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Applying Metrics in Agile
Development of Performance Indicators to Support Agile Development Teams

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Abstract

Despite the recognized value of metrics and the accelerating trend towards agile, the connection between the two seem to be unexplored in existing research. While organizations across industries have acknowledged the benefits of using metrics, there is an extensive opposition to this idea. In particular, practitioners are skeptic to the use of metrics in agile settings although continuous improvement and feedback are central to the agile way of working. This study investigates the compatibility between metrics and agile, and aims to develop a procedure for establishing metrics to support agile development teams.

A literature review provides the foundation of the analytical framework, which presents the applicability of metrics in agile, the development of metrics in agile, as well as features of a metric set in agile. Based on the analytical framework, a case study is designed to empirically evaluate the findings and arrive at a recommended procedure. Workshops with agile development teams are carried out to assess two alternative procedures of developing metrics in practice. Observations of workshops and interviews with participants comprise the basis for evaluation.

Metrics are commonly used to measure individual performance, which can lead to controlling effects on employees and hindered learning, as well as selfishness and cooperation barriers. It is apparent that these effects are contradictory to the agile approach, which opposes that metrics are compatible with agile. However, metrics are applicable in an agile setting and supportive of team progress if the development is carried out by the team itself and steered by agile values. The metric set should be focused on the opportunities for team improvement and include metrics within the following categories: Efficiency, Team Support, and Self-Leadership. The procedure of developing metrics in agile is circular and starts with defining a relevant set of team goals, followed by an identification of information needed to track goal fulfillment. Based on the goals and accompanying information, specific metrics are then formulated. This way of developing metrics leads to an application that is team focused and improvement oriented, which is in line with the agile approach. The procedure recommended for developing metrics to support agile development teams is presented in this report.

Keywords: Metrics in Agile, Development of Metrics, Team Improvement, Measurement System

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1. Introduction

The rapidly changing markets of today require a flexible way of working that enables to adjust ongoing projects in order to stay aligned with the market requirements. This has enhanced a trend of transforming to the agile way of working, which calls for increased flexibility, team work, iterativity and continuous improvement. Volvo Car Corporation, in the following referred to as Volvo Cars, has recently introduced agile work methods in their R&D organization, which inevitably has implied a major change for all employees involved. Successfully adapting to such a transformation takes time and requires extensive employee motivation and effort. Hence, it is of value to provide the employees with support to ease the adoption of the new work situation as well as their development over time. Countless number of organizations across industries have acknowledged the benefits of continuous improvements and use metrics as a primary tool for their organizational development. Metrics could be employed to enhance motivation by visualizing and acknowledging the results of employee efforts (Kerzner, 2013), and provide valuable feedback to support performance improvements (Klubeck, 2011). Furthermore, metrics can be used to increase customer satisfaction, employee satisfaction, process efficiency and value of products or services (Kerzner, 2013).

It should be noted that far from all organizations see the value in measuring performance and progress of employees. Targets might limit the organization since employees focus merely on fulfilling set targets, and lose incentives to achieve in other areas (Ordonez et al., 2009). They argue that processes are not improved by the use of targets, but rather by creating opportunities for those working in the organization (Johnson and Bröms, 2000). Johnson and Bröms (2000) mean that the emphasis of an organization should be on understanding the internal processes that fulfill customer needs, and attempting to increase that knowledge, rather than focusing on the outcome of those processes. Consequently, it is crucial to understand that effects of using metrics are determined by the way they are applied.

Despite the extensive use of metrics and the accelerating trend towards agile, the connection between the two seem to be unexplored in existing research. An interest for metrics in agile has dramatically emerged within agile communities, leading to agile experts and practitioners taking a stance regarding this phenomenon. Although research-based evidence is lacking, there is an extensive skepticism regarding the compatibility of metrics and agile. The use of metrics in agile organizations can be considered a paradox, since it appears to control the agile teams with external targets. Some of the underlying principles behind the agile way of working, stated by the founders of Agile, mention the benefits of using self-organizing teams in development and the need for continuous evaluation of team effectiveness (Agile Manifesto, 2001). Self-transcendence is one of the criteria for self-organization, which means that the team shall establish their own goals in order to reach the long-term vision set out by management, and be in control of the follow-up and evaluation of these in order to improve iteratively (Edström & Söderberg, 2018). Hence, it could be considered contradictive to the agile principles when management controls the development by establishing external metrics.

Based on the problematization above, it is of interest to investigate the compatibility between agile and metrics to fill this gap in literature. This study stresses whether metrics are suitable in an agile approach and, if so, how they should be applied. It is in Volvo Cars' interest to

discover how metrics could be used to support the agile development teams and ease their improvement over time. To arrive at these conclusions, a case study is conducted with agile development teams at Volvo Cars. With an ambition of bringing value to several parties, this study investigates a procedure of developing metrics rather than suggesting a specific set of metrics. Additionally, the recommended procedure for developing metrics can be useful over time as circumstances change.

1.1 Purpose

The purpose of the study is to develop a procedure for establishing metrics to support agile development teams. The metrics aim to provide the teams with valuable feedback to drive team progress.

1.2 Research questions

The following research questions form the basis of the investigation and have been formulated to facilitate the fulfillment of the purpose. Each paragraph highlights the reasoning behind these research questions to clarify the rationale of the study.

Organizations across industries agree that there are extensive benefits to gain from using metrics. Having a set of metrics and accompanying measurements could be considered a prerequisite for effective project management (Kerzner, 2017). Defining metrics is an easy task, but developing the right ones that truly bring value to the organization is much harder (Eusgeld et al., 2008). To initiate this study, it is of value to review existing research regarding the development of metrics.

How can the procedure of developing metrics be designed?

There is a wide range of elements that distinguish the agile approach from traditional ways of working, including cross-functionality, iterativity, responsiveness to change and frequent interaction with stakeholders (Lankhorst et al., 2012). Furthermore, the agile mindset and values have a central role in the organizations and should guide decision-making at all levels. It is therefore crucial to understand and comply the cornerstones of the agile way of working and not to compromise its values. At first sight, metrics can be regarded as contradictory to the agile way of working due to its controlling effects. To acquire the benefits of metrics in an agile setting, the compatibility between metrics and agile need to be ensured. It is therefore of interest to investigate how these two topics could be arranged to co-exist. This is initially investigated through an analysis of theoretical findings. Although existing research might suggest that the procedures are applicable in an agile approach, there is a need for practical evaluation through a case study.

How can metrics be developed to be applicable in an agile setting?

The case study further aims to identify the procedure of developing metrics that generates the most favourable outcome in agile setting. This is accomplished by applying steps of metric development, suggested in existing research, in practice. The steps are carried out by agile development teams and evaluated on feasibility and success.

How should the procedure of developing metrics to support agile development teams preferably be designed?

2. Theoretical Framework

As mentioned in the introduction, theory regarding metrics in an agile setting is rather lacking. In particular, metrics in agile from a team improvement perspective is unexplored. Consequently, existing research on the two topics is studied separately and later analyzed in relation to each other. The following chapter presents the findings from the literature review, divided into two main sections: Metrics and The Agile Approach.

2.1 Metrics

This chapter elaborates on the topic of metrics, presenting existing research regarding the definition of metrics, benefits and drawbacks of metrics, quality of metrics, development of metrics, and features of a metric set.

2.1.1 Definition of Metrics

The definition of metrics somewhat varies in existing research, and is often confused with the term measurements. The MITRE Corporation (1999) states that measures are deduced from interpretations of metrics. Metrics are explained as performance indicators of a system, a group or a user, which can be observed for scenarios in a set or separately. To clarify, MITRE Corporation describes a metric as being an observable value, and a measure being the meaning of the metric gained by adding human judgement. Kerzner (2017) takes a more general approach to the term metrics, defining it simply as something that is measured. In turn, measurements can be described as objective descriptions of empirical knowledge by numbers (Finkelstein & Leaning, 1984), or as a process where attributes of an entity, in reality or abstraction, is allocated symbols or numbers in order to describe them by a set of rules (Polančič & Cegnar, 2000). Eusgeld et al. (2008) mean that measurements could be seen as an activity in which numbers are attached to an object, but also define measurements as a function that assigns an object a specific element out of a set based on an observation.

In contrast to MITRE Corporation, Klubeck (2015) argues that measures consist of data and appoint a minimal degree of context to the data. Metrics, in turn, is constituted by data, measures and information and provide a more complete picture. Furthermore, Klubeck (2015) emphasizes that metrics are not facts, but indicators with many possible interpretations, and that it is crucial not to regard them as facts. This study is based on the viewpoint of Klubeck (2015), meaning that metrics are assumed to consist of measures, information and data. To clarify this, the components of a metric are visualized in Figure 1 below.
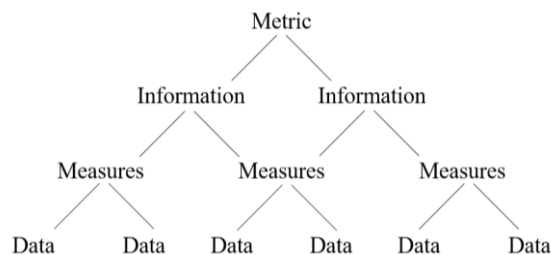

Figure 1. The components of a metric.

2.1.2 Benefits of Metrics

Kerzner (2017) states that having a set of metrics and accompanying measurements that provide organizations with complete, or almost complete, information is a prerequisite for effective project management. Organizations lacking good metrics are forced to make guesses rather than decisions based upon evidence and facts. Furthermore, Kerzner means that things that cannot be measured, can neither be fully understood nor managed. A good set of metrics, which refers to timely and informative metrics, may prompt a proactive rather than reactive project management. Hubbard (2014) and Muller et al. (2005) agree that measurements are useful to make informed key decisions. Hubbard (2014) adds that other reasons to use measurements may be to sell the results to third parties or simply to satisfy curiosity. Muller et al. (2005) further states that metrics affect employee behavior by aligning objectives and efforts with company interests.

Kerzner (2013) means that employees are motivated by viewing the benefits of their efforts, and that metrics can be used to create that awareness. Metrics provide support for projects as well as provide information and motivation for employees. Klubeck (2011) describes that metrics provide valuable feedback useful for improvement as well as insights of employee efforts. Metrics should not be viewed as solutions, but should be used to give an indication of where to focus employee efforts. Furthermore, Klubeck sees the benefits in using metrics to share efforts with other parties, such as customers, since they are easily understood.

2.1.3 Critique of Metrics

Castellano and Roehm (2001) discuss the risks of managing by objectives and managing by results in their article. Managing by results was first mentioned by W. Edwards Deming, who stated that there is no use of numerical goals and that focusing on the outcome leads to selfishness and ineffectiveness (Deming, 2000). Instead of focusing on individual results, managers should help all employees understand their contribution to the bigger system. Johnson and Bröms (2000) argue that most organizations put emphasis on the outcomes rather than providing opportunities and time for people to learn. Potential risks of managing by results to control employees or motivate their behaviour are ineffective systems and cooperation barriers (Castellano and Roehm, 2001).

Bourne et al. (2017) state that although performance measurement and management (PMM) has provided various benefits for organizations over the years, the use in increasingly uncertain environments is limited. The controlling effect of PMM can be damaging, especially in dynamic environments, since it may hinder learning and ability to challenge the circumstances. Thus, the authors mean that the new paradigm would question the monitoring and controlling effects of PMM systems and instead promote learning and adaption.

