85	0.46	0.43
Knowledge and skill	140	41	19	3	3	3	3.52	3.78	3.12	.81	0.49	0.37
Team effectiveness criteria	140	41							3.22			0.43
Team social processes	140	41		7		7			3.25			0.45
Quality of interaction	140	41	16	4	4	4	3.80	3.73	3.30	.79	0.61	0.50
Relationship satisfaction	140	41	19	3	4	3	3.91	3.87	3.26	.70	0.46	0.43
Individual well-being	140	41		11		14			3.18			0.41
Internal work motivation	140	41	18	4	4	4	4.13	3.97	2.70	.60	0.43	0.41
Growth satisfaction	140	41	20	3	3	3	3.87	3.83	3.39	.77	0.39	0.40
General satisfaction	140	41	19	3	3	3	3.89	4.10	3.46	.84	0.42	0.42
Productive output	–	–	14	–	–	4	–	–	3.22	–	–	0.49

Note. 1 = Wageman et al. (2005), 2 = Berg (2010), 3 = Maigatter (2015). Empty cells indicate that no values have been given by the authors.

"–" cells indicate that this aspect has not been assessed by the authors.

^a response scales were ranging from 1 = highly inaccurate to 5 = highly accurate. ^b computed as the average of (1) coaching availability, (2) average of helpfulness & extent and focus of team leader coaching and (3) peer coaching.

Table B2

Descriptive measures of the TDS including the reliability values

Measure	Cronbach's Alpha (individual level)			Cronbach's Alpha (team level)			Selectivity		
	1 ^a	2 ^a	3	1 ^a	2 ^a	3	1 ^a	2 ^a	3
Real Team									
Boundedness	.57	.54	.61	.84	.55	.43	.40	.39	.28
Interdependence	.56	.54	.53	.84	.64	.82	.39	.47	.69
Stability	.81	.47	.84	.94	.62	.94	.68	.48	.88
Compelling Direction									
Clarity	.63	.52	.71	.87	.53	.78	.46	.35	.62
Challenge	.35	.62	.67	.68	.66	.63	.21	.47	.46
Consequentiality	.68	.55	.56	.89	.57	.30	.51	.40	.19
Enabling Structure									
Team Composition									
Size	.36	.71	.46	.69	.84	.32	.22	.70	.16
Diversity	.31	.65	.60	.64	.81	.79	.18	.67	.63
Skills	.63	.72	.70	.87	.76	.79	.36	.58	.66
Task Design									
Whole Task	.32	.39	.62	.65	.61	.52	.19	.45	.27
Autonomy / Judgement	.40	.67	.55	.73	.77	.40	.25	.60	.25
Knowledge of results	.68	.54	.44	.89	.68	.43	.41	.47	.28
Group norms	.79	.67	.84	.94	.73	.86	.55	.41	.74

Supportive Organizational Context									
Rewards / recognition	.81	.67	.78	.94	.81	.83	.58	.52	.72
Information	.73	.65	.72	.92	.76	.89	.48	.60	.79
Education / Consultation	.73	.66	.75	.92	.77	.84	.48	.62	.72
Material resources	.65	.73	.67	.88	.86	.88	.48	.74	.80
Available, expert Coaching ^b									
Coaching availability	.75	.54	.75	.92	.55	.91	.50	.35	.85
Coaching helpfulness									
Leader Coaching									
Task-focused Coaching	.92	.93	.83	.98	.96	.85	.66	.88	.66
Operant coaching	.43	.65	.34	.75	.77	.18	.27	.61	.10
Interpersonal coaching	.79	.86	.77	.94	.92	.87	.65	.83	.76
Unhelpful directives	.51	.44	.31	.86	.50	-.07	.34	.32	-.03
Peer Coaching									
Task-focused Coaching	.90	.83	.81	.97	.87	.89	.76	.71	.81
Interpersonal coaching			.81			.83			.70
Unhelpful interventions			.62			.70			.53
Process Criteria									
Effort	.78	.69	.57	.92	.84	.75	.49	.73	.60
Performance Strategy	.69	.69	.62	.90	.81	.73	.53	.64	.56
Knowledge and skill	.67	.63	.68	.89	.78	.70	.40	.59	.55

Team effectiveness criteria

Team social processes									
Quality of interaction	.78	.73	.76	.93	.84	.94	.47	.70	.85
Relationship satisfaction	.76	.63	.60		.64	.83	.52	.42	.69
Individual well-being									
Internal work motivation	.66	.59	-.27		.77	-.29	.33	.59	-.08
Growth satisfaction	.71	.69	.63		.68	.89	.45	.51	.78
General satisfaction	.84	.73	.61		.78	.82	.57	.62	.69
Productive output	–	–	.84	–	–	.88	–	–	.74

Note. 1 = Wageman et al. (2005), 2 = Berg (2010), 3 = Maigatter (2015). Empty cells indicate that no values have been given by the authors.

"–" cells indicate that this aspect has not been assessed by the authors.

^a response scales were ranging from 1 = highly inaccurate to 5 = highly accurate. ^b computed as the average of (1) coaching availability, (2) average of helpfulness & extent and focus of team leader coaching and (3) peer coaching.

Table B3

Questionnaire about team effectiveness including variables, items, item origin and item modification

Item	for	Description	Inverse	Origin	Hackman's model / variable
		<p>Wichtige Vorabinfo: Wenn nachfolgend von Rollen und Scrum teams die Rede ist, so ist folgendes gemeint:</p> <p>Ein Scrum team besteht aus einem Scrum Master, einem Product Owner und den Entwicklern (Keine Linienvorgesetzte oder externe Mitarbeitende).</p> <p>Mit Rollen hingegen sind Scrum Master, Product Owner, Entwickler und Linienvorgesetzte gemeint.</p>			
ADP1	alle	<p>Ich arbeite in folgendem Land</p> <p><input type="radio"/> Deutschland <input type="radio"/> Schweiz</p>		eigenes Item	Allgemeine Daten zur Person

ADP2	alle	<p>Welche der nachfolgenden Rollen haben Sie inne? Wichtige Info : Falls Sie mehrere Rollen erfüllen, beantworten Sie bitte den gesamten Fragebogen für diejenige Rolle, in der Sie die meiste Zeit arbeiten und setzen Sie sie bitte auf Prio 1.</p> <p><input type="radio"/> Scrum Master <input type="radio"/> Product Owner <input type="radio"/> Entwickler <input type="radio"/> Linienvorgesetzter</p>	eigenes Item
ADP3	alle	Wie lange haben Sie bereits diese Rolle inne?	eigenes Item
ADP4	LV	Wie viele Mitarbeitende haben Sie?	eigenes Item
ADP5	LV	Auf wie viele Teams sind Ihre Mitarbeitenden verteilt?	eigenes Item

Wichtige Info: Falls Sie mit mehr als einem Team zusammenarbeiten, denken Sie bitte bei der folgenden Befragung an dasjenige Team, in welchem entweder die meisten Mitarbeitenden von Ihnen sind (weil Sie es dadurch evtl. besser kennen als andere. Nachfolgend antworten Sie für "Ihr Team".

ADP6	SM, PO, Ent w.	In wie vielen Teams arbeiten Sie zur Zeit? Falls Sie in mehr als einem Team arbeiten, denken Sie bitte bei der folgenden Befragung an dasjenige Team, in dem Sie die meiste Zeit verbringen und bleiben Sie bitte bei diesem.	eigenes Item
ADP7	alle	Wie lange besteht Ihr jetziges Team bereits? Runden Sie bitte jeweils ab, bspw. bei "1,4 Jahren" auf "1 Jahr".	eigenes Item
ADP8	alle	Wie viel Erfahrung haben Sie bereits mit der Arbeit in Scrum? Ich würde mich als...- bitte wählen Sie aus - bezeichnen. O Laie O Fortgeschrittene/r O Experte/in	eigenes Item
ADP9	alle	Ich bin O weiblich O männlich	eigenes Item

ADP1 0	alle	<p>Mein Alter ist</p> <p><input type="radio"/> bis 20 Jahre</p> <p><input type="radio"/> 21 - 30 Jahre</p> <p><input type="radio"/> 31 - 40 Jahre</p> <p><input type="radio"/> 41 - 50 Jahre</p> <p><input type="radio"/> 51 - 60 Jahre</p>	eigenes Item	
RT	alle	<p>Bitte beantworten Sie die nachfolgenden Angaben zu den Eigenschaften Ihres Teams, und zwar für den aktuellen Sprint.</p> <p>Versuchen Sie bitte, so objektiv wie möglich zu sein.</p> <p>Antworten: 1 - vollkommen nicht zutreffend, 2 - eher nicht zutreffend, 3 - eher zutreffend, 4 - vollkommen zutreffend, 5 - weiss nicht / keine Angabe</p>		Real Team
RT1	alle	<p>Die Teamzugehörigkeit ist <i>recht klar und eindeutig</i> - jeder weiss genau, wer in diesem Team ist und wer nicht.</p>	<p>Originalitem von Wagemann et al. (2005), Übersetzung von Berg (2010) mit Ergänzungen in Kursiv</p>	RT - bounded

RT2	alle	Die Mitglieder dieses Teams sind stark voneinander abhängig, um das Teamziel zu erreichen.		Originalitem von Wagemann et al. (2005) selbst übersetzt, Übersetzung von Berg (2010) weist zu wenig Ähnlichkeit mit dem Original auf (Aspekt der Abhängigkeit auf "Zusammenarbeit" reduziert)	RT - interdependent
RT3	alle	Zu diesem Team kommen ständig neue Mitglieder hinzu bzw. verlassen es.* * Gemeint sind damit nur interne Mitarbeitende, keine externen.	X	Originalitem von Wagemann et al. (2005) selbst übersetzt, Übersetzung von Berg (2010) ist nicht wortwörtlich bzw. auf mehrere Items verteilt (Mitgliederaufnahme von Mitgliederverlust getrennt) (Heterogene Werte im Pretest)	RT - stable
RT4	alle	Die Mitglieder dieses Teams haben ihre eigenen individuellen Aufgaben zu erledigen, <i>die nur wenig Anlass zur Zusammenarbeit im Team geben.</i>	X	Originalitem von Wagemann et al. (2005) selbst übersetzt, Übersetzung von Berg (2010) ist zu wortwörtlich und nicht gebräuchlich, Änderungen in Kursiv.	RT - interdependent

RT5	alle	Im Team herrscht so grosse Unklarheit, wer zum Team gehört und wer nicht, dass eine genaue Mitgliederliste nicht erstellt werden kann.	X	Originalitem von Wagemann et al. (2005) selbst übersetzt bzw. in Originalform belassen, da Berg (2010) das Item teilte.	RT - bounded
RT6	alle	Dieses Team ist <i>relativ</i> stabil in der Zusammensetzung, d.h. dass es nur sehr selten bis nie Änderungen bei den Teammitgliedern gibt.		Originalitem von Wagemann et al. (2005), Übersetzung von Berg (2010) mit Veränderungen in Kursiv	RT - stable
RT7	alle	<i>Um das Ergebnis bzw. das Produkt das Teams zu erstellen, müssen wir viel miteinander kommunizieren und uns im Team koordinieren.</i>		Originalitem von Wagemann et al. (2005) selbst übersetzt, Übersetzung von Berg (2010) ist zu wortwörtlich und nicht gebräuchlich, Änderungen in Kursiv.	RT - interdependent
RT8	alle	In diesem Team werden regelmässig Mitglieder ausgetauscht.	X	Originalitem von Wagemann et al. (2005), Übersetzung von Berg (2010) mit Auslassungen "gegen neue Mitarbeiter"	RT - stable
RT9	alle	Jede/r, die/der das Team kennt, könnte alle Teammitglieder korrekt benennen bzw. zuordnen.		Originalitem von Wagemann et al. (2005) selbst übersetzt, Berg (2010) greift es gar nicht auf	RT - bounded

CD	alle	Bitte beantworten Sie nachfolgende Angaben zu den Teamzielen für den aktuellen Sprint.			Compelling Direction
		Antworten: 1 - vollkommen nicht zutreffend, 2 - eher nicht zutreffend, 3 - eher zutreffend, 4 - vollkommen zutreffend, 5 - weiss nicht / keine Angabe			
CD1	alle	Die Ziele des Teams sind so herausfordernd, dass sich die Teammitglieder ziemlich anstrengend müssen, um sie zu erreichen.		Originalitem von Wagemann et al. (2005) selbst übersetzt, Die Übersetzung von Berg (2010) erhielt heterogene Werte im Pretest.	CD - challenging
CD2	alle	Die <i>Ziele</i> des Teams sind so klar <i>spezifiziert</i> , dass alle Mitglieder genau wissen, was das Team erreichen soll.		Originalitem von Wagemann et al. (2005), Übersetzung von Berg (2010) jedoch mit Ergänzungen vom Originalitem	CD - clear
CD3	alle	Die Arbeit dieses Teams hat keinerlei Auswirkungen für irgendjemanden.	X	Originalitem von Wagemann et al. (2005), Übersetzung von Berg (2010) jedoch mit Änderung von "Purpose" in "Arbeit"	CD - consequential

CD4	alle	Die Ziele des Teams sind nicht besonders <i>herausfordernd - man kann sie relativ leicht erreichen.</i>	X	Originalitem von Wagemann et al. (2005) selbst übersetzt, die Übersetzung von Berg (2010) ist nicht ("hoch" für "challenging") bzw. zu wortwörtlich (2. Teil), Änderungen in Kursiv	CD - challenging
CD5	alle	Über die Ziele, die das Team erreichen soll, besteht Klarheit.		Item von Berg (2010)	CD – clear (3. Item zu "Clear")
CD6	alle	Die Arbeit des Teams hat spürbare Auswirkungen auf diejenigen, die wir beliefern.		Originalitem von Wagemann et al. (2005), Übersetzung von Berg (2010) jedoch mit Änderung von "Purpose" in "Arbeit"	CD - consequential
CD7	alle	Für das Team ist es nicht leicht, die geforderten Ziele zu erreichen.		Item von Berg (2010)	CD - challenging (3. Item zu "Challenging")
CD8	alle	Für andere hat die Arbeit dieses Teams bedeutsame Konsequenzen.		Item von Berg (2010)	CD - consequential (3. Item zu "Consequential")
CD9	alle	Im Team herrscht grosse Unsicherheit und Unklarheit <i>darüber</i> , was das Team erreichen soll.	X	Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010) jedoch mit Änderungen in Kursiv	CD - clear