Although a metric is a way to improve decision-making, poor or inaccurate metrics may imply worse decisions (Kerzner, 2017). Latham and Locke (2006) mean that providing employees with performance goals, which are outside of their knowledge base to attain, may prompt poorer results than telling workers to do their best. The authors also discuss the risk of performance goals being viewed as a threat rather than a challenge, which commonly reduces the performance of employees. Moreover, goals are set to direct efforts in cases where outcomes are critical but may imply that other performance areas get ignored to a high extent.

Klubeck (2011) agrees that measuring performance may remove attention from other areas leading to drops in performance elsewhere. Therefore, Klubeck suggests that metrics and measures of success should merely be viewed as an indicator and not celebrated. The emphasis should be placed on attaining the goals rather than the measure itself.

Dahler-Larsen (2014) means that the intentions behind a measurement system influence the consequences followed by using it. A metric can never perfectly reflect the intended concept, leading to an issue of validity. The validity of a metric reflects whether it measures the intended attributes (Eusgeld et al., 2008). Although the measurement always is more or less off-target, it guides actions and decision making (Dahler-Larsen, 2014). The lower the validity of the indicator, the lower the correspondence between indicator and concept as well as more space for misinterpretation. The result of these poor measurements are unintended consequences, such as tunnel vision, sub-optimization and effort substitution. Figure 2 below illustrates this reasoning by Dahler-Larsen (2014).
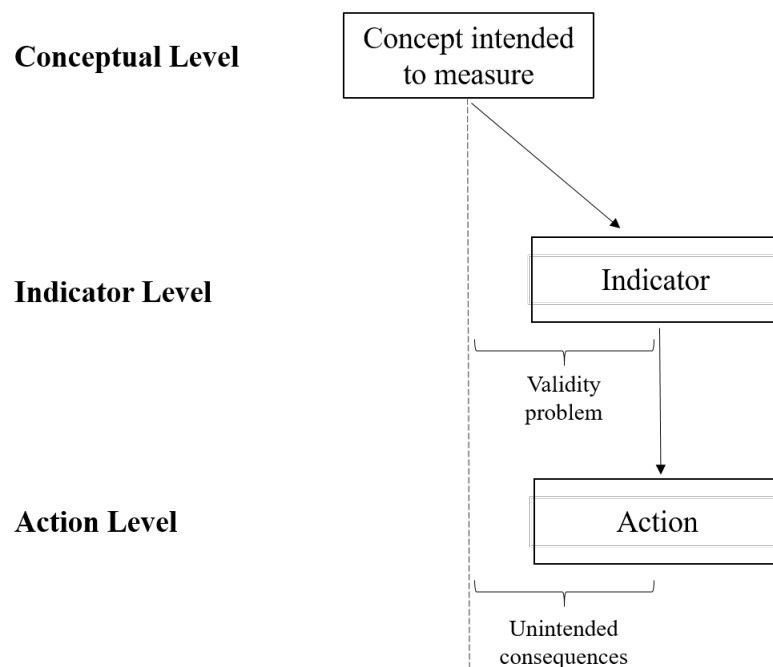
Figure 2. Dahler-Larsen's (2014) reasoning behind unintended consequences.

In reality, there are often more than one intention behind the measurement system, and these are not always clarified (Dahler-Larsen, 2014). When the intentions of an indicator are unclear, there is always a risk of employees striving to hit the target but failing to accomplish what was intended. Consequently, management may accuse employees of misusing the indicators although they strive to do their best based on their misinterpretation. If the objectives with a metric set differ among management, this further complicates the situation for employees striving to hit the targets. Even in situations where the intentions behind the indicators are clear to everyone, it may get problematic when indicators change over time.

2.1.4 Development of Metrics

For simplicity many organizations seek to find a one-size-fits-all tool for measuring, which tends to cause more problems than it resolves (Klubeck, 2011). When deciding upon metrics,

each unit is therefore recommended to embrace its uniqueness and form the metrics around its specific root question. Kerzner (2017) states that the correct set of metrics and key performance indicators should be agreed upon by the project manager, clients, and stakeholders. Klubeck (2011) means that all people that could be considered owners of a process, service or product should take part in the design, creation, and publication of those metrics. Owners could be defined as the people carrying out and improving the actual work. Klubeck suggests that it is harmful to have upper management review metrics corresponding to processes, services or products that are owned by another party, if these are not made aware of it. Groen et al. (2016) have investigated the impact of employee participation in the development of performance metrics. The results indicate that employee involvement leads to metrics of better quality and that managers employ these metrics in a greater extent for evaluating and rewarding employees. Furthermore, it could be found that employee performance was enhanced when these metrics were applied for evaluation purposes.

Polancic and Cegnar (2000) describe one way of defining a metric, including the following three steps: (1) Identification of the entity to be measured, (2) Identification of attributes of the entity to be measured, and (3) Metric definition. There are several other existing approaches, such as Goal Question Metric and Balanced Score Card, that help organizations in planning well-established measurement programs (Gencel et al., 2013). However, few address the issue of managing and sustaining these over time. There is value in having measurement programs adapt to dynamic environments, due to changing circumstances. This may include changes in size of an organization, the number of stakeholders as well as the organizational goals and priorities (Gencel et al., 2013). Some suggested procedures for metric development are presented in more detail below.

2.1.4.1 Klubeck's Framework for Designing Metrics

Martin Klubeck describes a framework for developing metrics in his book Planning and Designing Effective Metrics (2015). This framework proposes a detailed set of process steps and tools, which together could be used for an organization to establish a new set of valuable metrics from scratch. Additionally, Klubeck (2015) emphasizes the need to start with goals. If the organization does not have clear and established goals, it is valuable to start by developing such before entering the process steps in the framework. Further, Klubeck (2017) describes, the importance of the organization to know itself and the underlying reasons for its existence before establishing metrics. Hence, long term objectives, the organizations' mission and vision for the future should be identified (Klubeck, 2015). This in order to put lower level goals into the context of the organization's higher level objectives, and to clarify the reasoning behind each lower level goal. With an established set of goals providing a basis for the development of metrics, the creation of metrics is substantially eased. The framework for development of metrics is presented below.

Step 1: Develop root question

To start the process of designing a metric, a root question shall be formulated (Klubeck, 2015). This root question shall reflect what the real and underlying needs are, what the organisation wants, what needs to be improved, achieved or resolved. Klubeck suggests the use of the *Five Why Tool* in order to identify these underlying needs. The *Five Why Tool* is used by simply

asking why five times, so that the underlying reasons for the provided answers are revealed and elaborated upon until the abstraction level is as high as possible to formulate. The root question shall be clearly formulated and exact.

When the root question is identified, it shall also be tested (Klubeck 2015). Klubeck presents five test questions to use for evaluating if the identified root question really addresses the underlying need, all test questions are listed in Table 1. Further, he emphasizes that not all root questions pass all the five tests, but if the root question requires metrics it shall pass all. If the root question proves not to pass all tests, the question could either be reformulated or the answer to it might not lie in developing metrics.

Table 1. Five questions to test a root question, by Klubeck (2015). All questions quoted Klubeck (2015, p 31-32).

	Question	How to interpret answer
Test 1	"Is the "root" question actually asking for information, measures, or data?"	If yes, then the question might not be a good root question. A root question shall address the underlying need for information, measures or data, but not directly express a request for data.
Test 2	"Is the answer to the question going to be simple?"	If yes, the question might not be a good root question. A good root question shall not be possible to answer with yes or no.
Test 3	"How will the answer be used?"	If there are no predefined expectations on how to use the answers, then the question might not be a good root question.
Test 4	"Who will the answer be shared with? Who will see the metric?"	If only upper management, then the question might not be a good root question. More people than upper management shall benefit from the answer to the root question.
Test 5	"Can you draw a picture using it?"	If no, then the root question might not be a good root question.

Step 2: Design an abstract view

When the root question is identified, it is important to clarify the meaning of it in an abstract way (Klubeck, 2015). This could effectively be done by drawing a picture. All terms in the root question shall first be defined to ensure clarity of its meaning, this decreases the risk of developing metrics that measure the wrong things, Klubeck argues. After defining all terms to create a common understanding, a picture of the answer to the root question shall be drawn to visualize the concept. The drawing of a picture helps thinking abstractly and creatively about the answer to the root question, avoiding practical issues like possibilities for data collection to affect the results, as well as avoiding to directly think about data as the answer. Klubeck states

that this technique helps capturing the underlying needs in an effective way, since preconceptions of the answer or potential metrics are not considered to a large extent.

The picture shall be improved and modified until the answer is fully represented in the drawing, and it should preferably be drawn together by a group of people to increase creativity and generate the best ideas (Klubeck, 2015). When the picture is complete, the task of identifying measures, data and information for the root question is facilitated and the possibility of defining the right elements for the metrics is increased.

Step 3: Identify information, measures and data

When the abstract view of the answer to the root question is clear, the components of the answer is to be addressed (Klubeck, 2015). These components will contain information, measures and data that together form the design of the metric, see Figure 3 for an illustration of the components of a metric and their relationship. By breaking the components down into information needed, then measures needed and finally data needed for the metric to answer the root question, a complex concept can be systematically simplified. In doing this, more aspects of information needed will possibly arise, adding to the answer of the research question. Adjustments could be performed frequently to make sure that all relevant information, measures or data to answer the root question is included in the metric design.
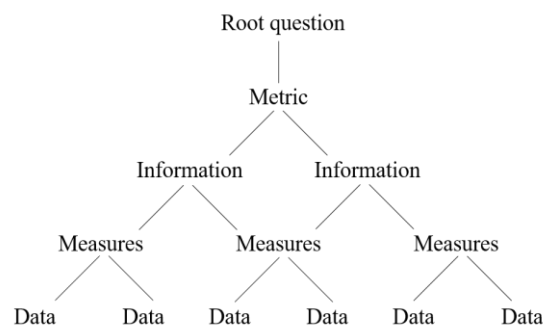
Figure 3. The components of a metric (Klubeck, 2015).

Step 4: Data collection

After identifying the needed information, measures and data to the metric design, the data is to be collected (Klubeck, 2015). Klubeck does not describe how to collect the data in practice, but provides some guidelines for the data collection.

Firstly, Klubeck (2015) argues to use automated data in as large extent as possible. This to minimize human interaction with the data used and thereby increase the confidence in accuracy. But he also describes a risk of using automated data, stating that managers often want to use already available automated data due to convenience, with the risk of it having no relation to the root question. Further, the data collection shall be employed with help from software and/or hardware to retain accuracy, but not providing too much data to analyze. Surveys are useful to gather information when needing opinions of people, Klubeck describes. Further he emphasizes to assess the criticality of accuracy when using people for collecting data.

Step 5: Metric documentation

When the metric is designed and the data is collected, it is important to document what to measure and how, as well as the information used in the metric and involved processes (Klubeck, 2015). Further, how the metric is to be used and not used is important to document, as well as how to analyze the metric, its purpose and a list of the people who will use it. This documentation ensures that the process is repeatable and sets the direction for the use of the metric.

2.1.4.2 The Goal Question Metric Approach

Basili et al. (2007) explain the GQM approach as a process to develop measurement goals of a specific software product or process, derive questions from those goals, and identify the measures required to answer those questions. Thereafter the product or process is tracked to determine conformance to the goals (2007). Eusgeld et al. (2008) mean that the GQM approach, although originally developed for software products and processes, has generic underlying concepts and is applicable in other measurement settings.

Eusgeld et al. (2008) describe the value of first establishing goals of measuring to identify the correct metrics. The authors mean that without a common understanding of the context and goal of measuring, the process of selecting and interpreting metrics becomes unclear. An advantage of the GQM approach is therefore that links between metrics and goals are established and reflected in the framework. Moreover, stating goals prior to selection of metrics means that only the data required to achieving those goals will be collected, which points to reduced effort. The interpretation also becomes less burdensome due to the explicit link between measured data and goals of measuring as laid out in the framework (Eusgeld et al., 2008).

Latham and Locke (2006) describe that having a set of goals leads employees to increase their effort and find strategies to achieve those. Goals are used for monitoring, measuring and adjusting the behavior and provides an indication of accomplishment. Latham and Seijts (2016) states that employee participation in goal setting is a powerful way of increasing job performance. Ford (2017) agrees that employee participation is important when defining goals. Involvement leads to lower risk of employees challenging the goals, due to a sense of ownership and an understanding of the reasoning behind those. Weihrich (1982) presents a step-by-step procedure for how to develop metrics derived from organizational goals. The initial step is to formulate a purpose statement for the job, describing why it exists. The following steps include identifying key tasks and areas and prioritizing those on importance. The importance rating can be conducted using A-B-C ranking or percentage weights. Before setting goals for each key result area, it is important to consider forecasted changes in internal and external environment. When goals are defined, the process ends. However, it can be iterated to set new goals at a later point in time (Weihrich, 1982).

Eusgeld et al. (2008) suggests that the method for applying the GQM approach includes four phases. The initial phase is a *planning phase*, in which the desired improvement area (such as performance or reliability) is identified and the product or process of interest is selected and characterized. During the *definition phase*, measurement goals are determined, and questions

are stated based on those goals. Afterwards, metrics are created, each belonging to a specific question, and checked for consistency and completeness. The outcome of this phase include a GQM plan, a measurement plan, and an analysis plan. In the *data collection phase*, the actual measurements are performed and a measurement support system is put into place. The collected data is then processed in the *interpretation phase*. The measures are used to answer the questions and determine if goals have been met (Eusgeld et al., 2008).

Gencel et al. (2013) has created a Decision Support Framework for Metrics Selection by extending the traditional GQM process. The new process builds on traditional GQM by including iterative cycles for identifying and deciding on metrics, incorporating mechanisms for establishing traceability among GQM elements, prioritization of goals and transfer of those ratings to metrics, as well as deciding on an optimum set of metrics. Creating traceability among GQM elements is essential to address the issue with changing environments, including changing goals or prioritization of stakeholders. The extended process is made up of four main phases, which are listed in the following (Gencel et al., 2013).

Step 1: Goal definition

This step includes identifying the organizational goals and dependencies among these as well as determining the importance rating of goals (Gencel et al., 2013). Vertical dependencies refer to the relationship between long-term and short-term goals, meaning that a strategic goal should be traceable to an operational goal. Horizontal dependencies, in turn, indicate that the ability to fulfill one goal is affected by the fulfillment of another goal at the same level. Upon identification of goals and their dependencies, the importance values of goals are rated and later transferred to the metrics. The rating of goals is a primary step to accomplish optimization of metrics.

Step 2: Questions definition

During this phase, the questions to be answered to fulfill the goals are identified. To avoid different analysts coming up with different questions, a defined and repeatable process is used. The identified questions can be broken down further into more detailed sub-questions. Gencel et al. (2013) give an example of a goal and corresponding main question and sub-questions.

Goal: "…We want to reduce the number of customer reported defects by x %..."

Question: "…How does the inflow of defects change over time?"

Sub-questions: "…How many defects are reported per week? and What is the distribution of defects with respect to fault criticality in weekly time intervals?"

Gencel et al., 2013, p. 3095

Step 3: Classifying metrics to attributes

The Attributes/Metrics Repository contains a set of attributes and associated metrics defined for various software entities (Gencel et al., 2013). The repository is used to define and classify metrics according to attributes in well-known standards, such as the ISO standards. The

questions defined in the previous phase are mapped to their relevant attributes in the repository and the traceability between goals, questions and attributes are then established.

In the repository, each attribute corresponds to a number of alternative candidate metrics. All metrics that can be considered to measure the attribute of interest are considered candidate and are used as inputs to the decision making.

Step 4: Decision making

The metrics set that provides the highest level of information, taking the cost for each metric and the importance value of a metric into account, is chosen (Gencel et al., 2013). To decide upon the level of information, the following six steps are performed: 1) Transfer the importance values of goals to metrics, 2) Calculate the cost of each candidate metric, 3) Find an optimum set of metrics, 4) Check whether the metrics set fulfills the goals, 5) Decide on the metrics, 6) Store links of GQM elements in the tree as well as the cost factors.

2.1.4.3 Extended Goal Question Metric Approach

GQM[+]Strategies builds on traditional GQM by extending the measurement program to ensure alignment between business goals and strategies, software-specific goals, and measurement goals (Basili et al., 2007). GQM[+]Strategies puts emphasis on explicitly stating the business goals, strategies, and lower level goals. The method aims to establish links between each goal and the corresponding strategy. In addition, there are relevant context factors and assumptions attached to the strategies and goals at every level. The context factors are described as the environmental variables that are specific for the company and that affect the models and data that can be used. Assumptions, in turn, are unknown variables that can influence interpretation of data. The GQM[+]Strategies comprises the following set of tasks.

Step 1: Business goals

The business goals are defined by making use of the context factors and assumptions (Basili et al., 2007). To formalize the business goal, a goal template is filled out. The template includes the activity to be performed in order to fulfill the goal (e.g. reducing, achieving), the focus of the business goal (e.g. cost, customer satisfaction), the object to consider (e.g. people, project), quantification of the goal (e.g. 10% more than last year), and the timeframe in which the goal is to be fulfilled. Moreover, the template comprises the scope of the goal (e.g. whole organization, business unit), constraints that can influence the fulfilling of the goal, and relations with other goals (e.g. tradeoffs, ordering).

Step 2: Strategies for business goals

The most promising strategy for achieving the business goal is determined out of a set of potential strategies (Basili et al., 2007). The selection is based on feasibility, cost, and benefit as well as takes the context factors and assumptions into consideration.

Step 3: Measurement plan for goals and strategies

To evaluate the fulfillment of business goal, a measurement plan is developed. The measurement goals are determined using the template (Basili et al., 2007). Thereafter, the questions, metrics and criteria for evaluating the achievement of those goals are determined. Furthermore, interpretations guidelines for the collected data are defined.

Step 4: Lower-level goals

Lower-level goals are determined to break down the upper-level strategy decisions (Basili et al., 2007). The most promising goal, taking feasibility, cost and benefit into consideration, is chosen and defined using a template.

Step 5: Strategies for lower-level goals

The most promising strategy for achieving the lower-level goals is identified (Basili et al., 2007)

Step 6: Measurement plan for lower-level goals and strategies

A measurement plan of the lower-level goals is identified together with measurement goals, questions, metrics and an interpretation model.

The process can be iterated to break down the goals and strategies further (Basili et al., 2007). However, the sequence for developing a GQM$^+$Strategies model is not set in stone. It is possible to start from somewhere in the middle and have steps be done in parallel, bottom-up, or top-down.

2.1.5 Features of a Metric Set

Muller et. al (2005) state that single metrics in isolation cannot express the full truth about the innovation capability. Too few metrics may result in too little information provided and inaccurate decision making (Kerzner, 2017). However, too many metrics is not recommended as it takes time from other work and provides too much information to stakeholders as well as information of limited value. Consequently, there is value in determining the correct number of metrics for a particular project (Kerzner, 2017). Muller et. al further states that the optimal selection of metrics as well as the optimal value of any metric will vary between companies (Muller et al., 2005). In addition, the quality of a metric set should be considered. Mendonca and Basili (2000) define a good measurement framework as one that fulfills the following four criteria: *sound*, *complete*, *lean,* and *consistent*. A measurement system is considered to be sound when the metrics and measurement models are valid in the environment they correspond to. A complete system covers all measurements that are required for users to achieve their goals. Leanness of the measurement system refers to the ability to measure what is needed and nothing besides that. Finally, consistency means the metrics are consistent to user goals (Mendonca & Basili, 2000). As for what to include in a metric set, the following sections present features considered relevant in existing research.

Chaneski (2012) suggests organizations to study five key elements of business, including *People Skills*, *Quality*, *Customer service*, *Cash Management* and *Productivity*, and derive

metrics from those. People skills can be broken down into five employee attributes, including reliability, open-mindedness, initiative, potential for promotion, and support. The focus on quality should not merely be on the end results but in-process efforts as well, taking the time it takes to check, adjust, repair and replace things into account. The element of customer service concerns the delivery timeliness, communication with customers, problem resolution, and ease of doing business. Cash management encompasses many parts of the business and therefore has several cycles to be kept under control, which include sales cycle, engineering cycle, production cycle, inventory cycle, and shipping cycle. The last element of business suggested by Chaneski is productivity, which is a measure of output over input.

Muller et al. (2005) present an innovation framework, including four elements of innovation to consider when selecting metrics. The framework comprises a *Resource View*, *Capability View*, and *Leadership View*. Metrics for the resource and capability view could be split into inputs and outputs. Inputs for the resource and capability view refer to the resources allocated to innovation and preconditions for innovation respectively. The outputs corresponding to the resource view are measures on return on investment from innovation. In turn, success at providing renewal is considered the outputs of the capability view. The leadership view reflects the degree to which the leadership within an organization supports innovation, including leaders' involvement in innovation activities, establishment of processes to encourage innovation, and spreading of goals related to innovation. In addition to these views, the framework is extended with *Processes* as a fourth cornerstone (Muller et al., 2005). Muller et al. further state that the following principles should be considered within an organization.

1. Create a comprehensive metric set, which includes at least one metric for the listed inputs and outputs as well as for the leadership view and processes.
2. If metrics already exist in the company, assess whether those would be applicable for the current needs.
3. Complex metrics are to be avoided to ensure that they are used often and at all levels.
4. Remember that not every parameter can be tracked.
5. Add customer-driven metrics to complement the internally focused metrics.
6. The metrics should correspond to existing methodologies, such as Balanced Scorecard, if used.

Klubeck (2015) defines the Answer Key as a tool for helping organizations ensure that the right answer to the root question is identified. Furthermore, it provides an indication of other areas that may be of interest to measure. The Answer Key breaks down Organizational Information Needs into several tiers, and for each step the root question becomes more specific and tactical. The second tier is split into Return versus Investment and State of the Union. State of the Union deals with how the organization manages its resources. The third tier can, in turn, be broken down into Customer View (effectiveness), Business View (efficiency), Worker View and Management View. The Answer Key, including a fourth tier, is visualized in Figure 4 below.
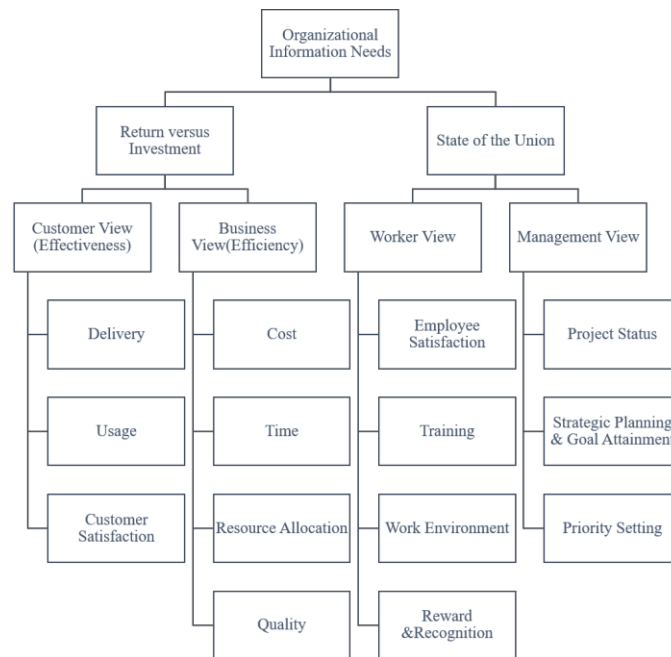
Figure 4. Visualization of the Answer Key presented by Klubeck (2015).