CD10	alle	Bitte wählen Sie aus, welche Aussage über die Zielsetzung und -erreicherung am meisten für Ihr Team zutrifft.	Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010).	CD - ends vs means
		O Die Ziele unseres Teams wurden von Dritten festgelegt, aber die Wege und Vorgehensweisen zur Zielerreichung sind uns überlassen.		
		O Wie wir bei unserer Arbeit vorgehen sollen, wird im Detail von Dritten festgelegt, aber die Ziele unseres Teams können wir festlegen.		
		O Sowohl die Ziele unseres Teams als auch die Vorgehensweisen zur Zielerreichung werden von Dritten festgelegt.		
		O Weder die Ziele für unser Team noch die Vorgehensweisen zur Zielerreichung werden von Dritten festgelegt.		
VW1	alle	"Dritte" bezieht sich auf folgende Rolle/n:	eigenes Item	Führung (Verantwortlichkeiten)
		O Product Owner		
		O Linienvorgesetzte/r		
		O Product Owner UND		
		Linienvorgesetzte/r		
		O Weiss ich nicht		

	alle	Wie viele Mitglieder hat Ihr Team (inkl. Ihnen selbst)?		eigenes Item	Team Composition
ESTC	alle	Bitte beantworten Sie nachfolgende Angaben zur Teamstruktur für den aktuellen Sprint. Antworten: 1 - vollkommen nicht zutreffend, 2 - eher nicht zutreffend, 3 - eher zutreffend, 4 - vollkommen zutreffend, 5 - weiss nicht / keine Angabe			Enabling Structure
ES_T C1	alle	Jeder im Team hat genau die Fähigkeiten, die für die Teamarbeit notwendig sind.		Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010).	ES - TC - Skills
ES_T C2	alle	Dieses Team ist etwas grösser als es sein muss.	x	Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010). ((erhielt im Pretest heterogene Werte))	ES - TC – Size
ES_T C3	alle	Die Mitglieder dieses Teams sind zu <i>verschieden</i> , um gut zusammenzuarbeiten.	X	Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010) mit Änderungen in Kursiv. (erhielt im Pretest heterogene Werte)	ES - TC - Diversity

ES_T C4	alle	Die Mitglieder <i>dieses Teams</i> haben mehr als genug Fähigkeiten und Erfahrungen für die Art der Arbeit, die wir <i>erledigen</i> .		Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010) mit Änderungen in Kursiv.	ES - TC - Skills
ES_T C5	alle	Dieses Team hat zu wenige Mitglieder für das, was es erreichen soll.	X	Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010).	ES - TC - Size
ES_T C6	alle	Dieses Team hat eine nahezu ideale Mischung von Mitgliedern - einen unterschiedlichen Mix von Menschen, die verschiedene Sichtweisen und Erfahrungen für die Arbeit mitbringen.		Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010).	ES - TC - Diversity
ES_T C7	alle	Einzelnen Mitgliedern in diesem Team mangelt es an Wissen und Fähigkeiten für <i>unsere Arbeit</i> .	X	Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010) mit Änderungen in Kursiv.	ES - TC - Skills
ES_T C8	alle	Dieses Team hat genau die richtige Grösse, um seine Aufgaben zu erfüllen.		Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010).	ES - TC - Size

ES_T C9	alle	Dem Team fehlt eine ausreichende Bandbreite an Erfahrungen und Weitsicht, um die Aufgaben zu erfüllen.	X	Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010). (erhielt im Pretest heterogene Werte)	ES - TC - Diversity
ES_T TD	alle	Bitte beantworten Sie nachfolgende Angaben zur Teamaufgabe für den aktuellen Sprint. Antworten: 1 - vollkommen nicht zutreffend, 2 - eher nicht zutreffend, 3 - eher zutreffend, 4 - vollkommen zutreffend, 5 - weiss nicht / keine Angabe			Team task design
ES_T TD1	alle	Die Arbeit des Teams bietet kaum Spielraum für eigene Entscheidungen oder eigene Initiativen.	X	Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010).	ES - TTD - autonomy / judgement
ES_T TD2	alle	Beim Erledigen unserer Teamaufgaben werden glaubwürdige Kenngrößen erzeugt, die belegen, wie gut wir arbeiten.		Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010).	ES - TTD - knowledge of results

ES_T TD3	alle	Unser Team erledigt einen so kleinen Teil <i>des Endproduktes</i> , dass es schwer ist, unseren eigenen Beitrag zu erkennen.	X	Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010) mit Änderungen in Kursiv.	ES - TTD - whole task
ES_T TD4	alle	Die Arbeit selbst gibt uns so gut wie keine vertrauenswürdige Rückmeldung über die Leistung unseres Teams.	X	Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010).	ES - TTD - knowledge of results
ES_T TD5	alle	Die Ausführung der Arbeit verlangt vom Team viele eigenständige Entscheidungen.		Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010).	ES - TTD - autonomy / judgement
ES_T TD6	alle	Die Arbeit betrifft das gesamte Arbeitsprodukt von Anfang bis Ende.		Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010) - hier allerdings nur der eine Teil "We do a whole [...] task").	ES - TTD - whole task

ES_T TD7	alle	Unsere eigenen Tätigkeiten kann man dem Endprodukt leicht ansehen.		Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010) - hier der zweite Teil "[...] identifiable task").	ES - TTD - whole task
ES_T TD8	alle	Wir bekommen erst heraus, wie gut wir arbeiten, wenn es uns andere aus dem Unternehmen mitteilen.	X	Originalitem von Wagemann et al. (2005) selbst übersetzt, die Übersetzung von Berg (2010) ist nicht wortwörtlich bzw. zu verfremdet ("andere im Unternehmen" entspricht nach Berg "ausserhalb der Teamarbeit").	ES - TTD - knowledge of results
ES_T TD9	alle	Unser Team hat die Freiheit, die eigene Arbeitstätigkeit zu überwachen und diese zu ändern oder anzupassen, wenn notwendig.		Item von Berg (2010).	ES - TTD - autonomy / judgement (3. Item zu "Autonomy/ judgement")
ES_T TD10	alle	Die <i>Arbeit</i> des Teams ist insgesamt <i>betrachtet</i> wichtig und bedeutsam.		Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010) mit Änderungen in Kursiv.	ES - TTD - whole task

ES_G N	alle	Bitte beantworten Sie nachfolgende Angaben zu den Teamnormen.			Group norms
		Versuchen Sie bitte, möglichst objektiv zu antworten.			
		Antworten: 1 - vollkommen nicht zutreffend, 2 - eher nicht zutreffend, 3 - eher zutreffend, 4 - vollkommen zutreffend, 5 - weiss nicht / keine Angabe			
ES_G N1	alle	Die Anforderungen an das Mitarbeiterverhalten im Team sind vage und unklar.	X	Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010). (Berg schreibt "Anforderungen", Wagemann "Standards")	ES - group norms
ES_G N2	alle	Jedem ist klar, was akzeptables Mitarbeiterverhalten in diesem Team ist und was nicht.		Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010).	ES - group norms
ES_G N3	alle	Die Mitglieder dieses Teams stimmen in den Vorstellungen überein, wie Mitglieder sich im Team verhalten sollen.		Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010).	ES - group norms

SOC	alle	Bitte beantworten Sie nachfolgende Angaben zu den organisationalen Rahmenbedingungen für das Scrum team.		Supportive Organisational Context
		Antworten: 1 - vollkommen nicht zutreffend, 2 - eher nicht zutreffend, 3 - eher zutreffend, 4 - vollkommen zutreffend, 5 - weiss nicht / keine Angabe		
SOC1	alle	In diesem <i>Unternehmen</i> ist es leicht für Teams, alle Informationen oder Hinweise zu bekommen, die sie für ihre Arbeit benötigen.	Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010) mit Änderungen in Kursiv.	SOC - Information
SOC2	alle	Exzellente Teamleistung lohnt sich in diesem <i>Unternehmen</i> .	Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010) mit Änderungen in Kursiv.	SOC - rewards / recognition
SOC3	alle	In diesem <i>Unternehmen</i> müssen Teams mit dem bereits vorhandenen Fachwissen der Mitglieder auskommen - Trainings und Unterstützung sind nicht verfügbar, auch wenn diese benötigt werden.	X Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010) mit Änderungen in Kursiv, "technische" von Berg (2010) weggelassen, weil für Scrum nicht passend.	SOC - education / consultation

SOC4	alle	Teams in diesem <i>Unternehmen</i> können jederzeit alle <i>technische und materielle</i> Unterstützung erhalten, die sie für ihre Arbeit benötigen.		Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010) mit Änderungen in Kursiv, "technische und" eingefügt aufgrund von informationstechnologischem Hintergrund	SOC - material / resources
SOC5	alle	Sogar Teams, die besonders gute Arbeit leisten, erhalten von diesem <i>Unternehmen</i> keine Anerkennung.	X	Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010) mit Änderungen in Kursiv. (erhielt heterogene Werte im Pretest)	SOC - rewards / recognition
SOC6	alle	Dieses Unternehmen lässt seine Teams über notwendige, arbeitsrelevante Informationen im Dunkeln.	X	Originalitem von Wagemann et al. (2005) selbst übersetzt, die Übersetzung von Berg (2010) ist nicht wortwörtlich bzw. bietet zu viel Interpretationsspielraum und Hinweis auf andere Infos ("und hält Informationen zurück, ihre Arbeitsplätze beeinflussen")	SOC - Information

SOC7	alle	Wenn etwas passiert, bei dem Teammitglieder nicht wissen, wie sie damit umgehen sollen, können sie problemlos Trainings und Hilfe erhalten.		Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010) mit Änderungen in Kursiv, "und technische" weggelassen, weil unnötig genau.	SOC - education / consultation
SOC8	alle	Dieses <i>Unternehmen</i> lobt und bestärkt Teams, die gute Arbeit leisten.		Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010) mit Änderungen in Kursiv.	SOC - rewards / recognition
SOC9	alle	Der Mangel an <i>Ressourcen (Technik, Personal, etc.)</i> ist in diesem <i>Unternehmen</i> ein echtes Problem für Teams.	X	Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010) mit Änderungen in Kursiv, Ergänzung eingefügt, damit besser verständlich.	SOC - material / resources
SOC10	alle	In diesem <i>Unternehmen</i> erhalten Teams für die Arbeit, die sie erledigen müssen, nicht das geeignete Training.	X	Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010) mit Änderungen in Kursiv.	SOC - education / consultation

SOC1 1	alle	Teams in diesem <i>Unternehmen</i> können alle Informationen bekommen, die sie zur Planung ihrer Arbeit benötigen.		Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010) mit Änderungen in Kursiv.	SOC - Information
SOC1 2	alle	Teams in diesem Unternehmen haben alle Arbeitsmaterialien, die sie benötigen.		eigenes Item	SOC - material / resources (3. Item zu "Material / resources")
EAC_ avail	alle	Bitte beantworten Sie folgende Angaben bzgl. der Verfügbarkeit von Unterstützung. Antworten: 1 - niemals, 2 - manchmal, 3 - oft, 4 - fast immer, 5 - weiss nicht / keine Angabe			expert, available Coaching
EAC_ avail1	alle	Wenn <i>Team</i> mitglieder bei der Zusammenarbeit Schwierigkeiten haben, ist niemand da, um ihnen zu helfen.	X	Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010). Änderung in Kursiv und "dieses Betriebs" weggelassen.	EAC - ATC - coaching availability
EAC_ avail2	alle	In diesem <i>Unternehmen</i> können Teams Hilfe von <i>Experten und / oder Coaches</i> erhalten, um aus Erfolg oder Misserfolg zu lernen.		Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010). Änderung in Kursiv.	EAC - ATC - coaching availability

EAC_ avail3	alle	In diesem <i>Unternehmen</i> sind <i>Experten und / oder Coaches</i> jederzeit für Teams verfügbar.		Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010). Änderung in Kursiv.	EAC - ATC - coaching availability
EAC_ peer	alle	Auch Ihre Teammitglieder selbst sind von Interesse. Bitte geben Sie an, wie oft die Teammitglieder folgende Handlungen ausführen. Antworten: 1 - niemals, 2 - manchmal, 3 - oft, 4 - fast immer, 5 - weiss nicht / keine Angabe Mitglieder meines Teams...			extent and focus of coaching provided by peers
EAC_ peer1	alle	... ergreifen die Initiative, um eine hohe gemeinsame Motivation und <i>Zielbindung</i> zu fördern.		Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010). Änderung in Kursiv, bisher wurde "commitment" immer mit "Zielbindung" übersetzt.	EAC - EFPC - task-focused peer coaching
EAC_ peer2	alle	... verlieren sich oftmals in Teamdiskussionen, die dadurch nicht mehr zielführend sind.	X	eigenes Item	EAC - EFPC - unhelpful peer intervention (2. Item zu unhelpful peer intervention, nach TLEC4)

EAC_ peer3	alle	... ergreifen die Initiative, um konstruktiv Probleme oder Konflikte, die sich zwischen den Teammitgliedern entwickeln, zu lösen.		Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010).	EAC - EFPC - interpersonal peer coaching
EAC_ peer4	alle	... ergreifen die Initiative, um sicherzugehen, dass das Team die bestmögliche Herangehensweise an die Arbeit entwickelt und nutzt.		Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010).	EAC - EFPC - task-focused peer coaching
EAC_ peer5	alle	... erzählen anderen Teammitgliedern, was zu tun ist und wie sie es tun sollen.	X	Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010).	EAC - EFPC - unhelpful peer intervention
EAC_ peer6	alle	... fördern gutes Miteinander unter den Teammitgliedern.		eigenes Item	EAC - EFPC - interpersonal peer coaching (3. Item zu interpersonal peer coaching, nach TLEC_15)
EAC_ peer7	alle	... ergreifen die Initiative, um dem Team zu helfen, das Wissen und die Fähigkeiten von Teammitgliedern aufzubauen und effektiv zu nutzen.		Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010).	EAC - EFPC - task-focused peer coaching
EAC_ peer8	alle	... erteilen sich gegenseitig oft unverdientes Lob und /oder unangebrachte Kritik.	X	eigenes Item	EAC - EFPC - unhelpful peer intervention (3. Item zu

				unhelpful peer intervention nach TLEC_14)
EAC_ peer9	alle	... helfen sich gegenseitig, an ihren zwischenmenschlichen Beziehungen zu arbeiten.	eigenes Item	EAC - EFPC - interpersonal peer coaching (2. Item zu interpersonal peer coaching nach TLEC_10)
TEP / TEK	alle	Bitte geben Sie an, wie Sie die Zusammenarbeit im Scrum team beschreiben würden. Antworten: 1 - vollkommen nicht zutreffend, 2 - eher nicht zutreffend, 3 - eher zutreffend, 4 - vollkommen zutreffend, 5 - weiss nicht / keine Angabe		Working together as a Team (Process Criteria of team effectiveness - quality of team interaction)
TEP1	alle	Meine Teamkollegen zeigen ihren Einsatz für das Team, indem sie zusätzliche Zeit und Anstrengung investieren, damit wir erfolgreich sind.	Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010).	TEP - Process - effort- related process criteria
TEP2	alle	Unser Team findet oft neue Wege zur Fortsetzung der Arbeit, die sich als genau das Richtige herausstellen.	Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010).	TEP - Process - strategy-related process criteria

TEP3	alle	Wie ernst die Ideen und Vorschläge eines Teammitglieds genommen werden, hängt eher von seiner bzw. ihrer Person ab, als von seiner bzw. ihrer Kompetenz und Expertise.	X	eigene Übersetzung von Wagemann et al. (2005), weil Berg (2010) nicht wortwörtlich bzw. zu verfremdet ("wenn diese Kollegen wichtig für das Team sind" entspricht nicht Wagemanns (2005) "depends more on who the person is than an how much he or she actually knows") (Übersetzung von Berg (2010) hatte heterogene Werte im Pretest.)	TEP - Process - knowledge - and - skill-related process criteria
TEK1	alle	Zwischen den Teammitgliedern gibt es eine Menge Unfreundlichkeit.	X	Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010).	TEK - team interpersonal process - quality of team interaction
TEP4	alle	Jeder in diesem Team ist hoch motiviert, damit das Team erfolgreich ist.		Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010).	TEP - Process - effort-related process criteria
TEK2	alle	Je länger wir als Team zusammenarbeiten, desto weniger gut arbeiten wir.	X	Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010).	TEK - team interpersonal process - quality of team interaction

TEP5	alle	<i>Einzelne</i> Teammitglieder übernehmen keinen fairen Anteil von unserer gesamten Arbeitsbelastung.	X	Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010). Änderungen in Kursiv, denn "some" ist eher als "manche/einzelne" nicht als "einige" zu verstehen.	TEP - Process - effort-related process criteria
TEP6	alle	Die Mitglieder unseres Teams teilen ihr Spezialwissen und ihre Expertise miteinander.		Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010). Änderungen in Kursiv, denn "special knowledge" ist eher als "Spezialwissen" nicht als "spezielle Kenntnisse" zu verstehen, "expertise" wörtlich übersetzt. (Übersetzung von Berg (2010) hatte heterogene Werte im Pretest.)	TEP - Process - knowledge - and - skill-related process criteria
TEP7	alle	Unser Team fällt oft in kopflose Routinetätigkeiten, ohne zu bemerken, dass sich die Situation geändert hat.	X	Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010). Nur Satzstellung "sich" geändert.	TEP - Process - strategy-related process criteria

TEK3 alle Die Zusammenarbeit gibt uns Energie und Antrieb.

Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010).

TEK - team interpersonal process - quality of team interaction

TEP8	alle	Unserem Team fällt es schwer, die Arbeitspläne, die wir erstellen, auch umzusetzen.	X	eigene Übersetzung von Wagemann et al. (2005), weil Berg (2010) zu wortwörtlich bzw. zu verfremdet ("...hat eine ganze Menge Schwierigkeiten, unsere Pläne, wie wir die Arbeit angehen wollen, auszuführen" entspricht zwar Wagemanns (2005) "has a geat deal of difficulty actually carrying out the plans we make for how we will proceed with the task", betint jedoch zusätzlich den Aspekt des Arbeitangehens und nicht Arbeitfortsetzens, ausserdem ist es nicht umgangssprachlich)	TEP - Process - strategy-related process criteria
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TEK4	alle	Immer, wenn jemand versucht, ein Teammitglied auf sein unangebrachtes Verhalten anzusprechen, wird alles nur noch schlimmer.	X	eigene Übersetzung von Wagemann et al. (2005), weil Berg (2010) zu wortwörtlich bzw. zu verfremdet ("ständig..." entspricht nicht Wagemanns (2005) "every time someone attempts", letzter Satz von Berg ist ebenfalls unnötig wortwörtlich.	TEK - team interpersonal process - quality of team interaction
TEP9	alle	Unser Team ist ziemlich geschickt <i>darin</i> , Lehren aus unseren <i>Arbeitserfahrungen</i> zu ziehen.		Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010). Änderungen in Kursiv.	TEP - Process - knowledge - and - skill-related process criteria
TEK	alle	Bitte geben Sie an, wie Sie selbst die Zusammenarbeit im Team erleben. Antworten: 1 - vollkommen nicht zutreffend, 2 - eher nicht zutreffend, 3 - eher zutreffend, 4 - vollkommen zutreffend, 5 - weiss nicht / keine Angabe			criteria of team effectiveness: Individual learning and well-being
TEK5	alle	Ich lerne sehr viel bei meiner Arbeit in diesem Team.		Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010).	ILW - satisfaction with growth opportunities

TEK6	alle	Meine Beziehungen zu den anderen Teammitgliedern sind angespannt-	X	Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010).	WTT - team interpersonal process - satisfaction with team relationships
TEK7	alle	Ich mag die Art der Arbeit, die wir in diesem Team machen.		Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010). (heterogene Werte im Pretest)	ILW - general satisfaction
TEK8	alle	Ich fühle eine echte persönliche Zufriedenheit, wenn unser Team <i>gute Arbeit leistet</i> .		Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010). Änderungen in Kursiv, weil umgangssprachlicher.	ILW - internal work motivation
TEK9	alle	Ich genieße den Austausch und die Zusammenarbeit mit meinen Teamkollegen sehr.		eigene Übersetzung von Wagemann et al. (2005)	WTT - team interpersonal process - satisfaction with team relationships
TEK10	alle	Wenn unser Team schlecht gearbeitet hat, fühle ich mich schlecht und unglücklich.		Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010). Lediglich Satzstellung geändert. (heterogene Werte im Pretest)	ILW - internal work motivation

TEK1 1	alle	Meine eigene Kreativität und Eigeninitiative werden von den anderen Teammitgliedern unterdrückt.	X	eigene Übersetzung von Wagemann et al. (2005), weil Berg (2010) zu wortwörtlich bzw. zu verfremdet ("... und mein Handeln werden durch das Team behindert" entspricht nicht Wagemanns (2005) "... and initiative are suppressed by this team")	ILW - satisfaction with growth opportunities
TEK1 2	alle	Die Möglichkeit, meine Teamkollegen bei der Arbeit näher kennenzulernen, gefällt mir <i>mit</i> am besten an der Teamarbeit.		Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010). Änderungen in Kursiv, Wagemann et al (2005) von "one of the best" sprechen (heterogene Werte im Pretest)	WTT - team interpersonal process - satisfaction with team relationships
TEK1 3	alle	In diesem Team zu arbeiten, ist für mich sehr frustrierend.	X	Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010).	ILW - general satisfaction
TEK1 4	alle	Mein eigenes Erleben und Wohlbefinden ist nicht davon beeinflusst, wie gut wir im Team arbeiten.		eigene Übersetzung von Wagemann et al. (2005) (Übersetzung von Berg (2010) hatte heterogene Werte im Pretest.)	ILW - internal work motivation

TEK1 5	alle	Durch die Arbeit in diesem Team vergrössern sich mein eigenes Wissen und meine persönlichen Fähigkeiten.	Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010).	ILW - satisfaction with growth opportunities
TEK1 6	alle	Wenn unser Team gut gearbeitet hat, habe auch ich gut gearbeitet.	Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010).	ILW - internal work motivation
TEK1 7	alle	Im Allgemeinen bin ich sehr zufrieden mit diesem Team.	eigene Übersetzung von Wagemann et al. (2005)	ILW - general satisfaction
TEK	alle	Wie nehmen Sie persönlich den Erfolg des Scrum teams wahr? Antworten: 1 - (fast) nie, 2 - manchmal, 3 - oft, 4 - (fast) immer	eigenes Item	criteria of team effectiveness: Subjektive Erfolgswahrnehmung
TEK1 8	alle	Unsere Ergebnisse erfüllen den Qualitätsstandard.	eigenes Item	
TEK1 9	alle	Unsere Ergebnisse erfüllen den Quantitätsstandard.	eigenes Item	
TEK2 0	alle	Unsere Ergebnisse erfüllen die zeitlichen Anforderungen seitens des Kunden.	eigenes Item	
TEK2 1	alle	Unsere Ergebnisse halten den finanziellen Rahmen ein.	eigenes Item	

EAC_ TL_y es_no	alle	Bitte beantworten Sie die nachfolgenden Angaben zur Teamleitung.	eigenes Item	Führung (Verantwortlichkeiten)
		Gibt es in Ihrem Team bzw. für Ihr Team eine offizielle (ernannte) Teamleitung?		
		<input type="radio"/> Ja, und zwar ist dies die Rolle vom Scrum Master		
		<input type="radio"/> Ja, und zwar übernimmt dies die Rolle vom Product Owner		
		<input type="radio"/> Ja, und zwar übernimmt dies die Rolle vom Linienvorgesetzten		
		<input type="radio"/> Ja, und zwar ein Entwickler		
		<input type="radio"/> Nein.		
		<input type="radio"/> O weiss ich nicht/niemand von den obigen.		

EAC_ TL_ focus	"ja" bei F25	<p>Worauf legt die Teamleitung den Fokus? Bitte erstellen Sie eine Rangfolge mit 1 = wird am häufigsten gezeigt und 4 = wird am seltensten gezeigt. Falls die Teamleitung eine Handlung überhaupt nicht ausführen sollen, lassen Sie diese Aussage bitte unsortiert.</p>	<p>Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010). Änderungen in Kursiv.</p>	<p>EAC - ATC - focus of team leaders attention</p>
		<p><i>O Coaching (Beratung und Betreuung) auf individueller Ebene</i> <i>O gibt Hilfestellung, damit die Teammitglieder lernen, wie man gut zusammenarbeitet</i> <i>O Setzt das Team gut auf: z.B. Klären der Teamziele, Auswahl von Teammitgliedern, Strukturieren der Aufgaben, Erwartungen formulieren, usw.</i> <i>O Kümmert sich um externe Behinderungen des Teams: z.B. Beschaffung von Arbeitsmitteln/Ressourcen, Sicherung von externer Unterstützung, Entfernung von Hindernissen, usw.</i></p>		

EAC_ TL	"ja" bei F25	Genauer nachgefragt - bitte geben Sie an, wie häufig die nachfolgenden Tätigkeiten von der Teamleitung ausgeführt werden.		extent and focus of team leader coaching
		Antworten: 1 - (fast) nie, 2 - manchmal, 3 - oft, 4 - (fast) immer, 5 - weiss nicht / keine Angabe		
		Die Teamleitung...		
EAC_ TL1	"ja" bei F25	... unterstützt die Teammitglieder, voneinander und von der Arbeitserfahrung des Teams zu lernen.	Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010). (heterogene Werte beim PO im Pretest)	EAC - EFTC - task- focused Coaching
EAC_ TL2	"ja" bei F25	... arbeitet mit dem Team zusammen, um die bestmögliche Herangehensweise an die Arbeit zu entwickeln.	Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010). (heterogene Werte beim PO und SM im Pretest)	EAC - EFTC - task- focused Coaching
EAC_ TL3	"ja" bei F25	... unterstützt das Team, eine hohe gemeinsame Zielbindung aufzubauen.	Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010). (heterogene Werte beim LV und SM im Pretest)	EAC - EFTC - task- focused Coaching

EAC_ TL4	"ja" bei F25	... mischt sich stark in den Inhalt und den <i>Prozess</i> von Teamdiskussionen ein.	Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010). Änderung in Kursiv, weil Berg (2010) nicht wortwörtlich war.	EAC - EFTC - unhelpful directives
EAC_ TL5	"ja" bei F25	... unterstützt <i>Teammitglieder</i> bei der Lösung von Konflikten, für den Fall, dass diese auftreten.	Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010). Änderung in Kursiv. (heterogene Werte beim LV im Pretest)	EAC - EFTC - interpersonal Coaching
EAC_ TL6	"ja" bei F25	... gibt positives Feedback, wenn das Team gute Leistung zeigt.	Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010). Teile von Berg (2010) weggelassen, weil redundant: "gut arbeitet oder" ist dasselbe wie "gute Leistung zeigt" - bei Wagemann et al. (2005) ist hier noch das "gute Verhalten" angesprochen, was nicht präzise genug ist. (heterogene Werte bei allen im Pretest)	EAC - EFTC - operant Coaching

EAC_ TL7	"ja" bei F25	... gibt, wenn nötig, Rückmeldung mit dem Ziel, Fehler zu korrigieren.	Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010), auch wenn es nicht wörtlich übersetzt ist: "corrective feedback" bei Wagemann et al. (2005) ist "Rückmeldung mit dem Ziel....etc". (heterogene Werte beim LV im Pretest)	EAC - EFTC - operant Coaching
EAC_ TL8	"ja" bei F25	... unterstützt das Team, die Motivation aller Teammitglieder aufrecht zu erhalten.	Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010). (heterogene Werte beim LV und SM im Pretest)	EAC - EFTC - task- focused Coaching
EAC_ TL9	"ja" bei F25	... <i>instruiert</i> das Team ganz genau, wie es seine Probleme lösen soll.	Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010). Änderung in Kursiv: "instruct" bedeutet "instruieren", nicht "unterrichten"; "soll" ist eher im Sinne des Originals, da direktive Führung als "kann".	EAC - EFTC - unhelpful directives

EAC_ TL10	"ja" bei F25	... hilft den Teammitgliedern, an ihren zwischenmenschlichen Beziehungen zu arbeiten.	eigene Übersetzung von Wagemann et al. (2005), weil Berg (2010) zu wortwörtlich ("hilft an der Verbesserung der zwischenmenschlichen Beziehungen in der Gruppe zu arbeiten.")	EAC - EFTC - interpersonal Coaching
EAC_ TL11	"ja" bei F25	... hält das Team für Eventualitäten aufmerksam, die eine Änderung der Arbeitsstrategie erfordern.	Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010). Änderung in Kursiv.	EAC - EFTC - task-focused Coaching
EAC_ TL12	"ja" bei F25	... hilft dem Team, die besonderen Talente jedes Teammitglieds zu erkennen und optimal zu nutzen.	Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010). Änderung in Kursiv. (heterogene Werte beim LV und SM im Pretest)	EAC - EFTC - task-focused Coaching
EAC_ TL13	"ja" bei F25	... erzählt dem Team alles, was es falsch macht.	Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010). (heterogene Werte beim PO und SM im Pretest)	EAC - EFTC - unhelpful directives

EAC_ TL14	"ja" bei F25	... erteilt oft unverdientes Lob und /oder äussert oft unangebrachte Kritik.	X	Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010). Berg trennte jedoch das Originalitem. (heterogene Werte beim LV im Pretest)	EAC - EFTC - operant Coaching
EAC_ TL15	"ja" bei F25	... fördert gutes Miteinander unter den Teammitgliedern.		Item von Berg (2010) (heterogene Werte bei allen im Pretest)	EAC - EFTC - interpersonal Coaching (3. Item zu Interpersonal Coaching)
EAC_ Tlhelp	"ja" bei F25	Generell betrachtet, wie <i>hilfreich</i> ist Ihre <i>Teamleitung</i> , die <i>Leistungsfähigkeit</i> des Teams <i>sicherzustellen</i> ?		Eigene Übersetzung, da Berg (2010) nicht wortwörtlich das Originalitem von Wagemann et al. (2001) übersetzte. Antwortmöglichkeit "weder besonders hilfreich, noch besonders hinderlich" aus Original gelöscht --> hat keine Aussage.	EAC - helpfulness of team leader coaching
		O nachteilig: Die Handlungen der Teamleitung behindern unsere Entwicklung als Team. O eher nachteilig O eher hilfreich O sehr hilfreich: Die Handlungen des Teamleiters fördern deutlich die Fähigkeiten des Teams.			