Dewangan and Godse (2014) have identified the shortcomings in previously proposed innovation performance measurement schemes and built upon existing schemes by broadening the measurement scope. The following set of guiding principles are suggested by the authors to design an effective innovation performance measurement scheme.

1. The scheme should be well balanced in terms of financial and non-financial measures, meaning that it should provide a multi-dimensional view of performance.
2. The scheme should include measures of performance of various stages in the innovation life-cycle.
3. The scheme should effectively address organizational goals, including those of stakeholders, customers, employees, suppliers, regulators and society.
4. The scheme should have a cause and effect relationship between performance measures, which means that they should be logically connected to each other.
5. The scheme should be easy to implement and use.

Klubeck (2015) expresses the value in using both qualitative and quantitative data as indicators and preferably collecting more than one data point of each type. Qualitative data is subjective in nature and often expresses an opinion, such as customer satisfaction ratings, while quantitative data is objective in nature and often refers to numbers.

2.2 The Agile Approach

To determine whether and how metrics can be applied in the agile approach, research regarding the cornerstones of agile, the most common agile method and characteristics of agile team work is presented. The agile way of working can be somewhat hard to grasp. Agile is an umbrella term for how to manage projects in a new way, comprised by methods, techniques and practices (Hoogendoorn, 2014). Explained shortly, some characteristics of agile projects are: short iterations, team collaboration, small work units, responsiveness to change, ongoing planning and measuring, early and continuous testing, early and frequent deliveries, simple

communication and co-location of team members. Cohen et al. (2004) describe that being agile is having the ability to deliver fast, as well as change fast and often.

Recently, the trend of digitalization has fundamentally influenced markets due to enhancement of complexity and speed (Lipowsky & Schmidt, 2016). As devices and systems get more connected, complexity is increasing. Simultaneously, the importance of a short time to market is increasing for companies to keep up with the quick changes in customer demand and stay competitive. These changes have affected both technical and traditional industries, leading to an extended use of agile methods to manage projects effectively.

The origin of agile took place in 2001, when representatives using various software development methods met up to discuss the need for a new way of creating software (Agile Manifesto, 2001). There was a common need for an alternative to the heavy and documentation driven development methods used at the time. The foundation for agile development, including values and principles to guide the development, was then invented and documented in the Agile Manifesto. The four agile values are presented below.

"Individuals and interactions over processes and tools

Working software over comprehensive documentation

Customer collaboration over contract negotiation

Responding to change rather than follow a plan"

Agile Manifesto, 2001

There are several agile methods such as Scrum, Extreme Programming, Crystal Methods and Feature Driven Development (Cohen et al., 2004). These methods all share the same agile values and principles but include different practices or techniques. Lipowsky and Schmidt (2016) state that agile methods build on self-organizing and dynamic teams. Further, Lankhorst et al. (2012) describe that commonalities between agile methods include: cross-functional and empowered teams, stakeholder feedback, iterative work in short cycles with incremental deliveries to stakeholders, development in increments to ensure flexibility, continuous testing and integration, as well as continuous improvements in a closed-loop learning cycle. Agility is also considered to be something bigger than a set of practices, Cohen et al. (2004) describe true agility as a mindset. Cockburn and Highsmith (2001) take this perspective one step further, explaining agile as a world view. They argue that recognizing people as the primary project success drivers is what makes agile methods differ from old approaches. This viewpoint, in combination with focus on maneuverability and effectiveness, generate values that define the agile world view.

Rigby et al. (2016) state that focusing on the team rather than individuals is one way to destroy barriers to agile behaviors. Studies have shown that the collective intelligence of a team has greater impact on team performance than individual intelligence. Agile teams take use of several facilitators to improve their collective intelligence, such as clarifying roles, teaching conflict resolution techniques, and ensuring equal team member contribution. Rewarding team results higher than individual efforts as well as shifting the focus of metrics from output and

utilization rates to business outcomes and team happiness have also shown advantageous. Another technique to overcome barriers to agile behaviors is leading with questions, not orders. Rigby et al. (2016) describe that leaders in agile organizations learn to guide with questions, leaving space for the team to recommend solutions and work methods.

2.2.1 Scrum

Out of existing Agile methods, one of the most commonly used is Scrum (Srivastava & Jain, 2017); (Cohen el al, 2004). Layton and Morrow (2018) describe Scrum as a simple framework that helps defining roles and organize work, for an effective work prioritization and efficient way of completing tasks. The scrum process is transparent and iterative, containing elements of inspection and adaption. It is common to believe that scrum is designed to fit software or IT projects, but Layton and Morrow (2018) state that any project, no matter size or characteristics, can use the scrum framework effectively.

Scrum includes three main roles (Layton & Morrow, 2018). The first is the development team, a group of people who collaboratively work to create the product in question. The team itself plan its own work, decides how to do things and how much work tasks to take on during a predefined time period. The development team is the core of the bigger scrum team, which further includes two roles: the product owner and the scrum master. These roles work together with the team of developers to minimize distractions that steal focus from developing a high quality product, and establish alignment between development and business priorities. The product owner prioritizes the work to be done (Layton & Morrow, 2018), provides customer feedback to the team (Srivastava & Jain, 2017) and accounts for business alignment of the development. The scrum master supports the team members and help them work efficiently by focusing on easing the development process. The development team, the scrum master and the product owner have equal status (Layton & Morrow, 2018). Beside the main roles of scrum, other stakeholders also affect the project. These stakeholders can involve internal parties like members of marketing or legal departments, but also external parties like customers.

The product owner prioritizes work tasks by adding assignments with a specified priority to a *product backlog*, which can be described as to a to-do-list for the development teams (Layton & Morrow, 2018). This ensures that the teams work with the tasks of highest priority. The work is divided into fixed time periods called *sprints*. Within each sprint work tasks are developed, tested and then approved or declined. Each sprint starts with a *sprint planning* activity, where the team decides on how many work tasks from the product backlog to complete during the upcoming sprint and a mutual goal for the period is established. The selected tasks are then moved from the product backlog to the team's *sprint backlog* (Cohen et al., 2004). During the sprint, *daily scrum* meetings are held where the development team and the scrum master discuss priorities of the day (Layton & Morrow, 2018), how to coordinate the work, identified problems (Cohen et al., 2004) and project status. In the end of the sprint, a *sprint review* and a *sprint retrospective* take place. The purpose of the sprint review is for the development team to demonstrate working product increments developed during the sprint to the product owner and stakeholders. Hence, stakeholder feedback is continuously flowing into the development process, generating new work tasks for the product owner to prioritize into the product backlog when improvements are needed. The sprint retrospective puts focus on improving the team environment and development processes to increase efficiency. The scrum cycle iterates,

repeating the activities described above, helping organizations to reflect on customer requirements, focus on top priority work tasks, and deliver high quality to their customers in a fast way (Layton & Morrow, 2018).

2.2.2 Agile teams

Lankhorst et al. (2012) describe that one of the commonalities in agile methods is cross-functional and empowered teams highly focused on team communication. Hoda and Murugesan (2016), in turn, state that self-organization is a primary element of agile software development. These statements can be derived from the Agile Manifesto (2001) that, among the twelve principles, phrases the value of having self-organized teams as well as face-to-face conversation within the development team.

Self-organized teams can be considered to have high level of autonomy and are responsible for selecting and accomplishing their own tasks (Hoda & Murugesan, 2016). Members in self-organizing teams commonly take on implicit and temporary tasks to fulfil various needs of the team (Hoda & Murugesan, 2016), and should to a high extent be able to assist in and take over the tasks of other members (Hoda et al., 2018). Furthermore, team members are known to balance their work between freedom and responsibility, cross-functionality and specialization as well as promote continuous learning in iterative cycles (Hoda & Murugesan, 2016). Self-organization implies having a variety of skills within the team to effectively address the varying external environment (Hoda et al., 2018). Harrington-Mackin (1999) state that self-managed teams take on several activities. These include identifying their own goals and team direction, setting performance standards for the team as well as coaching and providing feedback on performance of members. In addition, they collect performance data and review results, meet requests from inside and outside the team, and identify, analyze and solve task and relationship problems (Harrington-Mackin, 1999). Guzzo and Dickson (1996) describe self-managed groups, or autonomous groups, to be given significant authority and responsibility for various aspects of their work, including planning, scheduling, dividing workload and decision-making. Autonomous teams imply participation and involvement leading to greater commitment and motivation among employees as well as higher creativity, productivity and service quality (Brede Moe et al., 2008).

Many researchers have contributed their definition of self-organization. However, Hoda et al. (2018) state that perhaps the most accurate one was first mentioned by Takeuchi and Nonaka. Takeuchi and Nonaka (1986) describe a group to be self-organized when it fulfils three conditions: autonomy, self-transcendence, and cross-fertilization. In an autonomous team, top management provides guidance as well as financial and moral support, but rarely intervenes in the day-to-day work of the team. The team is instead provided freedom to organize their own work and set their own direction. Self-transcendence refers to the team's ability to establish self-set goals and continuously evaluating them throughout the development process. Cross-fertilization refers to having a variety of specializations and behaviours within the team and over time gaining an understanding of each other's view by interaction.

Hoda et al. (2018) have identified top barriers to autonomous teams. Among these is the issue of not having established clear and common goals within the team. Lacking a common understanding of the direction and objective may lead to time spent on understanding what to

do rather than coordinated efforts to achieving those objectives. Furthermore, Hoda et al. (2018) stress the importance of having trust within the team and between team members and managers as well as low level of dependencies to other parties. Other barriers to autonomous teams may be limited coaching and organizational support as well as not engaging enough in the norms that guide the team forward.

3. Analytical Framework

The analytical framework builds on existing theory by discussing the research on metrics in relation to the agile approach. This chapter elaborates on three key issues: applicability of metrics in agile, development of metrics in agile, and features of a metric set in agile. The analytical framework provides a basis for the empirical study.

Applicability of Metrics in Agile

Continuous improvements (Lankorst et al., 2012); (Hoda & Murugesan, 2016), iterative learning cycles and continuous measurements (Hoogendoorn, 2014) are included in the common characteristics of the agile way of working. This shows that agile advocates learning and development, as well as the use of measures. Klubeck (2011) states that metrics yield feedback that can be useful to improvement efforts and provide feedback of employee performance. Hence, metrics show to have valuable applications in the agile approach. But literature also mentions aspects of metrics that can be seen as negative and sometimes contradictory to the agile approach. Bourne et al. (2017) consider performance measurements to bring controlling and monitoring effects that prevent learning in dynamic environments, implying that metrics might not be suitable in agile settings. Based on these statements, metrics can provide valuable feedback if used to support team development rather than control individual efforts. The risk of controlling individual performance with metrics is that employees aim to deliver desirable numbers to management instead of performing at their best. Thus, employees might lose incentives to perform and improve in all relevant areas, instead focusing merely on what is measured. In an agile setting, however, top management shall not intervene in the daily work of agile teams, their role is to support and provide guidance (Takeuchi & Nonaka, 1986). Rigby et al. (2016) state to put focus on the team to create an agile behavior, conformingly Cockburn and Highsmith (2001) insist on seeing people as the main success drivers in agile projects. In accordance, the metrics should be developed for and used by the people of the team, not management, putting the team and their needs in focus. Hence, these controlling and monitoring effects are hindered when metrics are applied to fit the agile setting. In agile teams, the metrics should aim to help the team evolve rather than controlling and acknowledging the outcome of individual efforts. Thereby, the issue of selfishness and ineffectiveness discussed by Deming (2000) and cooperation barriers mentioned by Castellano and Roehm (2001) might also be eluded. To conclude, existing theory indicates that using metrics can bring effects both supportive and contradictive to the agile way of working. However, when connecting literature regarding the two topics it is suggested that the application of metrics, rather than the metrics themselves, determines the effects. By applying the metrics to support the team and their improvement, the negative effects of using metrics and the contradiction with agile can be avoided.

The self-organizing teams shall be responsible for selecting and accomplishing their work tasks (Hoda & Murugesan, 2016); (Guzzo & Dickson, 1996). They manage many aspects of their work (Guzzo & Dickson, 1996) and take on multiple activities (Harrington-Mackin, 1999). These activities include decision making (Guzzo & Dickson, 1996), identifying team goals and direction (Harrington-Mackin, 1999); (Takeuchi & Nonaka, 1986), collecting performance data and providing feedback (Harrington-Mackin, 1999), evaluating goal attainment (Takeuchi

& Nonaka, 1986) as well as reviewing results (1986). Metrics can be valuable in several of the activities mentioned above. Both Hubbard (2014) and Muller et al. (2005) argue that measurements can help provide information useful for decision making. Metrics support project management and generate important information for the teams (Kerzner, 2013). Further, metrics create awareness of progress and thereby increase employee motivation (Kerzner, 2013), as well as help improvement efforts (Klubeck, 2011). To conclude, having teams use metrics to help manage their own development and work is both useful and compatible with the agile approach.

Development of Metrics in Agile

Groen et al. (2016) state that employee participation in the development of metrics leads to metrics of higher quality as well as more commonly employed metrics. In addition, applying these metrics for evaluation purposes indicate higher performance among employees. Klubeck (2011) agrees that the people carrying out and improving the actual work should take part in the development of accompanying metrics. It is suggested to be harmful to have upper management review metrics if the owners are not made aware of it (Klubeck, 2011). These statements are in line with the agile way of working that puts emphasis on the autonomy of the teams (Lankhorst et al., 2012) and their ability to select and accomplish their own tasks (Hoda & Murugesan, 2016). However, Kerzner (2017) states that metrics should be agreed upon by the project manager, clients and stakeholders. Guzzo and Dickson (1996) state that autonomous groups should be given authority and responsibility over various aspects of their work, including the planning and decision making. Having external parties monitor and review the metrics set up by the team would therefore be considered contradictory in an agile setting. Hence, to fit the principles of an agile approach, the teams should themselves establish and revise the metrics that belong to them. This suggestion is further supported by Klubeck (2011) who states that many organizations seek to find a one-size fits-all tool for measuring, which has a tendency of causing more problems than it resolves. These issues could be avoided by building the metrics around the specific conditions of each team. The risk of providing employees with performance targets that are outside of their knowledge base (Latham & Locke, 2006) could thereby be avoided. Dahler-Larsen (2014) mentions the risk of unintended consequences due to unclear intentions behind the metrics. By delegating the metric development to the team, they have the opportunity to discuss and agree on the intentions behind their own metric set. Consequently, unintended consequences as a result of misinterpretation and varying intentions are not expected to be problematic.

The majority of reviewed authors describe the value of establishing goals as an initial step when developing metrics (Gencel et al., 2013); (Basili et al., 2007); (Klubeck, 2015); (Latham & Locke, 2006). Reviewing the literature, it appears that goals help in identifying the correct strategies (Latham & Locke, 2006) and that employee participation is beneficial when establishing those (Latham & Locke, 2006); (Ford, 2017). Deriving metrics from a set of goals eases the creation of metrics (Klubeck, 2015) which, in turn, may enhance the quality of metrics in terms of consistency (Medonca & Basili, 2000). Eusgeld et al. (2008) further means that goals help in identifying the correct set of metrics. Lacking a common understanding of the context and goal of measuring leads to unclear selection and interpretation of metrics. One way to develop goals is described by Weihrich (1982), who states that it is beneficial to initiate the

process by formulating the purpose of the job and then identify the most relevant key tasks and areas. Finally, goals are formulated within these categories.

Following the establishment of goals, the literature presents two alternative actions. Some authors argue that questions should be formulated to understand the needs behind the goals and help fulfill those (Klubeck, 2015); (Eusgeld et al., 2008); (Gencel et al., 2013). Klubeck (2015) describes that the Five Why tool can be used to help understand these underlying needs, while Gencel et al. (2013) advocates sub questions to concretize the issue. In contrast, Basili et al. (2007) proposes that strategies should be formulated for how to fulfil the goals. Based on the questions or strategies, literature indicates that the development of metrics continues with the identification of information, data or measures needed to answer the questions (Klubeck, 2015); (Eusgeld et al., 2008); (Gencel et al., 2013) or track goal fulfillment (Basili et al., 2007). Eusgeld et al. (2008) argue that goals help identify only the relevant data, which leads to reduced data collection efforts. Klubeck (2015) suggests employees to think creatively about the answer to the root question and ignore practical considerations when identifying the information needed. This will help to identify all elements needed to finally design the correct metric. When the relevant information is identified, a measurement plan and accompanying guidelines for evaluation and interpretation are to be developed (Eusgeld et al., 2008); (Basili et al., 2007); (Klubeck, 2015). To conclude, three main phases for developing metrics are identified in literature: formulating goals, identifying information, and defining metrics.

Two features that characterize the agile way of working are short iterations (Hogendoorn, 2014) and the ability to change frequently (Cohen et al., 2014). Gencel et al. (2013) suggest that there is value in having measurement programs adapt to dynamic environments. However, the development of metrics, according to GQM as well as the process proposed by Klubeck, are performed linearly. This indicates that these processes are not suitable in an agile setting, and thereby call for adjustment. However, it could be problematic to change the metric set over time without updating the intentions behind the metric set to ensure correspondence (Dahler-Larsen, 2014). Along with changing circumstances and shifting organizational needs, the objectives and metrics need to be modified accordingly. This points to a need for a circular process for developing metrics and revising these over time. The development phases of GQM and Klubeck could thereby be applicable in an agile setting if adjusted to form a closed-loop process. These procedures start with defining goals, which means that the intentions with the metric set are updated and clarified in each iteration. Mendonca and Basili (2000) state that metrics should be valid in their corresponding environment. As circumstances change, so does the validity. Several authors discuss validity of metrics and the importance of ensuring high quality metrics (Eusgeld et al., 2008); (Mendonca & Basili, 2000); (Klubeck, 2011); (Polancic & Cegnar, 2000). This further supports the need for an iterative process of developing and revising metrics over time. An illustration of the main phases to develop metrics in an agile setting is presented in Figure 5.
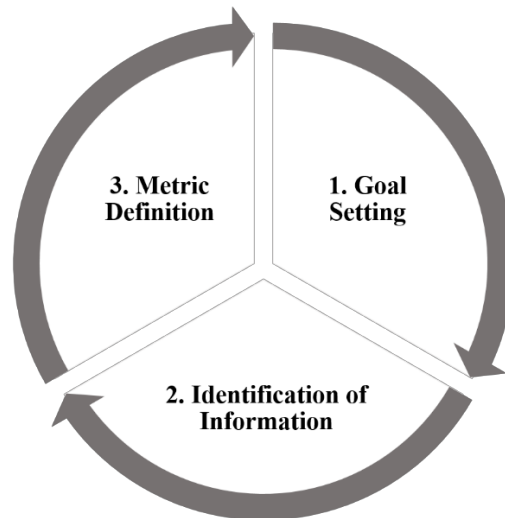
Figure 5. Overview of the main phases for developing metrics in agile

Features of a Metric Set in Agile

Several authors have addressed the value of having a set of metrics that covers various areas of business. Dewangan and Godse (2014) mean that the measurement scheme should take a multi-dimensional view and address organizational goals of various parties, while Klubeck (2015) describes the value of collecting both qualitative and quantitative points of data. Moreover, researchers have identified various features beneficial to include in a set of metrics. To illustrate the apparent commonalities between these features, a visualization is presented below in Table 2. The visualization is based on four main cornerstones chosen to capture the aspects presented by various authors: *Effectiveness*, *Efficiency*, *Worker Perspective*, and *Management Perspective*. Effectiveness concerns what to do, while efficiency focuses on the way the work is carried out. In turn, worker perspective concerns the pre-conditions required for the individual employees to carry out their work, while management perspective relates to the work carried out on a strategic level. It should be noted that these build on the elements identified by Klubeck. However, other labels have been chosen to distinguish between these general areas and the features identified by Klubeck.

Table 2. Framework showing how the features to include in a metric set presented by various researchers relate to the identified cornerstones.

	Effectiveness	Efficiency	Worker Perspective	Management Perspective
Klubeck (2015)	*Customer View/Effectiveness* (delivery, usage, customer satisfaction)	*Business View/Efficiency* (cost, time, resource allocation, quality)	*Worker View* (employee satisfaction, training, work environment, reward & recognition)	*Management View* (project status, strategic planning, goal attainment, prioritization)

Chaneski (2012)	*Quality of end results* (what comes out of the process)	*Quality of processes* (in-process efforts) *Cash Management* (sales, engineering, production, inventory, shipping) *Productivity* (output over input) *Customer Service* (delivery timeliness, communication with customers, problem resolution, ease of doing business)	*People Skills* (reliability, mindedness, initiative, potential for promotion, support)	
Muller et al. (2005)	*Outputs of Resource view* (return on investment from innovation)	*Outputs of Capability view* (success at providing renewal) *Processes*	*Inputs of Resource view* (resources allocated to innovation) *Inputs of Capability view* (preconditions for innovation)	*Leadership View* (leadership involvement in innovation activities, encouraging innovation, spreading goals related to innovation)