EAC_ Tlnie & EAC_ TLnie _help A1	"nie" bei TLE C1- 15 & "0" bei TLF A1	Bei folgenden Aussagen gaben Sie an, dass diese nie von der Teamleitung übernommen werden. Wer – falls sie ausgeführt werden sollten - führt diese Handlungen stattdessen am ehesten aus? Und wie hilfreich sind diejenigen Rollen, die Leistungsfähigkeit des Teams zu gewährleisten? Bitte geben Sie daher untenstehend die verantwortliche Rolle und den Grad der Nützlichkeit in der letzten Spalte an. Antworten: 1 - PO, 2 - SM, 3 - LV, 4 - niemand von diesen hier	eigenes Item	Führung (Verantwortlichkeiten)
EAC_ NTL	"nein" bei F25	Wer übernimmt die folgenden Tätigkeiten? Antworten: 1 - PO, 2 - SM, 3 - LV, 4 - niemand	eigenes Item	EAC - ATC - focus of team leaders attention
EAC_ NTL_ focus 1	"nein" bei F25	... <i>übernimmt das Coaching</i> (Beratung und Betreuung) <i>auf individueller Ebene</i>	Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010). Änderungen in Kursiv.	EAC - ATC - focus of team leaders attention / Führung (Verantwortlichkeiten)

EAC_ NTL_ focus 2	"nei n" bei F25	... gibt Hilfestellung, damit die Teammitglieder lernen, wie man gut zusammenarbeitet	Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010). Änderungen in Kursiv.	EAC - ATC - focus of team leaders attention
EAC_ NTL_ focus 3	"nei n" bei F25	... setzt das Team gut auf: z.B. Klären der Teamziele, Auswahl von Teammitgliedern, Strukturieren der Aufgaben, Erwartungen formulieren, usw.	Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010). Änderungen in Kursiv.	EAC - ATC - focus of team leaders attention
EAC_ NTL_ focus 4	"nei n" bei F25	... kümmert sich um externe Behinderungen des Teams: z.B. Beschaffung von Arbeitsmitteln/Ressourcen, Sicherung von externer Unterstützung, Entfernung von Hindernissen, usw.	Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010). Änderungen in Kursiv.	EAC - ATC - focus of team leaders attention
EAC_ NTL_ extent 1	"nei n" bei F25	... unterstützt die Teammitglieder, voneinander und von der Arbeitserfahrung des Teams zu lernen.	Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010). (heterogene Werte beim PO im Pretest)	EAC - EFTC - task-focused Coaching
EAC_ NTL_ extent 2	"nei n" bei F25	... arbeitet mit dem Team zusammen, um die bestmögliche Herangehensweise an die Arbeit zu entwickeln.	Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010). (heterogene Werte beim PO und SM im Pretest)	EAC - EFTC - task-focused Coaching
EAC_ NTL_ extent 3	"nei n"	... unterstützt das Team, eine hohe gemeinsame Zielbindung aufzubauen.	Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg	EAC - EFTC - task-focused Coaching

	bei F25			(2010). (heterogene Werte beim LV und SM im Pretest)	
EAC_ NTL_ extent 4	"nein" bei F25	... mischt sich stark in den Inhalt und den <i>Prozess</i> von Teamdiskussionen ein.	X	Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010). Änderung in Kursiv, weil Berg (2010) nicht wortwörtlich war.	EAC - EFTC - unhelpful directives
EAC_ NTL_ extent 5	"nein" bei F25	... unterstützt <i>Teammitglieder</i> bei der Lösung von Konflikten, für den Fall, dass diese auftreten.		Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010). Änderung in Kursiv. (heterogene Werte beim LV im Pretest)	EAC - EFTC - interpersonal Coaching
EAC_ NTL_ extent 6	"nein" bei F25	... gibt positives Feedback, wenn das Team gute Leistung zeigt.		Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010). Teile von Berg (2010) weggelassen, weil redundant: "gut arbeitet oder" ist dasselbe wie "gute Leistung zeigt" - bei Wagemann et al. (2005) ist hier noch das "gute Verhalten" angesprochen, was nicht präzise genug ist. (heterogene Werte bei allen im Pretest)	EAC - EFTC - operant Coaching

EAC_ NTL_ extent 7	"nein" bei F25	... gibt, wenn nötig, Rückmeldung mit dem Ziel, Fehler zu korrigieren.		Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010), auch wenn es nicht wörtlich übersetzt ist: "corrective feedback" bei Wagemann et al. (2005) ist "Rückmeldung mit dem Ziel....etc". (heterogene Werte beim LV im Pretest)	EAC - EFTC - operant Coaching
EAC_ NTL_ extent 8	"nein" bei F25	... unterstützt das Team, die Motivation aller Teammitglieder aufrecht zu erhalten.		Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010). (heterogene Werte beim LV und SM im Pretest)	EAC - EFTC - task-focused Coaching
EAC_ NTL_ extent 9	"nein" bei F25	... <i>instruiert</i> das Team ganz genau, wie es seine Probleme lösen <i>soll</i> .	X	Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010). Änderung in Kursiv: "instruct" bedeutet "instruieren", nicht "unterrichten"; "soll" ist eher im Sinne des Originals, da direktive Führung als "kann".	EAC - EFTC - unhelpful directives

EAC_ NTL_ extent 10	"nein" bei F25	... hilft den Teammitgliedern, an ihren zwischenmenschlichen Beziehungen zu arbeiten.		eigene Übersetzung von Wagemann et al. (2005), weil Berg (2010) zu wortwörtlich ("hilft an der Verbesserung der zwischenmenschlichen Beziehungen in der Gruppe zu arbeiten.")	EAC - EFTC - interpersonal Coaching
EAC_ NTL_ extent 11	"nein" bei F25	... hält das Team für Eventualitäten aufmerksam, die eine Änderung der Arbeitsstrategie erfordern.		Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010). Änderung in Kursiv.	EAC - EFTC - task-focused Coaching
EAC_ NTL_ extent 12	"nein" bei F25	... hilft dem Team, die besonderen Talente jedes Teammitglieds zu erkennen und optimal zu nutzen.		Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010). Änderung in Kursiv. (heterogene Werte beim LV und SM im Pretest)	EAC - EFTC - task-focused Coaching
EAC_ NTL_ extent 13	"nein" bei F25	... erzählt dem Team alles, was es falsch macht.	X	Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010). (heterogene Werte beim PO und SM im Pretest)	EAC - EFTC - unhelpful directives

EAC_ NTL_ extent 14	"nei n" bei F25	... erteilt oft unverdientes Lob und /oder äußert oft unangebrachte Kritik.	X	Originalitem von Wagemann et al. (2005), gute Übersetzung von Berg (2010). Berg trennte jedoch das Originalitem. (heterogene Werte beim LV im Pretest)	EAC - EFTC - unhelpful directives
EAC_ NTL_ extent 15	"nei n" bei F25	... fördert gutes Miteinander unter den Teammitgliedern.		Item von Berg (2010) (heterogene Werte bei allen im Pretest)	EAC - EFTC - interpersonal Coaching (3. Item zu Interpersonal Coaching)
EAC_ NTL_ SM1 - 15, EAC_ NTL_ PO1 - 15, EAC_ NTL_ LV1 - 15	"nei n" bei F25 & abh. Von Roll en bei F26	Bitte geben Sie an, wie oft die soeben ausgewählte/n Rolle/n die Handlungen ausführt. Antworten: 1 - niemals, 2 - manchmal, 3 - oft, 4 - fast immer siehe Items von Frage 30			expert, available Coaching / Führung (extent & focus of team leader coaching)

EAC_NTL_Sp, EAC_NTL_POhel_p, EAC_NTL_Lvhel_p	"nein" bei F25 & abh. Von Rollen bei F26	Generell betrachtet, wie hilfreich sind die von Ihnen ausgewählten Rollen, die Leistungsfähigkeit des Teams sicherzustellen? O nachteilig: Die Handlungen dieser Rolle behindern unsere Entwicklung als Team. O eher nachteilig O eher hilfreich O sehr hilfreich: Die Handlungen dieser Rolle fördern deutlich die Fähigkeiten des Teams.	Antwortmöglichkeit "weder besonders hilfreich, noch besonders hinderlich" aus Original gelöscht --> hat keine Aussage.	EAC - helpfulness of team leader coaching
VS1	alle	Was ist für Sie Führung, die zum Erfolg führt?		Führung (Verständnis)
VS2	alle	Was ist für Sie Führung, die NICHT zum Erfolg führt?		Führung (Verständnis)
VS3	alle	Wer übernimmt in Ihrem direkten Arbeitsumfeld Führung? Bitte wählen Sie die entsprechende Rolle/n aus und beschreiben Sie, wie diese Führung aussieht. Dropdownauswahl mit PO, SM, LV, Scrum team inkl. Textfeld und weiteres Feld mit "andere Personen"		Führung (Verantwortlichkeiten)

VW2 3	alle	Bitte geben Sie an, wer für die folgenden Aspekte verantwortlich ist- Verantwortlich sein, heisst nicht zwingend, die Aufgabe auch auszuführen, sondern daür zu sagen, dass sie ausgeführt wird.	Führung (Verantwortlichkeiten)
		Antworten: 1 - PO, 2 - SM, 3 - LV, 4 - Scrum team gesamt, 5 - weiss nicht	
VW2 4		Management der Aufgabe Darunter verstehe ich: _____	gemäss Katharina Wurst
VW2 5		Management der Grenzen Darunter verstehe ich: _____	gemäss Katharina Wurst
VW2 6		Management der Leistung Darunter verstehe ich: _____	gemäss Katharina Wurst
VW2 7		Führung im eigentlichen Sinne Darunter verstehe ich: _____	gemäss Katharina Wurst
VW2 8		Bereitstellung von notwendigen Informationen.	(Supportive Organizational Context)
VW2 9		Bereitstellung von Arbeitsmitteln.	eigenes Item gemäss Praxispartner
VW3 0		Verantwortlich für Anreize und Entlohnung.	eigenes Item gemäss Praxispartner

VW3 1	Verantwortlich für Erfolge des Teams.	eigenes Item gemäss Praxispartner
VW3 2	Verantwortlich für die Misserfolge des Teams.	eigenes Item gemäss Praxispartner
VS4 alle	Mit welchen Herausforderungen muss ein/e Linienvorgesetzte/r bei Scrum umgehen können?	eigenes Item gemäss Praxispartner

Note. The table is in German because the author and the sample are German. Therefore, all notes and explanations are in German, too. The sequence of questions in the final online survey was different. RT = real team, CD = compelling direction, ES = enabling structure, SOC = supportive organizational context, AEC = available expert coaching, TEP = process criteria of team effectiveness, TEK = Kriterien der Teameffectivität = criteria for team effectiveness, VW = Verantwortlichkeiten = responsibilities, these items belonged to the leadership part.

Appendix C–Results

Table C1

Overview of reliability values within team members of all teams

Team	Members	Intra-Class-Correlation			Tukeys Additivitätstest	
		ICC _{just}	<i>F</i>	<i>p</i>	<i>F</i>	<i>p</i>
1	3	.60	2.45	.00	3.95	.05
2	4	.62	2.60	.00	1.32	.25
3	6	.85	6.55	.00	0.02	.89
4	4	.48	1.93	.10	1.01	.33
5	9	.89	8.85	.00	8.07	.01 ^a
6	8	.91	11.61	.00	8.26	.00 ^b
7	4	.65	2.85	.00	1.18	.28
8	4	.83	5.83	.00	3.57	.06
9	4	.69	3.23	.00	0.01	.94
10	4	.69	3.18	.06	0.30	.60
11	4	.60	2.51	.00	0.63	.43
12	4	.37	1.59	.26	16.80	.01 ^c
13	3	.85	6.50	.00	0.38	.54
14	8	.72	0.35	.00	0.02	.89
15	3	.56	2.25	.00	2.14	.15
16	5	.90	9.55	.00	0.03	.87
17	3	.56	2.27	.00	12.46	.00 ^d
18	6	.87	7.87	.00	0.79	.38
19	3	.61	2.58	.00	0.71	.40
20	4	.90	9.60	.00	0.80	.37
21	5	.26	1.36	.30	0.31	.59
22	3	.58	2.37	.00	15.77	.00 ^e
23	3	.85	6.66	.00	1.23	.27
24	8	.92	13.20	.00	2.79	.10

Note. ICC values are average values because of the aggregation on team level. Therefore, individual values were not of interest (Wirtz & Caspar, 2002, p.162). Significant *F* means that there seems to be an interaction between the team members and the characteristic. In this case, ICC values are not allowed to be interpreted. But, if selectivity values are homogenous, than ICC values can be interpreted (Wirtz & Caspar, 2002, pp. 210-212).

^a Corrected selectivity values are between .51 and .76, and are regarded as homogeneous.

^b Corrected selectivity values are between .64 and .83, and are regarded as homogeneous.

^c Corrected selectivity values are between .40 and .51, and are regarded as homogeneous.

^d Corrected selectivity values are between .24 und .50, and are regarded as homogeneous.

^e Corrected selectivity values are between .27 und .53, and are regarded as homogeneous.

* $p < .05$, ** $p < .01$.

Table C2

Psychometric properties of items of the questionnaire about team effectiveness in Scrum teams on the individual level

Measures	<i>N</i>	No of items	<i>M</i>	<i>SD</i>	Skewness	Kurtosis	Difficulty	Cronbach's Alpha	Cronbach's Alpha, if item deleted	Selec- tivity
Real Team										
Boundedness		3						.61		
RT1	126		3.71	0.71	-2.49	5.61	90.21		.25	.57
RT5_recoded	126		3.81	0.58	-3.56	13.36	93.65		.69	.26
RT9	126		3.54	0.74	-1.74	2.77	84.66		.47	.44
Interdependence		3						.53		
RT2	131		2.80	0.84	-0.02	-0.84	60.05		.31	.40
RT4_recoded	131		2.84	0.82	-0.30	-0.40	61.32		.65	.19
RT7	131		3.34	0.77	-0.89	-0.08	78.12		.25	.45
Stability		3						.84		
RT3_recoded	131		3.27	0.80	-0.98	0.56	75.57		.71	.78
RT6	131		3.17	0.92	-0.82	-0.31	72.26		.87	.61
RT8_recoded	131		3.26	0.86	-0.98	0.14	75.32		.75	.73
Compelling Direction										
Clarity		3						.71		
CD2	122		3.11	0.69	-0.45	0.24	70.22		.52	.60
CD5	122		3.30	0.69	-0.94	1.38	76.78		.51	.62
CD9_recoded	122		3.30	0.71	-0.92	1.03	76.50		.79	.38
Challenge		3						.67		
CD1	118		2.86	0.76	-0.22	-0.31	62.15		.36	.63
CD4_recoded	118		3.14	0.68	-0.34	-0.26	71.47		.62	.44

CD7	118	2.50	0.82	0.06	-0.48	50.00		.70	.39
Consequentiality	3						.56		
CD3_recoded	115	3.77	0.53	-2.88	10.56	92.46		.70	.17
CD6	115	3.58	0.61	-1.33	1.74	86.09		.27	.48
CD8	115	3.31	0.72	-0.80	0.37	77.10		.24	.49
Enabling Structure									
Team Composition	9								
Size	3						.46		
ES_TC2_recoded	117	3.22	0.79	-0.73	-0.03	74.00		.64	.10
ES_TC5_recoded	117	3.21	0.84	-0.85	0.04	73.79		.27	.32
ES_TC8	117	3.03	0.79	-0.66	0.32	67.52		.04	.45
Skills	3						.70		
ES_TC1	117	2.89	0.77	-0.45	0.05	62.96		.60	.53
ES_TC4	117	2.99	0.78	-0.63	0.34	66.38		.63	.50
ES_TC7_recoded	117	2.93	0.85	-0.45	-0.37	64.39		.60	.53
Diversity	3						.60		
ES_TC3_recoded	117	3.37	0.81	-1.37	1.71	78.92		.38	.48
ES_TC6	117	3.10	0.82	-0.66	-0.06	70.09		.49	.41
ES_TC9_recoded	117	3.13	0.78	-0.53	-0.36	70.94		.61	.33
Task Design	10								
Whole Task	4						.62		
ES_TTD3_recoded	108	3.51	0.66	-1.15	0.69	83.64		.60	.32
ES_TTD6	108	2.94	0.96	-0.64	-0.53	64.81		.57	.38
ES_TTD7	108	3.33	0.84	-1.02	0.18	77.78		.46	.50
ES_TTD10	108	3.47	0.75	-1.57	2.48	82.41		.54	.40
Autonomy / Judgement	3						.55		