Table 2 indicates that the identified cornerstones capture the various aspects to be included in a comprehensive set of metrics. However, the features ought to be adjusted to match an agile approach. The element Effectiveness, that is, doing the right things, may have limited use in an agile team. Layton and Morrow (2018) state that the product owner prioritizes the work to be done, provides the team with customer feedback and is responsible for accomplishing business alignment of the development. The prioritization can be viewed in the product backlog, a to-do-list for the development teams, which ensures that the teams work with tasks of highest priority. Hence, the development teams are not involved in deciding what to do but rather how to do it. Therefore, elements concerning effectiveness are not seen as valuable in a metric set to support agile teams, and have therefore been excluded. Moreover, the need to cover strategic aspects of development when establishing metrics in agile teams can be questioned. Layton and Morrow (2018) mean that the team itself plans and organizes its own work as well as decides the amount of workload to take on in the predefined time period. Furthermore, self-managed teams are responsible for establishing their own goals and direction as well as collecting data and reviewing results (Harrington-Mackin, 1999). Consequently, the Management Perspective is adjusted to fit the agile setting, instead taking the perspective of the team and how they organize to lead themselves. The issues in the Management Perspective concern strategy and leadership involvement which are considered to be outside the scope of the team. Therefore, these are either adjusted to fit the team scope by creating value on an operative level, or excluded. In the following, this aspect is therefore categorized as Self-Leadership. The remaining features, Efficiency and Worker Perspective can be considered as valuable to cover also in an agile metric set. However, the Worker Perspective is in the

following referred to as Team Support to put emphasis on the team and their internal pre-conditions. Figure 6 below illustrates which features that lay within the team scope of responsibility as well as which features that are managed by other parties.
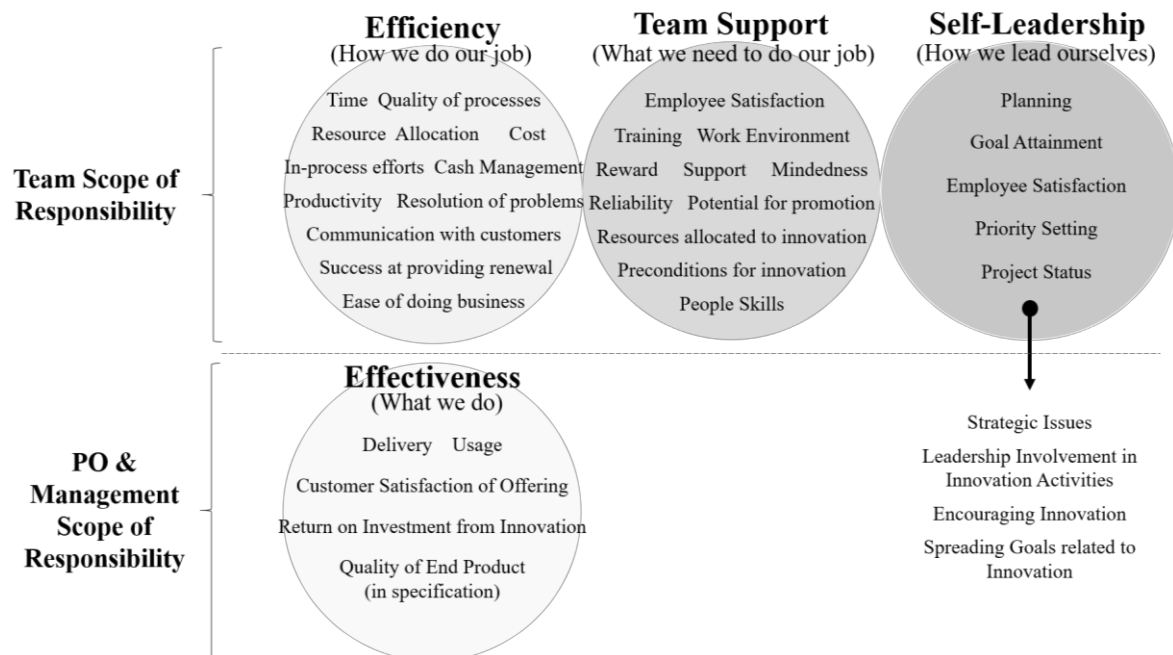

Figure 6. Features of a metric set applicable in an agile setting

It is apparent that the following categories of features should be included in a metric set in an agile setting: Efficiency, Team Support, Self-Leadership.

4. Methodology

The following chapter presents the methodology of this study, including research strategy, research design, research methods, analysis, research quality, delimitations, and ethical consideration. Furthermore, the possible implications of the chosen method on the results are discussed.

4.1 Research Strategy

A qualitative approach is focused on the generation of new theories, rather than testing of existing theories, as well as places its emphasis on social entities and their interpretations. A primary matter for qualitative researchers is being able to interpret the social context through the eyes of the people in that context. Qualitative research commonly uses observations and interviews to collect data and take the perspective of the people being studied (Bryman & Bell, 2011). This research aims to combine the subjects of metrics development and the agile way of working to suggest a process for developing metrics in agile development teams. It is essential to gain a deep understanding of the teams' specific context and preferences in order to present a suitable process. Thus, a qualitative approach has been chosen to fulfil the purpose.

Bryman and Bell (2011) state that an inductive approach is often used to draw generalizable inferences out of observations by moving from observations to theory. The study is often iterative, which refers to having cycles of theoretical and empirical investigation. In addition, Bryman and Bell (2011) state that theory often provides a basis for the qualitative investigation. Based on the discussion of Bryman and Bell, this study can be viewed as inductive as it aims to make generalizable findings from an empirical study, using several cycles of theoretical findings and empirical observations. However, it should be mentioned that there are deductive influences, especially in the early phases of the investigation. In an inductive study, theory is commonly considered the outcome of the study, rather than providing the basis for it (Bryman & Bell, 2011). In this study, a thorough literature review was conducted prior to the empirical investigation to create an outline for it.

4.2 Research Design

Bryman and Bell (2011) describe that a research design lays out a framework for how to collect and analyze data. This research is divided into two main parts, a theoretical study and an empirical study. The theoretical study was initiated first, to gain an understanding of relevant topics by reviewing and analyzing existing research before starting the empirical part, comprised by a case study. Based on the findings in the literature, the case study was initiated and further on conducted in parallel with the theoretical study, in order to ensure the possibility to iterate between further literature reviews and empirical data collection methods. This iterative research design helped to obtain relevant focus and content of workshops and interviews in the case study, and to increase the trustworthiness of the research. To clarify, the research design is illustrated in Figure 7.

The quality of a qualitative research can be assessed on its trustworthiness, which comprises the following criteria: credibility, transferability, dependability and confirmability (Bryman &

Bell, 2011). All elements of this research design aim to ensure a high trustworthiness while answering the stated research questions.
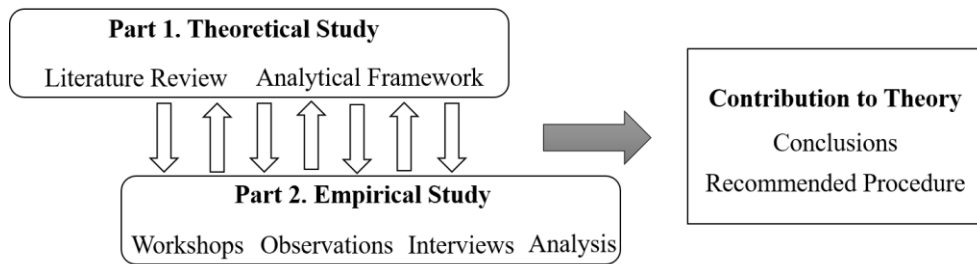
Figure 7. An illustration of the research design.

4.3 Research Methods

The following section presents the data collection methods used in this study. Firstly, a literature review was conducted to gain a deeper understanding of relevant areas and related previous research. Due to the lack of previous research regarding metrics applied in an agile approach, the literature review was focused on the agile way of working as well as metrics in general and how metrics can be designed. Secondly, an analysis of literature was conducted to suggest how metrics can be applicable in the agile setting and generate proposals for the empirical study. To clarify, findings in the literature provided the basis for the empirical study.

Thereafter, an empirical study was conducted with two agile development teams at Volvo Cars. The empirical study was carried out using three main data collection methods: workshops, observations and interviews. During the workshops the teams were guided in establishing their own set of metrics using the processes and tools for developing metrics found in the literature. While performing the workshops, observations were carried out to evaluate the practical feasibility of the processes and tools. Interviews were conducted to evaluate processes and tools from a participant perspective, validate the outcome, and further identify the most suitable procedure. Figure 8 visualizes an overview of the empirical study and the related research methods.

Figure 8. Overview of the empirical study and the related research methods.

4.3.1 Literature Review

A narrative review has been chosen to guide the literature study. Bryman and Bell (2011) state that narrative reviews are less directed around specific topics and more implicit in the criteria of inclusion and exclusion than systematic reviews. Furthermore, they describe that narrative

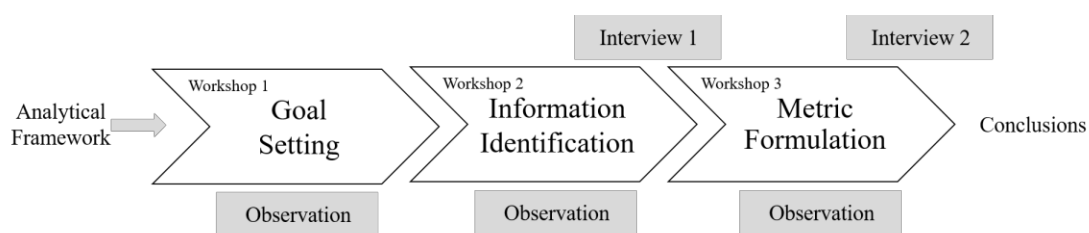reviews may be more appropriate for qualitative studies, since such researchers need greater flexibility to change direction of the study during its course (Bryman & Bell, 2011). The case study can be viewed as the central part of this investigation and supported the generation of new theories. The literature review, in turn, was used to guide the case study and was frequently returned to as new findings were made.

To find relevant literature, electronic databases, such as Google Scholar and Summit, were used. The primary sources of literature were scientific articles, but because of the limited research on the topics of interest, books were used as complementary sources. There is a gap in research regarding metrics applied in an agile approach. To discover how the two areas could be combined, they had to be researched separately. Thus, the literature search was divided into two main areas to ease the review: agile setting and metrics. Findings on the two topics were then analyzed to identify how they relate to each other. Keywords used to find articles on the agile setting included: scrum, self-organization, agile teams and agile development. Phrases used for metrics included: metrics, measurements, measurement design, performance metrics and development of metrics. Upon research on the topic of designing metrics, new areas of interest emerged, such as GQM and GQM$^+$Strategies. The articles were selected based primarily on their relevance to the research questions. If applicable, the original sources were viewed and referred to. The age of the source was taken into consideration as a criterion for inclusion in the report. Sources would preferably be written in the recent years, but in areas with little development and limited research, older sources were accepted.

Initially, the literature was quickly read through and key phrases were highlighted. Key phrases, including references, were then clustered into a logical flow. Having established an outline of the flow, it was easier to make a more thorough literature review. The study was however iterative, thus new areas of literature were reviewed upon empirical observations.

4.3.2 Workshops

Workshops constitute the main part of the empirical study, and were conducted to evaluate the findings in literature. The suggestions regarding the development of metrics, presented in the analytical framework, have been combined to form two alternative procedures, referred to as Procedure 1 and Procedure 2. These are divided into three main phases: goal setting, identification of information, and metric definition. Each procedure was performed in workshops with one group each, Team 1 and Team 2 respectively. Thus, each team carried out all main steps during workshops and eventually acquired their own set of metrics. All workshops were initiated with a short introductory presentation, including the purpose of the workshops, an overview of the upcoming tasks, as well as explanatory examples and instructions. When needed, further guidance was provided to support the teams. In cases where tasks clearly were misunderstood, the results were excluded from the findings in chapter 5 as well as from the hand-outs in upcoming workshops. Brief explanations of each workshop are presented below, but full workshop instructions and distribution materials are found in Appendices 1-4. All templates have been created by the researchers and aim to ease the process for the participants. Overviews of the two procedures are illustrated below in Figure 9. The figure comprises the structure of the workshops, and accompanying steps, belonging to each procedure. Each step is described in more detail in the following sections.

<u>Procedure 1</u>

Workshop 1: Goal Setting			**Workshop 2: Identification of Information**			**Workshop 3: Metric Definition**		
Discuss purpose of the team	Define key tasks and areas	Specify goals	Discuss underlying needs	Formulate root question	Identify information	Check goal relevance	Overview goal set	Formulate metrics

<u>Procedure 2</u>

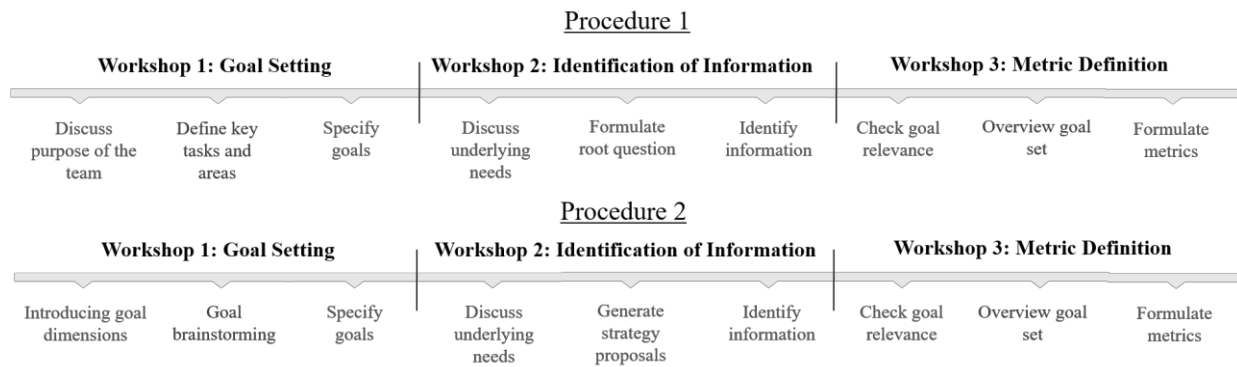| **Workshop 1: Goal Setting**			**Workshop 2: Identification of Information**			**Workshop 3: Metric Definition**		
Introducing goal dimensions	Goal brainstorming	Specify goals	Discuss underlying needs	Generate strategy proposals	Identify information	Check goal relevance	Overview goal set	Formulate metrics

Figure 9. An illustration of the two procedures evaluated in the empirical study.

The first workshop focused on defining goals for the teams. This was conducted with two separate procedures with different starting points. The workshop with Team 1 started with a discussion of the purpose of the team and their work, followed by a brainstorming session. The brainstorming was based on the Affinity Interrelationship Method but was adjusted to fit the time frame and purpose of the workshop. The brainstorming aimed to identify key tasks and key areas of the team and prioritize those on importance. Finally, goals were formulated based on the five most important key tasks and areas. This goal setting process is based on the research by Weihrich (1982). However, the researchers identified another process for goal setting that aims to ease the creation of a comprehensive goal set. This alternative was used to initiate Procedure 2. The workshop of Team 2 was initiated with an explanation of relevant dimensions to consider in goal setting. These dimensions correspond to the categories of features to include in a metric set, described in the Analytical Framework. By providing the participants with inspiration on possible features to include in their goal set, the metric set was expected to be comprehensive and generate feedback within several relevant areas. To generate ideas for team goals within the goal dimensions, a brainstorming session was conducted. The same brainstorming methodology as in Procedure 1 was used. However, Team 2 formulated goal ideas already at this stage and was directed to generate proposals in each of the relevant dimensions. Before finalizing the workshop, goals were specified based on the ideas and thereafter prioritized.

The aim of the second workshop was to give the participants an understanding of the underlying needs behind their goals, and from there derive information needed to help fulfil those goals. Hence, both workshops began with the participants discussing the underlying needs using the Five Why Tool as suggested by Klubeck (2015). This was carried out in groups of two to three, each group was assigned approximately three goals. Dividing the teams into smaller groups aimed to involve all participants and enable them to work in parallel. To test the need for note taking, Team 1 was provided with a template for taking notes, while Team 2 merely discussed freely. Having established an understanding of the reasoning behind the goals, the teams proceeded in separate ways. Team 1 continued with formulating root questions in the smaller groups, as suggested in GQM and by Klubeck. To support this, a template and accompanying test questions were used when formulating one root question per goal. The test questions originate from the theories of Klubeck, but two questions were removed from the set. The test regarding whether more than management would see the metric was eliminated since the metrics were to be owned by the team. Furthermore, the test regarding drawing a picture was not considered valuable and could possibly bring confusion for the team. Thus, it was

eliminated from the set. Upon finalizing this step, the underlying needs and the root questions were shared with the whole team to create consensus. In contrast, Team 2 continued with the generation of strategies for how to fulfil the goals, in accordance with the theory of Basili et al. (2007). This step was initially conducted individually, generating strategy ideas using a template. Henceforth, the smaller groups discussed the proposals and decided upon the best strategy to fulfil each goal. The final step for both teams was to identify data and information needed to help fulfil goals, based on the root questions or strategies. This was conducted individually by formulating suggestions on useful information or data on a template.

The purpose of the third workshop was to specify the metrics needed to help fulfil the identified goals and discuss how these can be used. In contrast to the other workshops, the procedures used in this workshop did not differ between the teams. This was due to lack of suggested procedures in research regarding metric formulation. Therefore, the teams specified metrics based on their goals and information proposals, generated in previous workshops, using the same steps. The workshops began with the teams evaluating the relevance of their goals to ensure that the participants did not elaborate further on irrelevant goals. All participants took a few minutes to read through the stated goals on the whiteboard and decided on the relevance of each. The participants individually marked all goals they found relevant by placing a dot next to it on the whiteboard. The goals found to be irrelevant after the voting were eliminated from the team goal set. After the voting, an overview of the team goals in relation to the goal dimensions were shown to the participants. To cover all relevant aspects of a goal set, the team now had the possibility to add complementary goals. The last step of the workshop was to define specific metrics. This began with a short introduction on how to define metrics and what to consider in the process. The team was divided into smaller groups of approximately three persons and the goals were evenly divided among these. For each goal, one or more metrics were formulated using a step-guide in the instruction as well as a template and the generated information proposals from previous workshops. The step-guide has been created by the researchers to provide additional support. To further help the participants in their metric formulation, they were provided with a few additional information proposals generated by the researchers. The participants were asked to constantly check that the formulated metrics were helpful in fulfilling the goal. When a relevant set of metrics was established, the team had the possibility to discuss how the metrics could be visualized and integrated into the team routine to support improvements.

4.3.3 Interviews

Interviews were conducted with four employees on two occasions throughout the research, with the purpose of evaluating the processes and tools used in the workshops. In qualitative research there are two types of interviews that could be conducted, semi-structured and unstructured interviews (Bryman & Bell, 2011). Semi-structured interviews are flexible enough to give space for follow-up questions and gain rich answers from the interviewee (Bryman & Bell, 2011), but still provide consistency among interviews so that the results could be compared subsequently and increase reliability of the data (Lochrie et al., 2015). In this study, semi-structured interviews were used.

When preparing an interview, it is important to consider some basic elements (Bryman & Bell). Firstly, the interview questions shall be ordered so that the areas or topics covered follows a

reasonable flow. The questions should be formulated so that they help answering the research questions, and the language should be adapted to be understood by the interviewee. Finally, it is important not to formulate leading questions. The preparations for the interviews in this research included considering all mentioned elements. A question guide was developed based on what data that was needed to answer the research questions, in specific, how the teams had experienced the workshops and how they evaluated the results. The language used was comprehensible to the team members and the questions were ordered to form a logical interview flow. Further, the questions were carefully formulated, in order to avoid all leading expressions. See Appendix 8 for full interview guide.

The interviews were conducted by two researchers and one interviewee at a time. One researcher was leading the interview by asking questions, follow-up questions, listening carefully and interacting with the interviewee while the other researcher took notes, observed and helped keeping track of time. The questions were formulated clearly to avoid any misinterpretations, and complementary explanations were added when needed to get the interviewee to understand fully. All interviewees approved recording prior to the start of the interview.

After the interview, it is valuable to take notes regarding the researchers' reflections (Bryman & Bell, 2011). Directly after the interviews, some impressions and thoughts about the interview were documented, such as key phrases, surprises, how the interview went and possible interviewee reactions. These notes supported the analysis of the interview data.

4.3.4 Observations

Observations were conducted during the workshops to observe the teams carry out the alternative procedures. The ease to follow the instructions and procedures as well as the degree to which they kept to the time plan were observed. Moreover, the observations comprised the team collaboration and participation as well as if the outcome lied within the expected focus area.

Since the study comprised guided workshops and interviews, the natural role of the researchers was overt. This means that the researcher's role is revealed to the participants in the study (Lancaster, 2005). According to Bryman and Bell (2011), the main reason for adopting an overt role is to foster an ethical study. Furthermore, the overt role enables the researchers to use additional data collection methods and eases the documentation process. During the workshops, the main task of the researchers was to observe passively but to intervene when additional directions were needed. This role could be categorized as observer-as-participant, in which the researchers rarely participate (Bryman & Bell, 2011). Notes were taken during the workshops to ensure that all important observations were documented. Immediately after each session, the procedure and accompanying notes were overviewed, concretized and complemented to truthfully retail the workshop.

4.3.5 Sampling

The criteria for the selection of teams were the following: agile development teams, preferably managing both hardware and software, as well as possibility to participate in all workshop and

interview sessions. Three teams that met the criteria were available. However, one team had heavy workload at this period and differed from the other in number of team members. Thus, the other groups were selected to participate in the study. This sampling method could be categorized as purposive sampling due to selection in a non-probability and strategic way (Bryman & Bell, 2011). Bryman and Bell (2001) argue that this type of sampling does not generate generalizable findings.

To access the teams' opinions regarding the workshops, the study had to be delimited to only two interviews per team. The focus of the interviews was the opinions of the whole team, not individuals. Prior to the interviews, the selected interviewee was asked to discuss the workshops with the team to be able to represent their opinions correctly. Therefore, the sampling of interviewees within the teams was not considered to influence the outcome of the study and could be delegated to the teams.

4.4 Analysis

The following section presents the methodology used to create the analytical framework from findings in literature, and the overall analysis. The overall analysis aimed to identify commonalities and differences in the findings of the empirical study.

4.4.1 Creation of Analytical Framework

An analytical framework was created to find patterns in literature and identify the applicability of existing procedures of developing metrics in an agile setting. This framework provides the foundation of the empirical study.

To start the analysis, all findings were briefly read through to get an overview of the content. This step eased the creation of a suggested structure of the analysis. Thereafter, the content of each chapter was summarized on a whiteboard to visualize the findings and prepare for the clustering. The visualized content was discussed element by element to identify similarities and differences, eventually finding patterns.

The findings in literature were then read through thoroughly, to highlight key sentences. This in order to build a detailed analysis with well described arguments and form the final structure.

4.4.2 Analysis of Empirical data

The analysis was conducted according to the following main steps. Initially the collected data from interviews and observations were combined stepwise, one procedure at a time. The combined data was inserted in a new document, color coding was used to separate the observations from the interview data. This information was then reviewed to identify patterns and differences between participant opinions and observations. Furthermore, reflections were made regarding the reasons for the outcome and adjustments to improve the procedure. These issues were formulated as bullet points in a new document and structured in accordance with the steps of the procedure. Thereafter, a draft of a possible analysis structure for the report was created, including the following sections: General Insights, Introductory Step, Brainstorming Session, Goal Specification, Underlying Needs, Goal Fulfilment, Identification of Information,

Goal Set Overview, Formulation of Metrics and Validation of Results. The identified insights from both procedures, related to each section, were inserted into the structure. To distinguish between the two procedures, color coding was used. Finally, all insights for each section were combined and elaborated on to present all findings in relation to each other.

4.5 Research Quality

Credibility concerns whether the findings can be considered believable, that is, if they reflect the reality (Bryman & Bell, 2011). To ensure credible results in this study, three main actions were taken. Firstly, interviews with participants were held to acknowledge the teams' perspective and include their opinions in the accumulated evaluation. Thereby, potential researcher bias could be reduced, and higher credibility ensured. Secondly, interviews were recorded and thereafter transcribed in order to avoid missing important data and to capture the formulation of the interviewees. Thirdly, participants were provided with notes from interviews to correct any misinterpretations and confirm the findings. Bryman and Bell (2011) refer to this technique as respondent validation, which helps to establish correspondence between findings and participant perspectives in qualitative research.