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ES_TTD1_recoded	114	3.22	0.70	-0.79	1.14	73.98		.60	.25
ES_TTD5	114	3.03	0.72	-0.43	0.13	67.54		.35	.42
ES_TTD9	114	3.22	0.75	-0.77	0.40	73.98		.35	.41
Knowledge of results	3						.44		
ES_TTD2	101	2.62	0.81	0.00	-0.47	54.13		.62	.13
ES_TTD4_recoded	101	3.28	0.65	-0.73	0.80	75.91		.14	.38
ES_TTD8_recoded	101	3.14	0.69	-0.53	0.78	71.29		.25	.32
Group norms	3						.84		
ES_GN1_recoded	110	3.16	0.80	-0.86	0.46	72.12		.84	.57
ES_GN2	110	3.28	0.80	-1.00	0.55	76.06		.67	.73
ES_GN3	110	3.22	0.77	-1.01	1.18	73.94		.71	.71
Supportive Organizational Context									
Rewards / recognition	3						.78		
SOC2	95	2.95	0.69	-0.30	0.01	64.91		.76	.56
SOC5_recoded	95	3.02	0.85	-0.70	-0.01	67.37		.75	.58
SOC8	95	2.81	0.72	-0.40	0.06	60.35		.58	.72
Information	3						.72		
SOC1	109	2.82	0.65	-0.20	0.15	60.55		.63	.55
SOC6_recoded	109	3.13	0.71	-0.52	0.17	70.95		.74	.45
SOC11	109	3.08	0.68	-0.57	0.63	69.42		.52	.64
Education / Consultation	3						.75		
SOC3_recoded	101	3.04	0.79	-0.79	0.65	67.99		.56	.67
SOC7	101	2.87	0.73	-0.43	0.27	62.38		.82	.44
SOC10_recoded	101	3.06	0.73	-0.52	0.35	68.65		.60	.65
Material resources	3						.67		

SOC4	110		2.93	0.63	-0.39	0.83	64.24		.50	.54
SOC9_recoded	110		2.87	0.78	-0.60	0.12	62.42		.71	.39
SOC12	110		3.19	0.64	-0.61	1.31	73.03		.51	.53
Available expert										
Coaching										
Coaching availability	109	3						.75		
EAC_avail1	109		3.27	0.79	-0.95	0.55	75.54		.81	.44
EAC_avail2	109		2.89	0.82	-0.52	-0.04	63.00		.60	.63
EAC_avail3	109		2.57	0.83	-0.16	-0.45	52.29		.54	.67
Coaching helpfulness ^a	83	1	3.28	.69			76	--	--	--
Leader Coaching ^a										
Task-focused Coaching		6						.83		
EAC_TL1	65		2.74	0.80	-0.14	-0.47	57.95		.79	.71
EAC_TL2	65		3.14	0.79	-0.44	-0.69	71.28		.83	.48
EAC_TL3	65		2.92	0.96	-0.49	-0.76	64.10		.79	.67
EAC_TL8	65		2.78	0.93	-0.34	-0.66	59.49		.81	.60
EAC_TL11	65		2.69	0.81	0.10	-0.59	56.41		.82	.54
EAC_TL12	65		2.66	0.96	-0.14	-0.93	55.38		.80	.65
Operant coaching		3						.34		
EAC_TL6	75		3.31	0.70	-0.46	-0.89	76.89		.15	.28
EAC_TL7	75		2.81	0.78	-0.28	-0.18	60.44		.29	.22
EAC_TL14_recoded	75		3.76	0.49	-1.99	3.33	92.00		.37	.17
Interpersonal coaching		3						.77		
EAC_TL5	65		2.95	1.10	-0.59	-0.99	65.13		.71	.58
EAC_TL10	65		2.37	1.08	0.20	-1.24	45.64		.65	.63
EAC_TL15	65		3.03	0.93	-0.79	-0.04	67.69		.69	.60

Unhelpful directives ^b		3						.31		
EAC_TL4_recoded	74		2.74	0.95	-0.32	-0.87	58.11		.24	.17
EAC_TL9_recoded	74		3.08	0.79	-0.52	-0.38	69.37		.12	.23
EAC_TL13_recoded	74		3.09	0.81	-0.55	-0.41	69.82		.32	.13
Peer Coaching										
Task-focused Coaching		3						.81		
EAC_peer1	113		2.61	0.85	0.05	-0.65	53.69		.74	.65
EAC_peer4	113		2.85	0.80	-0.35	-0.24	61.65		.67	.71
EAC_peer7	113		2.85	0.75	-0.14	-0.40	61.65		.78	.60
Interpersonal coaching		3						.81		
EAC_peer3	100		2.62	0.92	-0.12	-0.81	54.00		.72	.67
EAC_peer6	100		3.05	0.88	-0.58	-0.50	68.33		.73	.65
EAC_peer9	100		2.50	0.95	0.14	-0.89	50.00		.75	.64
Unhelpful interventions ^b		3						.62		
EAC_peer2_recoded	110		3.02	0.85	-0.55	-0.28	67.27		.46	.48
EAC_peer5_recoded	110		2.72	0.87	-0.18	-0.64	57.27		.54	.42
EAC_peer8_recoded	110		3.49	0.79	-1.47	1.37	83.03		.57	.40
Process Criteria		9								
Effort		3						.57		
TEP1	102		3.01	0.67	-0.22	0.03	66.99		.59	.30
TEP4	102		3.17	0.65	-0.52	0.57	72.22		.36	.47
TEP5_recoded	102		3.31	0.78	-1.05	0.83	77.12		.45	.40
Performance Strategy		3						.62		
TEP2	94		2.90	0.57	-0.39	1.24	63.48		.53	.43
TEP7_recoded	94		3.35	0.67	-0.99	1.48	78.37		.46	.47
TEP8_recoded	94		3.05	0.59	-0.01	-0.10	68.44		.57	.40

Knowledge and skill		3						.68		
TEP3_recoded	104		3.05	0.77	-0.61	0.33	68.27		.75	.37
TEP6	104		3.29	0.69	-0.97	1.75	76.28		.45	.58
TEP9	104		2.97	0.65	-0.66	1.68	65.71		.52	.54
Team effectiveness criteria										
Team social processes		7								
Quality of interaction		3						.76		
TEK1_recoded	95		3.54	0.70	-1.74	3.06	84.56		.68	.59
TEK2_recoded	95		3.63	0.62	-1.79	3.39	87.72		.66	.64
TEK3	95		3.16	0.66	-0.59	1.14	71.93		.76	.44
TEK4_recoded	95		3.37	0.76	-1.16	1.26	78.95		.70	.57
Relationship satisfaction		3						.60		
TEK6_recoded	100		3.56	0.73	-1.82	3.11	85.33		.65	.30
TEK9	100		3.51	0.66	-1.34	2.44	83.67		.40	.48
TEK12	100		2.91	0.83	-0.27	-0.61	63.67		.41	.46
Individual well-being		14								
Internal work motivation		4						-.27		
TEK8	100		3.57	0.56	-0.64	-0.67	85.67		-.56	.11
TEK10	100		2.67	0.83	-0.26	-0.46	55.67		-.07	-.15
TEK14	100		2.17	0.88	0.29	-0.64	39.00		.29	-.30
TEK16	100		3.28	0.62	-0.48	0.78	76.00		-.55	.08
Growth satisfaction		3						.63		
TEK5	109		3.38	0.65	-0.78	0.53	79.20		.25	.62
TEK11_recoded	109		3.50	0.73	-1.70	3.15	83.49		.85	.21
TEK15	109		3.39	0.64	-0.80	0.67	79.82		.39	.54

General satisfaction		3						.61		
TEK7	108		3.39	0.64	-0.78	0.66	79.63		.59	.35
TEK13_recoded	108		3.68	0.67	-2.17	4.15	89.20		.55	.39
TEK17	108		3.48	0.69	-1.31	1.31	82.72		.35	.51
Productive output		4						.84		
TEK18	91		3.35	0.77	-1.12	1.18	78.39		.79	.70
TEK19	91		3.18	0.71	-0.62	0.60	72.53		.81	.66
TEK20	91		3.20	0.76	-0.77	0.52	73.26		.80	.68
TEK21	91		3.09	0.88	-0.88	0.38	69.60		.80	.69

^a Only, if an officially announced leader is present ($n = 85$). ^b Wagemann et al. (2005) recoded those items, e.g. for peer coaching "to produce an overall assessment of good-quality peer coaching" (p. 387).

Table C3

Psychometric properties of items of the questionnaire about team effectiveness in Scrum teams on the team level

Measures	<i>N</i>	No of items	<i>M</i>	<i>SD</i>	Skewness	Kurtosis	Difficulty	Cronbach's Alpha	Cronbach's Alpha, if item deleted	Selectivity
Real Team										
Boundedness	24	3						.43		
RT1	24		3.72	0.29	-0.62	-1.05	90.79		.15	.37
RT5_recoded	24		3.83	0.23	-1.10	0.08	94.34		.59	.07
RT9	24		3.59	0.40	-1.58	4.11	86.21		.02	.40
Interdependence		3						.82		
RT2	24		2.89	0.44	0.18	-1.00	63.11		.75	.67
RT4_recoded	24		2.90	0.52	-0.24	0.82	63.35		.83	.62
RT7	24		3.35	0.38	0.03	0.02	78.30		.69	.76
Stability		3						.94		
RT3_recoded	23		3.24	0.65	-1.52	2.57	74.59		.89	.92
RT6	23		3.19	0.74	-1.11	0.21	73.02		.94	.86
RT8_recoded	23		3.26	0.68	-1.27	2.04	75.24		.93	.87
Compelling Direction										
Clarity		3	3.21	0.36				.78		
CD2	23		3.12	0.39	-0.99	0.21	70.76		.62	.70
CD5	23		3.28	0.45	-0.54	-0.29	76.10		.64	.66
CD9_recoded	23		3.22	0.45	-1.23	1.39	73.94		.83	.50
Challenge		3						.63		
CD1	23		2.90	0.46	0.14	0.28	63.39		.30	.61
CD4_recoded	23		3.16	0.45	0.45	0.18	71.87		.42	.52

CD7	23	2.55	0.57	0.03	-0.49	51.69		.83	.25
Consequentiality	3						.30		
CD3_recoded	22	3.76	0.26	-1.22	1.85	91.89		.66	-.16
CD6	22	3.59	0.32	-0.13	-0.92	86.30		-.33	.42
CD8	22	3.26	0.44	-0.94	1.90	75.19		-.26	.32
Enabling Structure									
Team Composition	9								
Size	3						.32		
ES_TC2_recoded	21	3.30	0.52	-0.96	1.64	76.67		.70	-.08
ES_TC5_recoded	21	3.18	0.59	-0.67	-0.69	72.76		.21	.19
ES_TC8	21	3.03	0.51	-0.62	0.10	67.77		-.63	.55
Skills	3						.79		
ES_TC1	21	2.85	0.44	-0.75	0.39	61.82		.66	.72
ES_TC4	21	3.00	0.47	0.13	-0.49	66.61		.81	.53
ES_TC7_recoded	21	2.86	0.68	-0.38	-0.61	61.97		.62	.75
Diversity	3						.79		
ES_TC3_recoded	22	3.25	0.56	-0.63	-0.80	75.05		.66	.67
ES_TC6	22	3.05	0.58	-0.51	-0.72	68.20		.68	.66
ES_TC9_recoded	22	3.09	0.48	0.30	-0.61	69.73		.78	.57
Task Design									
Whole Task	4						.52		
ES_TTD3_recoded	19	3.47	0.44	-1.02	1.12	82.44		.30	.46
ES_TTD6	19	2.98	0.55	0.19	-0.30	65.94		.46	.31
ES_TTD7	19	3.35	0.38	-0.84	1.23	78.26		.42	.35
ES_TTD10	19	3.48	0.37	-0.98	0.29	82.83		.56	.14
Autonomy / Judgement	3						.40		

ES_TTD1_recoded	21	3.19	0.43	-0.85	0.14	72.87		-.20	.36
ES_TTD5	21	3.09	0.36	0.20	-0.91	69.64		.50	.12
ES_TTD9	21	3.27	0.29	0.54	0.73	75.70		.29	.26
Knowledge of results	3						.43		
ES_TTD2	17	2.65	0.49	-0.60	-1.13	54.92		.01	.40
ES_TTD4_recoded	17	3.25	0.39	0.23	-0.61	74.93		.18	.36
ES_TTD8_recoded	17	3.15	0.35	-1.04	0.51	71.52		.61	.07
Group norms	3						.86		
ES_GN1	20	3.09	0.53	-0.15	-1.35	69.63		.91	.61
ES_GN2	20	3.26	0.53	-0.85	0.81	75.43		.72	.81
ES_GN3	20	3.17	0.47	-0.69	0.83	72.17		.75	.78
Supportive Organizational Context									
Rewards / recognition	3						.83		
SOC2	15	2.96	0.31	-0.42	0.39	65.43		.87	.61
SOC5_recoded	15	2.98	0.51	-0.11	-0.89	65.86		.66	.79
SOC8	15	2.73	0.48	0.46	-0.24	57.75		.69	.76
Information	3						.89		
SOC1	18	2.80	0.43	-1.16	1.76	60.15		.79	.86
SOC6_recoded	18	3.05	0.45	-0.44	1.14	68.34		.95	.67
SOC11	18	3.02	0.46	-1.62	3.97	67.34		.79	.85
Education / Consultation	3						.84		
SOC3_recoded	16	3.07	0.58	-0.99	0.96	69.01		.68	.81
SOC7	16	2.92	0.54	-0.32	-0.85	64.07		.87	.61
SOC10_recoded	16	3.02	0.47	-0.42	0.21	67.34		.77	.73
Material resources	3						.88		

SOC4	19		2.95	0.36	-0.56	1.58	64.95		.84	.77
SOC9_recoded	19		2.88	0.48	-0.94	1.26	62.50		.93	.73
SOC12	19		3.17	0.32	-0.88	1.58	72.30		.76	.90
Available. expert										
Coaching										
Coaching availability		3							.91	
EAC_avail1	19		3.22	0.40	0.06	0.54	73.88		.94	.75
EAC_avail2	19		2.84	0.65	-0.43	0.09	61.18		.87	.86
EAC_avail3	19		2.63	0.52	-0.16	-0.26	54.24		.76	.95
Coaching helpfulness ^a	14	1	3.23	.40			74.33	--	--	--
Leader Coaching ^a			3.09	.34						
Task-focused Coaching		6							.85	
EAC_TL1	13		2.73	0.43	-0.15	-0.28	57.79		.83	.64
EAC_TL2	13		3.19	0.55	-0.34	-0.48	73.14		.84	.56
EAC_TL3	13		2.98	0.54	-0.54	-1.43	65.96		.81	.76
EAC_TL8	13		2.70	0.69	0.00	-1.04	56.56		.82	.71
EAC_TL11	13		2.65	0.42	-0.56	0.41	55.13		.83	.66
EAC_TL12	13		2.62	0.69	-0.40	0.27	54.13		.84	.61
Operant coaching		3							.18	
EAC_TL6	14		3.26	0.37	0.07	-1.31	75.26		-.38	.29
EAC_TL7	14		2.86	0.47	0.95	1.35	62.13		.16	.09
EAC_TL14	14		3.73	0.29	-0.59	-0.73	90.87		.40	-.08
Interpersonal coaching		3							.87	
EAC_TL5	11		3.03	0.75	-0.50	-1.00	67.68		.78	.79
EAC_TL10	11		2.27	0.70	0.32	-1.14	42.20		.74	.83

EAC_TL15	11	2.99	0.60	-0.25	-0.89	66.45		.90	.66
Unhelpful directives	3						-.07		
EAC_TL4	14	2.75	0.69	-0.59	-1.06	58.49		-.55	.04
EAC_TL9	14	2.96	0.36	-0.68	-0.94	65.42		.33	-.25
EAC_TL13	14	3.09	0.36	-1.05	4.46	69.59		-.38	.12
Peer Coaching									
Task-focused Coaching	3						.89		
EAC_peer1	20	2.54	0.53	-0.16	-1.11	51.21		.80	.84
EAC_peer4	20	2.83	0.39	-0.49	-0.63	60.87		.83	.85
EAC_peer7	20	2.99	0.55	0.01	-1.29	66.41		.90	.74
Interpersonal coaching	3						.83		
EAC_peer3	19	2.57	0.68	-0.28	-0.92	52.28		.68	.77
EAC_peer6	19	2.99	0.57	0.01	-1.29	66.40		.73	.72
EAC_peer9	19	2.54	0.49	-0.29	-0.41	51.33		.84	.61
Unhelpful interventions	3						.70		
EAC_peer2	19	2.92	0.43	0.23	-0.84	64.11		.65	.49
EAC_peer5	19	2.68	0.34	0.58	-0.45	56.04		.69	.45
EAC_peer8	19	3.48	0.44	-0.57	-0.72	82.60		.44	.64
Process Criteria	9								
Effort	3						.75		
TEP1	18	3.01	0.45	0.08	1.27	66.91		.64	.62
TEP4	18	3.13	0.39	0.04	-0.21	70.92		.72	.55
TEP5	18	3.27	0.60	-1.49	2.14	75.66		.63	.64
Performance Strategy	3						.73		
TEP2	16	2.82	0.38	-1.29	1.53	60.67		.53	.66
TEP7	16	3.25	0.48	-1.15	2.12	74.87		.65	.55

TEAM EFFECTIVENESS AND LEADERSHIP IN SCRUM TEAMS

TEP8	16	2.97	0.44	-0.48	0.20	65.51		.74	.46
Knowledge and skill	3						.70		
TEP3	19	3.06	0.47	0.15	-0.55	68.53		.78	.45
TEP6	19	3.32	0.29	-1.01	0.68	77.38		.59	.58
TEP9	19	2.99	0.34	-0.17	0.52	66.28		.51	.61
Team effectiveness criteria									
Team social processes	7								
Quality of interaction	3						.94		
TEK1_recoded	16	3.46	0.55	-1.28	0.99	81.86		.91	.89
TEK2_recoded	16	3.54	0.43	-1.15	0.90	84.83		.92	.85
TEK3	16	3.10	0.52	-1.25	1.56	70.11		.90	.90
TEK4_recoded	16	3.25	0.55	-0.91	0.36	74.88		.94	.80
Relationship satisfaction	3						.83		
TEK6	19	3.46	0.37	-0.47	-0.28	82.00		.81	.64
TEK9	19	3.42	0.44	-1.13	0.82	80.53		.76	.69
TEK12	19	2.91	0.47	-0.55	-0.30	63.74		.70	.75
Individual well-being	14								
Internal work motivation	4						-.29		
TEK8	18	3.55	0.30	-0.09	-0.55	84.94		-.55	.08
TEK10	18	2.67	0.40	0.06	-1.29	55.76		-.06	-.17
TEK14	18	2.14	0.51	-0.46	0.27	38.09		.44	-.35
TEK16	18	3.30	0.31	-0.50	-0.35	76.55		-.98	.27
Growth satisfaction	3						.89		
TEK5	20	3.37	0.43	-0.47	0.35	78.97		.75	.87
TEK11	20	3.41	0.42	-1.15	0.99	80.47		.92	.68

TEK15	20	3.38	0.36	-1.14	2.90	79.39		.83	.80
General satisfaction	3						.82		
TEK7	19	3.34	0.44	-0.13	-0.77	77.92		.86	.57
TEK13	19	3.64	0.38	-1.28	1.29	87.94		.58	.86
TEK17	19	3.40	0.44	-0.64	-0.10	79.86		.81	.63
Productive output	4						.88		
TEK18	14	3.36	0.50	-0.45	0.02	78.53		.82	.82
TEK19	14	3.24	0.43	-0.56	0.38	74.60		.85	.76
TEK20	14	3.31	0.41	-0.71	1.44	77.07		.88	.67
TEK21	14	3.11	0.64	-1.60	4.05	70.21		.84	.80

^a Only, if an officially announced leader is present according to at least three team members ($n = 14$).

Table C4

Categories to describe leadership by the Scrum Master

<i>n</i>	Category	Description / rule of coding	Examples
14	administration / organisation / coordination	activities, that deal with organizing, coordinating of meetings / basic conditions	"Team Organisation", "Administrations-Check und -Hilfe "
13	team leader / leadership	statements that include the leadership-thought	"Leitung der Software-Entwickler", "Als Teamleiter."
12	helps / supports / coaches	the Scrum Master as a helping hand, a supporter	"Teamcoach", "Unterstützt das Team."
11	eliminates obstacles	statements about removing barriers and problems	"Beseitigt Impediments", "Problembeseitiger"
9	conducting / leading / moderating meetings	Scrum Master as the person who is responsible for that meetings take place and being the person to lead and moderate them	"Moderation der Diskussionen", "Leitet Sitzungen (Planning, Retro, Daily)"
5	Daily Scrum	Scrum Master is responsible for the Daily Scrum as a particular meeting	"Daily Scrum", "Organisation von Daily Standups"
5	participates in process design	Scrum Master fulfills activities to guarantee the work process	"Plant den Ressourceneinsatz", "Prozessmitgestaltung"
5	takes care of setting goals and achieving them	Scrum Master is responsible for goal setting and achieving	"Ziele überwachen", "Setzt Sprintziel"
4	Scrum-ambassador	takes care, that Scrum is understood and well implemented	"Einhalten der Scrum Artefakte", "Führung im Scrumprozess"
4	moderating / conflict solving	Scrum Master as the person being responsible for dealing with conflicts	"(Konflikt)moderation", "Konfliktlösung, Kompromissfindung"
4	Monitoring / controlling	Scrum Master monitors goal achievement and controls	"Kontrolle des Arbeitsfortschrittes während Sprint", "misst den Fortschritt"

3	Sprint Planning	Scrum Master is responsible for the Sprintplanning (as a particular meeting)	"Sprint Planung", "Leitet Sitzungen (Planning, Retro, Daily)"
2	clarifies, e.g. requirements	Scrum Master clarifies raised questions / requirements	"Abklärungen für das Team", "Anforderungen"
2	Backlog	takes care about the Product & Sprint Backlog	"Backlog Refinements", "Koordination des BackLogs fürs ganze Team"
2	motivates	Scrum Master as a motivator	"gibt Motivation", "Führung bei Motivationsproblemen."
2	not interpretable	statements that cannot be brought in relation to the question what leadership looks like of the Scrum Master	"Scrum Master ist gleichzeitig Mitglied des Scrum Teams und Linienvorgesetzter. Der Scrum Master ist als Team-Mitglied bei allen Scrum-Meetings anwesend und hat durch seine vielen Rollen implizit ein stärkeres Gewicht (z.B. bei Schätzungen)."
2	team development	Scrum Master is responsible for the development of the team	"Teamentwicklung", "Kümmert sich um die Team Entwicklung"
2	representing the team	Scrum Master as representative of the teams needs	"Die Vertretung des Scrum teams", "'Anwalt' des Teams: Team Bedürfnisse konsolidieren"
2	team togetherness	Scrum Master is responsible for the team members being tied together	"Zusammenhalt im Team stärken", "fördert den Teamzusammenhalt"
1	influences collaboration	Scrum Master has an influence on the team working together	"Einfluss auf Zusammenarbeit"
1	technical	Scrum Master leads in a technical way.	"fachlich"
1	humane	Scrum Master leads in a humane way.	"menschlich"

1	provides orientation	Scrum Master gives orientation for the team.	"Orientiert über anstehende Arbeiten"
1	retrospective	Scrm Master is responsible for the team performing a retrospective.	"Retrospektive"
1	across teams	Scrum Master leads across teams.	"Teamübergreifend"
1	team set up	Scrum Master sets the team up.	"Setzt das Team auf"

Note. This table is a working version and has not been reviewed by a native English speaker.

Table C5

Categories to describe leadership by the Product Owner

<i>n</i>	Category	Description / rule of coding	Examples
23	prioritizing of Backlog / tasks	Product Owner prioritizes requirements and, hence, tasks so that the developers know what to do first	"Backlog Priorisierung", "entscheidet über die Reihenfolge der anstehenden Tasks"
10	clarifying (functional) goals	Product Owner sets the goals that particularly refer to the product.	"funktionale Ziele klären", "Definiert die Ziele für das Increment"
7	writing of Backlog / tasks / User Stories	Product Owner is responsible for the creating the user stories and tasks on the basis of what the customer wants.	"schreibt die Stories die umgesetzt werden müssen", "über Definition des Inhaltes"
7	clarifying requirements	He clarifies requirements of the product that will be developed by the developers.	"Beschaffung der Anforderungen und der dazu relevanten Infos", "Business Anforderungen zu IT Requirements präzisieren"
6	not interpretable	statements that can not be brought in relation to the question what leadership looks like of the Product Owner	"Sehr direkt", "Team selber interagiert nicht (bzw. selten) direkt mit Product Owner"
5	(monitoring) of target achievement	Product Owner is responsible for fulfilling the goals and needs to control them therefore.	"Kontrolle von Zielerreichung", "Erreichung der Ziele und Storys"
4	knowing / solving of problems / conflicts	Product Owner leads through being aware of problems and searching for solutions.	"Konflikte auflösen", "sucht mit den Entwicklern nach effizienten Lösungen"
3	decision-maker	The Product Owner leads as a decision maker.	"schnelle pragmatische Entscheidungen", "Als Entscheidungsträger"
2	technical leader	Product Owner is a technical leader.	"fachlicher leader", "Fachlichkeit"

5	product management	Product Owner has the leadership in terms of the product.	"Führung bei produktspezifischen Unklarheiten", "Kümmert sich um die Produkte Entwicklung"
2	team leader	Product Owner functions as the team leader.	"Führt das ganze Team.", "Leitung des Scrum teams inkl. deren Ziele und Visionen"
2	external responsibility	He is responsible towards external parties.	"Ist verantwortlich gegenüber aussen ", "verantwortlich gegenüber dem Auftraggeber"
1	defining work scope	He decides on how much work will be done.	"Auferlegen von Arbeitspaketen"
1	defining working methods	He decides on how work will be done.	"Auferlegen von Arbeitsmethodiken "
1	no defining working methods	He does not decide on how work will be done.	"Wählt nicht aus, wie etwas umgesetzt wird"
1	budget responsibility	He is responsible for the budget	"Budget Verantwortung."
1	coaching	The leadership by the Product Owner is done through coaching.	"Coaching"

Note. This table is a working version and has not been reviewed by a native English speaker.

Table C6

Categories to describe leadership by the Developer

<i>n</i>	Category	Description / rule of coding	Examples
6	realizing User Stories	They perform tasks to realize User Stories.	"Detailkonzepte zur Storyumsetzung", "Wie implementieren wir"
6	quality	Developers lead through meeting standards, quality criteria and remove errors.	"durch Code-Reviews", "Erfüllung der Qualität"
4	not interpretable	Statements that can not be brought in relation to the question what leadership looks like of the Developer.	"Gibt Ziele klar vor und lässt den notwendigen Freiraum für deren Erreichung", "Entwickler, Scrum Master und Linienvorgesetzter in einem"
4	technical leader	Developers lead through making technical decisions.	"Technische Entscheide", "technischer leader"
3	one developer leads	Only one particular developer leads.	"Bei einzelnen Themen übernimmt oft ein bestimmter Entwickler den Lead, z.B. wenn dieser in diesem Gebiet über mehr Fachwissen verfügt als die anderen Entwickler oder der Team-Leader.", "Senior Entwickler Erstellt hauptsächlich Tasks (aber in Absprache)"
3	Commitment & engagement	Developers show commitment to their tasks.	"Zeigt Initiative", "Bestimmen das Commitment. "
3	solutions	Developers deliver solutions	"Design, Implementierung und Testing von Lösungen", "Kümmert sich um die Lösung"
2	knowledge exchange	Developers lead through knowledge exchange.	"Durch Wissensaustausch", "Teammitglieder über gute Bestpractices informieren"
2	technical responsibility	Developers carry technical responsibility for their productive output.	"Fachliche Verantwortung", "Tragen die Verantwortung für die ausgeführte Arbeit."

2	helping	Developers lead through helping.	"Leistet bei Unklarheiten / Problemen (technisch / fachlich / menschlich) immer die notwendige Hilfestellung", "Unterstützung bei technischen Fragen"
2	questioning	Developers question the state of the art.	"Hinterfragen kritisch die tägliche Arbeit", "hinterfragt"
2	improvements	Developers lead through making suggestions for improvement.	"macht Verbesserungsvorschläge", "bringen Verbesserungen an"
1	team coordination	The developer leads through coordinating team members	"stimmt sich mit dem Team ab"
1	feedback	Developer leads through giving feedback to the Product Owner.	"Gibt Feedback an den Product Owner"
1	self-organizing	Developers are self-organizing.	"Selbstorganisierend"

Note. This table is a working version and has not been reviewed by a native English speaker.

Table C7

Categories to describe leadership by the Line Manager

<i>n</i>	Category	Description / rule of coding	Examples
7	administrative tasks	Line Managers only have administrative tasks (without the leadership-aspect)	"Administrative Aufgaben werden wahrgenommen.", "Ferien usw."
4	administrative / formal leadership	Line Manager are leaders in an administrative way.	"Administrative Führung", "Als formeller Vorgesetzter."
4	supply of resources	Employees are provided by all necessary resources.	"Bereitstellung von Team-Ressourcen", "Informationsfluss in Ressortmeetings"
4	Personnel Development	Line Managers are responsible for personnel development.	"Förderung von Mitarbeitern", "Kümmert sich um die Mitarbeiter Entwicklung"
4	personnel matters	Line Manager take care of personnel matters.	"Personelles", "Personelle belange"
4	goal setting	Line Manager set the goals, such as the company's goal as the overall goal.	"als offizieller Vorgesetzter, gibt die Unternehmens-Ziele für unsere Abteilung vor.", "Zielsetzung"
3	leadership of employees	The Line Manager fulfills leadership for his employees.	"Führung des Entwickler-Teams", " Personalführung"
3	Individual employee management	Line Manager lead in dyads: There is an individual leadership for every employee.	"Individuelle Zielvorgaben", "über "klassisches People Management" für einzelne Entwickler"
3	employee appraisals	Line Manager is responsible for employee appraisals and performance appraisals.	"regelmässige Mitarbeitergespräche", "Es gibt unregelmässige bilaterale Meetings und ein jährliches Feedback-Gespräch."
3	Management by Exception	He only interferes in exceptions, like escalations.	"Entscheidung im Fall von Eskalation.", "Greift ein, wenn etwas ausserplanmässiges nicht klappt"

3	leading / organizing meetings	He leads meetings regularly.	"Meetingführung", "Wöchentliche Ressortmeetings"
3	framework	Line Managers design the framework for their teams, so that they can work effectively.	"Rahmengestaltung", "Schafft ein Arbeitsumfeld, das die Zielerreichung ermöglicht."
2	task planning & distribution	He knows the tasks and distributes them.	"Analyse, Planung und Verteilung der Aufgaben", "Der Linienvorgesetzte ist als Entwickler im Team integriert. Zusammen mit seinem Vorgesetzten trifft er die Vorauswahl der in Frage kommenden Tasks, also einen Teil der PO-Rolle."
2	budget	Line Manager takes care of the budget.	"Budget"
2	help / support	Line Manager help and support in case of problems.	"Leistet bei Unklarheiten / Problemen (technisch / fachlich / menschlich) immer die notwendige Hilfestellung", "unterstützend, kooperativ"
2	classical role not present	The traditional Line Manager does not exist.	"Der Linienvorgesetzte ist gleichzeitig Mitglied des Scrum Teams und Scrum Master. Die Rolle Linienvorgesetzter wird fast nicht wahrgenommen.", "Ist in der täglichen Arbeit eher ein Mit-Entwickler als ein Vorgesetzter."
2	personnel decisions	He makes decisions about personnel.	"ernennt PO's für Projekte im Team wo es PS's benötigt.", "Personalentscheide"
2	team leader	Line Manager are team leader.	"Teamleiter bei uns"
1	department head	Line Manager leads the department.	"Leitung der gesamten Abteilung"

1	Line Manager & Scrum Master are one and the same	Line Manager and Scrum Master are one person.	"Der Linienvorgesetzte ist gleichzeitig Mitglied des Scrum Teams und Scrum Master. Die Rolle Linienvorgesetzter wird fast nicht wahrgenommen."
1	Line Manager & Scrum Master & Developer are one and the same	Line Manager, Scrum Master and developer are one person.	"Entwickler, Scrum Master und Linienvorgesetzter in einem."
1	removing obstacles	If there are impediments, the team cannot take care of themselves, the Line Manager removes them.	"Impediments beseitigen (lassen), die nicht in die Teamkompetenz fallen"
1	across teams	Line Manager leads across teams.	"Koordination mit anderen Teams."
1	not interpretable	Statements that can not be brought in relation to the question what leadership looks like of the Line Manager.	"Entwicklung"
1	Operative concerns	Line Manager only lead operative.	"Operativ"
1	unconventional thinker	Line Managers are unconventional thinkers.	"Querdenker"
1	Strategic concerns	Line Manager only leads strategically.	"strategische belange"

Note. This table is a working version and has not been reviewed by a native English speaker.

Table C8

Categories to describe leadership by the entire Scrum team (Scrum Master, Product Owner, Developer)

<i>n</i>	Category	Description / rule of coding	Examples
7	team makes decisions - implementation	The Scrum team makes decisions about the performance and implementation on its own.	"Definiert, welche Tasks wann umgesetzt werden können", "schauen zusammen wie wir das Ziel am ehesten erreichen."
4	stick to the process & improve it	Scrum team is responsible for adhering to the process and improving it.	"Prozess, Lösung", "Prozessverantwortung"
4	self-organization	The members of a Scrum team organizes themselves.	"In Form von Selbstorganisation", "Organisatorisch führt sich das Team (Entw. + Scrummaster) selbständig."
3	team makes decisions	The Scrum team makes decisions on its own, in general.	"Entscheide werden diskutiert und im Team gefällt.", "Entscheide werden generell im Team gefällt."
3	team plans everything	The Scrum team makes plans in general, such as about tasks and dates, on its own.	"Planung von Aufgaben, Prioritäten und Terminen.", "Führung betreffend Ferienplanung, Einplanung, Planung allgemein"
2	feedback	Scrum team members give each other feedback.	"Feedback", "konstruktive Kritik"
2	solution	The Scrum team takes care for the solution at the end.	"Prozess, Lösung", "Gesamtlösung"
2	planning	Scrum team members lead through plannings.	"Planung"
2	reviews	Scrum team leads through Reviews.	"Review", "Reviews"
2	self-leadership	The Scrum team leads itself	"Das Team führt sich selber.", "selbständiges Durchführen der Aufgaben (unter obengenannten Einschränkungen)"

2	team makes decisions - process & method	The Scrum team makes decisions about the working process and methods on its own.	"Prozesse und Arbeitsweisen", "Team entscheidet selber über die Art- und Ablauf der Arbeit."
2	team plans tasks	The Scrum team makes plans about tasks on its own.	"Arbeitsverteilung", "wir planen die Aufgaben"
2	working together	Team members work together.	"setzt die Teamarbeit um", "Zusammenarbeit"
1	effort estimation	The Scrum team estimates the effort.	"Aufwandschätzung"
1	helping each other	Members of the Scrum team support each other and decide bilaterally.	"Einzelne Mitglieder fragen andere Mitglieder an, wenn sie spezifische Anforderungen haben. Bilateral wird dann ausgemacht, in welchem Zeitraum und welchem Umfang eine Zulieferung stattfindet."
1	everybody's a leader	Every member is allowed to take the lead and participate.	"Jeder darf sich einbringen und den Lead übernehmen."
1	not interpretable	Statements that can not be brought in relation to the question what leadership looks like of the Scrum team.	"DoD, DoR"
1	PO prioritizes	Prioritizing is done by the Product Owner.	"Für Priorisierungen definiert dies der PO unter Berücksichtigung der Inputs des ganzen Teams."
1	servant leadership	Scrum team lead through servant leadership.	"Servant leadership"
1	SM supports the team	The Scrum Master is seen as the supporter of the team.	"ScM unterstützt das Team um diese zu erreichen."
1	team motivation	The team motivates itself.	"Wir treiben uns selbst an"

1	trust in the PO	Team members trust in the Product Owners work.	"Alle vertrauen dem PO, das er die richtige Priorisierung gemacht hat."
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Note. This table is a working version and has not been reviewed by a native English speaker.

Table C9

Categories of leadership that leads to success

<i>n</i>	Category	Description / rule of coding	Examples
23	to support the team	Statements that focus on the support for the team in general or specifically if problems occur, including the team orientation by the Line Manager.	"Hilft und organisiert damit das Team möglichst optimal arbeiten kann", "Wenn das Team durch Unterstützung in die Lage versetzt seine Aufgaben effizient zu lösen"
17	to have clear / high / reachable goals	Leadership means to set clear goals. This was regularly mentioned with the self-organization of the team (to set the goals, but leave the methods to the team).	"Vision, Ziel, Strategie -> mit Disziplin und Leidenschaft verfolgt.", "Vorwiegend Ziele definieren und kontrollieren, nicht die Wege dazu", "Ziele setzen und dem Team grösstmögliche Eigenverantwortung / Autonomie zu überlassen"
13	to enhance self-organization	Statements about the self-determination and self-organization of the team.	"Führung ist für mich Selbstorganisation im Team (!)", "Eine Führung die auf Selbstständigkeit und Vertrauen setzt", "Wir müssen als Team lernen uns selber zu organisieren und unser Leistung (Output) zu optimieren."
12	motivation	Successful leadership is about motivating people.	"Aufrechterhaltung von Motivation", "Motivation der Teammitglieder"
11	autonomy	To provide the team with freedom and autonomy.	"Freiräume schützen", "Platz für Eigeninitiative und Lösungsfindung lassen", "Freiräumen innerhalb definierter Grenzen gewähren"

10	not useful	Statements that could not be understood or were not a clear answer to the question (Which "Kompetenz"?, Coordination of what?).	"fdgs", "Dieses Bild http://flauschig.ch/images/boss-vs-leader.png beschreibt sehr gut für mich, was ein erfolgreicher Leader ist.", "Kompetenz"; "koordinieren"
9	to remove barriers	Successful leadership removes obstacles of the team.	"Hindernisse beseitigen", "Probleme aus dem Weg räumen."
9	provision of current information and purpose	Successful leadership is about providing everybody with the highest possible transparency, through information giving to the team or from the team to the Manager.	"Transparente Informationspolitik", "Sinn- und Informationsvermittlung.", "Relevante Informationen fließt zum Team."
9	to provide a framework	Successful leaderships sets the framework for team work.	"Rahmen vorgeben", "Führung sollte Richtlinien / Leitplanken schaffen für das Team und daher eine gewisse Rahmenbedingung schaffen."
8	participation	Statements about collective decisions and participating of the team members in important matters. No solo-run by the leader.	"Transparente, teamorientierte und adaptive Einbeziehung aller Teammitglieder", "Eingehen auf die Mitarbeiter und gemeinsam zur Lösungsfindung beitragen. Keine Diktatur sondern eine Demokratie", "Ein kooperativer Führungsstil."
8	to protect the team	Statements about the protection of the team from influences that negatively affect its ability to work on its primary task.	"Nach aussen hin Druck abhalten, politische Entscheidungen aus der täglichen Entwicklungsarbeit heraushalten.", "Das Team von unproduktiven/administrativen Tasks entlasten"

7	appropriate staff assignment	To assign employees according to their strengths and availability.	"Menschen in ihren Gaben und Fähigkeiten einsetzen.", "Gemeinsam definierte Ziele mit den Stärken jedes Teammitglieds zu erreichen."
7	management by exception	A leader is allowed to intervene only if there are problems because then, the team is not able to solve it on its own.	"Falls Team auf Irrwegen ist bzw. Zielerreichung gefährdet ist, korrigierend eingreifen und darüber diskutieren", "Man lässt die Leute machen und wenn etwas nicht klappt, greift man ein."
7	team is responsible	Successful leadership leaves the competence and responsibility to the team.	"dem Team grösstmögliche Eigenverantwortung / Autonomie zu überlassen", "Das Team übernimmt Eigenverantwortung", "Kompetenz dem Team überlassen"
7	trust	Leadership that leads to success requires the Line Managers trust in his team, e.g. as a leap of faith.	"Vertrauensverhältnis zwischen Vorgesetztem und Mitarbeiter ", "Aufbau von Vertrauen", "Vertrauen in die Mitarbeiter setzen"
7	to be goal-oriented	The goal always needs to be present and successful leadership fosters the team to collaborate to achieve it.	"Das Team immer wieder auf das Ziel fokussieren.", "alle wollen das Ziel erreichen", "gemeinsam zum Ziel"
6	to control the progress	Successful leadership proactively controls if the team is on the right track.	"Vorwiegend Ziele definieren und kontrollieren", "Laufende Kontrolle während der Zielerreichung, ohne dabei als "Polizist" aufzutreten"
5	feedback	Constructive feedback and honest criticism is one aspect of successful leadership.	"ehrliches Feedback aussprechen", "Regelmässiges, konstruktives Feedback ", "konsequentes Einfordern und objektives Beurteilen von Resultaten."

5	approval	To praise and encourage the team, but in a sincere and honest manner.	"viel loben", "Lob"
5	to talk openly about problems & be solution-oriented	Successful leadership is about openly talk about problems and solving them.	" auftretende Probleme gleich welcher Natur offensiv ansprechen", "Probleme werden angesprochen und gelöst", "reibungslose Zusammenarbeit zu gewährleisten, indem Konflikte erkannt und gelöst werden - sei es zwischenmenschlich oder auf fachlicher Ebene, oder mit dem Kunden"
4	task planning	Successful leadership is about the right task planning.	"Aufgaben richtig priorisieren", "Gute, sinnvolle Planung."
4	communication	Successful leadership is about much communication in a positive manner and with the focus to provide relevant information.	"gute Kommunikation und Information", "good communication", "Positive Kommunikation"
4	to identify and promote talents	Statements that focus on the identification and the support of talents as one aspect of successful leadership.	"Förderung von Talenten", "Potential erkennen und fördern", "Talente finden und weiter entwickeln"
4	to be a role model	Successful leaders are role models for the team members.	"Vorleben der geforderten Arbeitsweise", "Mit gutem Beispiel vorangehen."
4	personal & personnel development	Successful leadership ensures possibilities of (personal / personnel) development.	"Aufzeigen von Perspektiven für die Weiterentwicklung - Individuelle Förderung (Weiterbildung)", "Ermöglichen von Weiterbildung"

3	to build up safety	Successful leadership provides the team with safety and stability.	"Aufbau von Vertrauen, Sicherheit und Loyalität.", "Zudem dem Team als Vorbild voranzugehen und so Sicherheit und Vertrauen zu gewährleisten", "Wenn die Führung eine eingeschlagene Kurs nicht zu oft wechselt"
3	to have a vision	Successful leadership has a long-term focus (visions, perspectives).	"Vision", "Share the vision", "Perspektiven"
2	leadership is in the background	Leadership that leads to success is invisible because it is done in the background.	"Führung, die eher im Hintergrund abläuft und die Entwickler während eines Sprints nicht von der Arbeit abhält.", "Gut Führung ist fast unsichtbar."
2	to be engaged / show interest	Successful leadership is about being interested in what the team does, and being active.	" Interesse zeigen", "Engagement"
2	to give honest critics	Successful leadership is about providing criticism but in an honest manner.	"Kritik", "echte Kritik"
2	to be open for criticism	Successful leadership is open about criticism and understandinf.	"Kritikfähigkeit", "Fehler einzugestehen und offen damit umgehen."
2	provision of material & resources	Successful leadership provides the team with those resources and materials which are necessary for the service provision.	"Beschaffung der nötigen/genügenden Ressourcen", "provide necessary materials/tools for the work of team members"

2	team togetherness	Successful leadership takes care that team members work together and pull together in the same direction.	"Den Miteinander Gedanken festigen, das Team zusammenhalten und schauen, dass keine Barrieren zwischen den Teammitgliedern entstehen.", "angenehmes Klima in der Gruppe schaffen"
2	team goals	Leadership is successful only then when te goals were set collectively.	"Im Team Ziele definieren", "Gemeinsam definierte Ziele"
2	to have an overview	Successful leadership never loses the overview about what happens within the team.	"Überblick behalten.", "Die Führung soll den Überblick haben über alle und alles haben."
1	to adapt to new circumstances	Leadership can be successful if new situations are correctly evaluated in order to adapt.	"Fähigkeit neue Situationen richtig einzuschätzen und sich entsprechend anzupassen"
1	individual leadership	Successful leadership focuses also on the individual employee.	" individuelle Führung der Mitarbeiter"
1	continous improvement	Successful leadership is about continuous improvement.	"Ständige Verbesserung in kleinen Schritten"
1	to build loyalty	Successful leadership is based on loyalty.	"Aufbau von Vertrauen, Sicherheit und Loyalität."
1	to be open-minded	Successful leadership requires openness.	" Offenheit"
1	balancing betweent command & control and self organization	Successful leadership balances between self-organization and command and control management.	"Situativ den Seiltanz zwischen Micromanagement (strikte Kontrolle, an der Leine nehmen) und Freiräumen innerhalb definierter Grenzen gewähren."

1	to be self-confident	Successful leadership is about being self-confident.	"Selbstbewusst"
1	self-leadership	Successful leadership is about self-leadership.	"Wenn sie sich überflüssig macht, d.h. jeder führt sich selbst "
1	servant leadership	Leadership is successful when leaders serve each other / others.	"Servant Leadership"
1	team design	Successful leadership is to guarantee an adequate team design.	"Optimale Team Zusammensetzung"
1	to integrate the team as an organizational unit	Successful leadership links the team to the organization and takes care, that it is perceived as a unit.	"Führung sollte ebenfalls dafür sorgen, dass die Team-Mitglieder in der Organisation als gesamtes wahrgenommen und integriert werden."
1	the leader is part of the team	Line Managers have to regard themselves as part of the team.	"Sich als Teil vom Team zu verhalten und nicht als Vorgesetzter."
1	transformational leadership	Successful leadership is transformational leadership.	"transformative"
1	interpersonal relationships	Successful leadership is based on interpersonal relationships.	" zwischenmenschliche Beziehungen"

Note. This table is a working version and has not been reviewed by a native English speaker.

Table C10

Categories about challenges of a Line Manager

<i>n</i>	Category	Description / rule of coding	Examples
22	accept self-organization	Self-organization means, that the team plans and performs the task themselves, including decision-making.	"Let the team work and seat back!", "keine genauen Vorgaben zum Weg zum Ziel", "Dass sich das Team selbst organisiert."
15	not useful	Statements that are understood but are not an adequate answer to the questions and therefore can not match clearly to a category.	"Freiräume werden genutzt ", "Organisation", "Matrixorganisation", "Störung"
12	loss of control	The Line Manager loses options for action / control, that he used to have in his traditional role.	"Keine direkte 'Steuerung' des Prozesses", "Er hat keinen direkten Einfluss mehr darauf wie und in welchem Umfang Aufgaben bewältigt werden.", "Kein Einfluss auf Aufgaben-Planung und Arbeitsvorgehen nehmen."
9	trust	To build up trust is regarded as a challenge.	" je nach Erfahrung des Vorgesetzten mit dem Prozess kann ebenfalls die Bildung von Vertrauen eine Challenge sein", "Vertrauen in Mitarbeiter.", "Vertrauen ins Team"
8	handing over of responsibility	The challenge is, that now the Scrum team is responsible, not the Line Manager any more.	"Verantwortung an das Team abgeben können.", "Delegieren von Verantwortung an das Team "

8	to lean back	Before Scrum, the Line Manager was responsible for service provision. Now, that the Scrum team is responsible he has to lean back and does not intervene into the working process (except it is needed).	"Das Zurücknehmen Aufgrund der starken Selbstorganisation des Teams", "Er muss sich zurücknehmen können", "Er sollte sich möglichst heraushalten.", "Das Team möglichst frei arbeiten lassen und sich nicht zu viel "einmischen"."
7	performance assessment	The Line Manager has difficulties to evaluate the performance of individual employees.	"Beurteilung der individuellen Leistung eines Teammitgliedes ist schwierig ", "Das er die individuelle Leistung der einzelnen Teammitglieder nicht direkt beurteilen kann"
5	no command	The Line Manager, now, is not allow to give instructions to the team, only in emergencies.	"Man kann nicht Aufgaben direkt an Personen zuweisen, weil das entgegen der Ziele von Scrum ist.", "das Team zu unterstützen in allen Angelegenheiten und nicht zu befehlen"
5	individual personnel development	The Line Manager takes care for the development of individual employees.	"Mitarbeiterförderung", "Es gibt meist recht viele Teammitglieder und jeder hat meist eigene Anliegen bzw. in welche Richtung er sich entwickeln möchte.", "Wie bringe ich Mitarbeiter dazu sich zu entwickeln, die das nicht eigengetrieben, selbstständig machen"
3	handing over of competence	The Line Manager needs to hand over his competence to the Scrum team. "Competence" is not described in detail."	"Kompetenz abgeben", "Abgabe von Kompetenzen"

3	provide resources	The Line Manager needs to provide resources for the team.	"Verfügbarkeit der Resources", "Bereitstellung von genügend und geeigneten Team Ressourcen"
3	team development & team building	It is a challenge to develop the team and to take care of team orientation.	"Teambildung", "Teamentwicklung ist meiner Meinung nach eine grosse Herausforderung."
3	not needed	The Line Manager is regarded as unnecessary or the traditional role of a Line Manager is not needed any more.	"Seinem Nicht-Benötigt-Werden", "Ihn braucht es gar nicht mehr, "den klassischen Linenvorgesetzten gibt es nicht mehr"
3	HR & personnel	The task of the Line Manager seems to be classical HR-tasks. This is a general categories, single HR-aspects are in different categories.	"Falls der Linienvorgesetzte nicht direkt im Scrum team involviert ist (z.B. als Product Owner), reduziert sich die Aufgabe auf klassisches People Management (HR, Leistungsbeurteilung, Ferien, ...). ", "Personalfragen", "Er muss sich zurücknehmen können und ist nur noch für die strategische Lenkung und HR Aufgaben zuständig."
3	team management	It is a challenge to show interest in all team members and to combine diversity.	"Heterogenität im Team ist grundsätzlich erwünscht und leistungsfördernd, aber auch eine andauernde Herausforderung: Alle sollen ihre Talente einbringen können, keiner soll die Kollegen 'dominieren' und keiner soll 'unter die Räder kommen'", "Integrativ auf sehr unterschiedliche Persönlichkeiten mit sehr grossem, aber meist sehr unterschiedlichen, Spezialwissen, einwirken zu können. "

3	distance	If the Line Manager is not part of the Scrum team, he is too far away from the team.	"Die gross entfernung, der lininevorgesetzte ist zu weit weg vom team, dass er es überhaupt beurteilen, führen kann.", "er ist zuweit vom Geschehen entfernt"
2	support the team	It is a challenge, that the Line Manager now supports the team.	"Das Team administrativ leiten und unterstützen", "das Team zu untertützen in allen Angelegenheiten und nicht zu befehlen"
2	unknowingness & uncertainty	The Line Manager is not informed about the working process. As a result, there is uncertainty.	"Ungewissheit", "Dass er nicht über alles informiert wird/ist, weil vieles teamintern besprochen wird und nicht bis zu ihm durchdringt (bekommt somit den "Groove" nicht mit)."
2	framework	The Line Manager provides an appropriate framework and conditions so that the team can work properly.	"Ensure that the conditions are met for the scrum team can do its job properly", "Bereitstellen einer Umgebung, in der das Scrum Team seine Aufgaben ungestört wahrnehmen kann."
2	agile	Statements that indicate that the Line Manager has difficulties with agility and needs to become agile him/herself.	"Agilität ", "Selber agil werden."
2	protection	The Line Manager protects the team, which is challenging.	"Schützen des Scrum teams", "Er muss das Team manchmal vor dem PO schützen."
2	multiple levels of leadership	There are multiple levels of leadership: either regarding the role or regarding the area of leadership.	"Verschiedene Führungsebenen, Scrummaster vs. Linienvorgesetzter", "Die fachliche Führung nimmt ab - die organisatorische Führung wird anders."

1	aministrative function	The Line Manager only has administrative tasks.	"Das Team administrativ leiten und unterstützen"
1	Scrum Master and Line Manager are two persons	It is a challenge, if those two roles are NOT performed by one person.	"Trennung der Rolle Vorgesetzter und Mitglied des Scrum Teams."
1	Scrum Master and Line Manager are one persons	It is a challenge, if those two roles are performed by one person.	"Rolle Linienvorgesetzter und Scrum Master müssen separat wahrgenommen werden."
1	staff turnover	It is challenging, if staff comes and goes.	"Mitarbeiter kommen und gehen"
1	ambiguity of roles	It is a challenge if the roles of the Scrum Master and of the Line Manager are not clearly defined.	"Ich kann mir vorstellen, dass es Konflikte / Unklarheiten bei der Verantwortung und Regelung der Zuständigkeiten geben kann, wenn diese beiden Rollen nicht in einer Person vereint sind."
1	no nr. 1	The Line Manager is not number one any more.	"Er ist nicht die Nr 1"
1	strategy	The Line Manager onyl remains responsible for strategic aspects.	"Er muss sich zurücknehmen können und ist nur noch für die strategische Lenkung und HR Aufgaben zuständig."
1	leadership	Leadership in general is regarded as challenging.	"Die Führung als Ganzes ist eine Herausforderung."
1	connection	It is a challenge to be the link between the agile and the non-agile part of the organization.	"Zudem ist oft das Bindeglied zwischen dem agilen Teil der Unternehmung den dem non-agilen Teil."
1	personnel selection	It is challenging to find appropriate staff.	"Die richtigen Leute finden und ihnen vertrauen, dass sie gut arbeiten."

1	many employees	Through flat hierarchies, the Line Manager has more people to lead.	" Dass er viele Untergebene hat (flache Hierarchie mit vielen Leuten bei mehreren Scrumteams) und er somit bei einzelnen deren Stimmung/Befinden nicht "wirklich" abholen kann (kein Direktbezug mehr) und somit die Zufriedenheit nur "vorgegaukelt" ist."
1	knowledge	The Line Manager needs to be informed about the working progress by the team but also where he himself gets support.	"Er muss die Prozesse kennen und muss auch wissen an wem er Fragen (vom Team, welche er selber nicht beantworten kann) weitergeben kann/soll."
1	no Scrum role	It is challenging, if the Line Manager is not a Scrum role himself.	"Er muss TEIL vom Scrum werden. Dh. entweder "Product Owner" oder "Entwickler"."

Note. This table is a working version and has not been reviewed by a native English speaker.

Appendix D–Interpretation and Results

Table D1

Problematic values of Cronbach's Alpha both on individual and team level

	Cronbach's Alpha	
	Individual level	Team level
Real Team		
Boundedness	.61	.43
Interdependence	.53	–
Compelling Direction		
Challenge	.67	.63
Consequentiality	.56	.30
Enabling Structure		
Team Composition		
Size	.46	.32
Diversity	.60	–
Task Design		
Whole Task	.62	.52
Autonomy / Judgement	.55	.40
Knowledge of results	.44	.43
Supportive Organizational Context		
Material resources	.67	–
Available, expert Coaching		
Leader Coaching		
Operant coaching	.34	.18
Unhelpful directives	.31	-.07
Peer Coaching		
Unhelpful interventions	.62	–
Process Criteria		
Effort	.57	–
Performance Strategy	.62	–
Knowledge and skill	.68	.43
Team effectiveness criteria		
Team social processes		
Relationship satisfaction	.60	–
Individual well-being		
Internal work motivation	-.27	-.29

Growth satisfaction	.63	-
General satisfaction	.61	-

Note. Acceptable values are marked with "-".

Table D2

Problematic items including their psychometric properties and suggestions for future modifications

Measures	Indiv. level	Team level	In- verse	Diffi- culty	Cron- bach's Alpha	Cronbach's Alpha, if item deleted	Selec- tivity	Suggestions
Real Team								
Boundedness								
RT5	x		x	93.65	.61	.69	.26	delete item (too easy, very low selectivity)
RT5		x		94.34	.43	.59	.07	delete item (too easy, very low selectivity)
Interdependence								
RT4	x		x	61.32	.53	.65	.19	delete item (rather difficult, very low selectivity)
Compelling Direction								
Clarity								
CD9	x		x	76.50	.71	.79	.38	(delete item)
CD9		x		73.94	.78	.83	.50	(delete item)
Challenge								
CD7	x			50.00	.67	.70	.39	(delete item, to reach .80, rather low selectivity, rather difficult)
CD7		x		51.69	.63	.83	.25	(delete item, to reach .80, rather low selectivity, rather difficult)
Consequentiality								

CD3	x		92.46	.56	.70	.17	delete item (too easy, very low selectivity)
CD3		x	91.89	.30	.66	-.16	delete item (too easy, very low selectivity)
Enabling Structure							
Team Composition							
Size							
ES_TC2	x	x	74.00	.46	.64	.10	delete item (very low selectivity)
ES_TC2		x	76.67	.32	.70	-.08	delete item (very low selectivity)
Task Design							
Whole Task							
ES_TTD10		x	82.83	.52	.56	.14	delete item (rather too easy, very low selectivity)
Autonomy / Judgement							
ES_TTD1	x	x	73.98	.55	.60	.25	delete item (very low selectivity)
ES_TTD5		x	69.64	.40	.50	.12	delete item (very low selectivity)
Knowledge of results							
ES_TTD2	x		54.13	.44	.62	.13	delete item (very low selectivity, rather too difficult)
ES_TTD8		x	71.52	.43	.61	.07	delete item (very low selectivity)
Supportive Organizational Context							
Information							
SOC6	x	x	70.95	.72	.74	.45	(delete item)
Education / Consultation							

SOC7	x		62.38	.75	.82	.44	delete item, rather difficult
Material resources							
SOC9	x	x	62.42	.67	.71	.39	(delete item)
Available, expert Coaching							
Coaching availability							
EAC_avail1	x		75.54	.75	.81	.44	delete item
Leader Coaching							
Operant coaching							
EAC_TL14		x	90.87	.18	.40	-.08	delete item (negative selectivity, too easy)
Unhelpful directives							
EAC_TL9		x	65.42	-.07	.33	-.25	delete item (negative selectivity, rather too difficult)
Process Criteria							
Effort							
TEP1	x		66.99	.57	.59	.30	(delete item)
Knowledge and skill							
TEP3	x	x	68.27	.68	.75	.37	delete item (rather too difficult, low selectivity)
TEP3		x	68.53	.70	.78	.45	delete item (rather too difficult, low selectivity)
Team effectiveness criteria							
Team social processes							
Relationship satisfaction							
TEK6	x	x	85.33	.60	.65	.30	(delete item)
Individual well-being							
Internal work motivation							

TEK14	x		39.00	-.27	.29	-.30	delete item (negative selectivity, too difficult)
TEK14		x	38.09	-.29	.44	-.35	delete item (negative selectivity, too difficult)
Growth satisfaction							
TEK11	x		83.49	.63	.85	.21	delete item (low selectivity)

Note. Suggestions in parentheses are recommended but not as necessary as suggestions without parentheses.