Transferability refers to the issue of applying the findings in other contexts (Bryman & Bell, 2011). This is especially difficult in qualitative studies due to the unique characteristics of each social setting. Hence, a thorough understanding of the specific circumstances of the studied context is needed in order to determine the applicability of conclusions in other settings. A detailed case description and a literature review about the agile setting support the reader in determining the transferability of conclusions.

Dependability concerns whether third parties can follow the used research methodology and determine its adequacy (Bryman & Bell, 2011). Dependability can be increased by extensive documentation of all research stages as well as having external parties review the methodology during the course of the project. In this study, consultations regarding the research methodology with supervisors at Chalmers and Volvo Cars have contributed to strengthened dependability. Furthermore, the documentation of the methodology has been ongoing and extended gradually as the project proceeded to capture all relevant details. To complement the description of the methodology and provide the reader with a thorough understanding, pertinent documents such as workshop instructions and interview templates are accessible in appendices.

Confirmability refers to the degree to which the researcher has allowed personal interests and values to interfere with the research (Bryman & Bell, 2011). Confirmability can be used as an indicator of the level of objectivity even though it is impossible to achieve complete objectivity in qualitative research. To enhance objectivity in this study, the findings and analyses were assessed by the supervisors at Chalmers. Furthermore, the participants have contributed their opinions to help reduce the subjectivity of the conclusions.

4.6 Delimitations

This study investigates the development of metrics to support agile teams until the point where metrics are formulated. The way metrics are used and analyzed, as well as the collection of data lie outside the scope of this study and have not been investigated. However, the teams have discussed how the metrics can be visualized and integrated into their team routine during the final workshop. This in order to facilitate the implementation of metrics within the teams at Volvo Cars.

The participating teams belong to the department Comfort Functions, no other departments were included in the study. Two teams were investigated, one for each procedure. It would have been beneficial to include at least two teams to evaluate each procedure. However, the number of teams had to be kept at a minimum due limited access. Furthermore, no external parties took part in the investigation, thus the results are solely derived from the specific situation at Volvo Cars.

4.7 Ethical Considerations

The study was carried out with respect to ethical considerations. Interviews and observations can be sensitive for the study objects, thus the purpose of the research and handling of data were to be carefully communicated to participants. Different personal values were taken into consideration, participation was optional, and responses could be withdrawn at any time. This was done to ensure that the participants felt comfortable and that a cooperative relationship was built. Furthermore, all participants were anonymous and interviews were recorded when consented. The study was carried out in accordance to Volvo Cars regulations and policies. Confidentiality was respected and the brand name used in line with the wishes of the company.

4.8 Discussion of Method

The analytical framework provides a basis for the empirical study and is a central part of this research. Due to lacking research, conclusions regarding metrics in agile have solely been drawn based on theory regarding the two topics separately. Thus, it is possible that subjectivity has impacted the analytical framework, and consequently the outcomes of the study. It should also be noted that scientific articles regarding the development of metrics are somewhat lacking. To complement this gap in research, relevant published books have been used. In particular, literature of Martin Klubeck has been a primary source in the theoretical framework. Martin Klubeck, a strategy and planning consultant at the University of Notre Dame, is an expert within the subject of practical metrics and is the author to several published books on this topic. His experiences within the subject are considered to be enough for his books to be used as valuable material for the theoretical framework in this report.

There is an extensive skepticism towards metrics across industries, considering the use of metrics to be superfluous and bring negative effects. Although there is lacking scientific research confirming all these opinions, it was of value to consider this opposition in the study. This is important for two main reasons: ensuring that all relevant aspects of the topic are considered in the study as well as addressing the critique to make skeptics responsive to the

conclusions. Thus, non-scientific sources have been used as complementary material to capture this critique and create more profound discussions.

Based on findings in literature, two alternative procedures have been formed. Although literature suggests several steps to include in the development of metrics, three main phases (Goal Setting, Identification of Information, and Metric Definition) are common to most authors. In some stages of the development, such as discussion of underlying needs and overview of goal set, the same steps are used in Procedure 1 and Procedure 2. In other parts, where literature suggests alternative steps, the two procedures differ. No more than two varying steps for the same stage of the development have been identified in research. Thus, two separate procedures have been formed and evaluated in the empirical study. It should be noted that not all steps mentioned in literature were included in the procedures, but a selection was made to fit the conditions of the team and the study. To exemplify, the step *abstract view* mentioned by Klubeck was excluded since it was not considered practically feasible or valuable.

The combination of steps for each procedure was arbitrarily selected, which means that there are more possible combinations that could be evaluated. Further, there may be interactions between the steps that have not been acknowledged, since each procedure is carried out by merely one team each. Due to possible individual variances between the teams, such as varying engagement and circumstances, the teams are not completely comparable. To enhance validity, it would have been beneficial to evaluate various combinations of steps as well as have several teams conduct the same procedure. However, due to limited access to teams, all individual variances were disregarded in the study to make the results comparable. Moreover, the fact that one person represented the whole team during the interviews might have affected the results of the study. The team was requested to discuss the questions in advance and select one member to speak for the whole team during the interview. Thus, several precautions were made to see to it that the answers of the interviewee reflected the opinions of the entire team.

5. Case Study

The following chapter presents a case description and findings from the case study at Volvo Cars. The findings of each procedure are divided into outcome of the case study and evaluation of the procedure. To make a clear distinction between the two procedures, illustrated in Figure 9, findings from each procedure are presented separately.

5.1 Case description

To enhance the transferability of the conclusions, the following section describes the circumstances of the case study divided into three levels of abstraction. Initially a brief description of Volvo Cars as well as the current situation in the automotive industry is presented, to give an understanding of the larger scene. Finally, relevant information regarding the department and teams involved in the study is presented.

In the recent year several automotive industries experienced a decline in the market (Volvo Car Group, 2018). The European automotive industry recorded a slight decline, while the Chinese market decreased for the first time in over two decades. Additionally, the market has experienced an increased price competition and introduction of new tariffs. At the same time, the consumer demands are changing due to a more digital lifestyle, the trend of urbanization, growing sustainability awareness and the need for convenient mobility. To meet these changing demands, Volvo Cars act on new opportunities within electrification, autonomous driving, connectivity as well as sharing services. This technological shift requires extensive R&D and Volvo Cars constantly strives to deliver innovative and high quality solutions. Apart from the changing demands and technologies, Volvo Cars is undergoing an organizational transformation. In mid-2017 parts of the organization initiated the implementation of SAFe (Scaled Agile Framework) as the new way of working. However, the department studied in this research, Comfort Functions, started the transformation eight months prior to this investigation. During the time of the study, the team maturity has not yet reached desirable levels and the transformation is still ongoing.

The Comfort Functions department comprise seven teams in total and is responsible for the development of doors, interior light, climate, switches, and electronic control units. The two teams participating in the study both belong to this department. Team 1 consists of eight members, including Scrum Master, and develops both hardware and software. Their areas of responsibility include developing electronic control units, the software that controls the doors, windows, roof, memory switches and exterior mirrors. Team 2 consists of ten members, including Scrum Master, and merely focus on software development. Their responsibilities comprise designing the system solution and software for the interior light as well as the light that illuminates all the switches in the vehicle. Both teams actively chose to participate in the study.

5.2 Findings of Procedure 1

The findings of Procedure 1 are presented below, full instructions and distribution material of the procedure are found in Appendix 1 and 2. The initial section includes the outcome of the workshops, more specifically the goals, information proposals as well as metrics defined by Team 1. The second section comprises an evaluation of Procedure 1, derived from observations and interviews of the workshops.

5.2.1 Outcome of Procedure 1

The outcome of Procedure 1 is presented in the following section. The result of the goal setting workshop is a prioritized list of the team's key tasks and areas and formulated goals within the five most important categories, see Table 3.

Table 3. Prioritized list of key tasks and areas as well as formulated goals within each.

Prioritized key tasks and areas and accompanying goals	Related goal dimension

1. Development
  • Meet target cost
  • Deliver on time according to set time plan
  • Deliver functional products within specification
	Efficiency

2. Work Environment
  • Fulfil code of conduct
  • Highly motivated team members
	Team Support

3. Requirements
  • Satisfied customers
  • Clear requirements
	Self-Leadership

4. Communication • Ensure clear and good communication, internally and externally	Efficiency
5. Collaboration • Ensure efficient and effective collaboration, internally and externally	Efficiency

The outcome of the second workshop is a list of information needed to help fulfil the goals. Table 4 below presents the goals as well as accompanying root questions and information proposals.

Table 4. Information proposals and root questions belonging to each goal.

Goals	Root questions	Information proposals
Meet target cost	How can we save money by selecting parts and solutions with quality and safety in mind, and also satisfy the market?	• Supplier solutions • Cost breakdowns • Supplier evaluation material • Relation between estimated cost and target cost
Deliver on time according to set time plan	How do we make sure we deliver our product in time with the right planning strategy to fit in Volvo's launch strategy?	• Detailed delivery plans • Delivery dates • Supplier time plan • Volvo's time plan • Development chain
Deliver functional products within specification	How do we collect user cases in order to create a proper specification?	• Customer feedback • Updated specifications • Updates usecases (with references from old cars) • Customer satisfaction report
Fulfil code of conduct	How do we make sure that employees and consultants behave correctly at work?	• Records of performed code of conduct e-learning • Complaints to TM or HR to log incorrect behaviour • Violation reports
Highly motivated team members	How can we have higher productivity?	• Timeliness of delivery • Storypoints finished • Overtime hours • Number of meetings vs action • Stress levels • Perceived meaning of work • Proudness of work
Ensure efficient and effective collaboration, internally and externally	How do we reduce obstacles and friction at work?	• Current work situation of employees • Obstacle awareness • Waiting times • Time to resolve misunderstandings
Satisfied customers	How do we make more turnover by increasing customer satisfaction? How do we make more turnover by increasing customer satisfaction?	• Customer needs (from surveys) • Quality overview • Number of customer complaints
Clear requirements	How do we make clear requirements to enhance customer satisfaction?	• Clear functions • Customer centric requirements
Ensure clear and good communication, internally and externally	How does clear/good communication relate to reduced costs and increased customer satisfaction?	• Happiness of employees • Information about occurred mistakes caused by lack of information • Costs of misunderstandings • Time spent filing issues linked to interpretation • Number of customers affected by problems

The outcome of the third workshop is a set of metrics related to each goal, presented in Table 5.

Table 5. Formulated metrics belonging to each goal and additional participant notes

Goal: Highly motivated team members **Metrics:** • Perceived meaning of work; average value, on a scale of 1-5. • Stress level; average value, on a scale of 1-5. • Proudness of work; average value, on a scale of 1-5. Collect data in a questionnaire quarterly. Visualize trends in graphs on PI evaluation meetings.
Goal: Ensure clear and good communication, internally and externally **Metrics**: • Perceived communication towards others; average value, on a scale of 1-5. • Perceived communication from others; average value, on a scale of 1-5. Collect data in a questionnaire quarterly. Visualize trends in graphs on PI evaluation meetings.
Goal: Satisfied customers **Metrics**: • Number of warranty claims divided by number of cars; average value. Trends over time presented monthly, based on data from system every second sprint.
Goal: Clear requirements **Metrics**: • The time elapsed from sending requirement to supplier until agreed and understood; single data points. • Number of changes made to a supplier requirement before agreement; single data points. Data points presented in graph after each change.
Goal: Meet target cost **Metrics:** • Difference between target cost and actual cost Trends over time presented monthly.
Goal: Deliver on time **Metrics:** • Expected delivery vs actual delivery. • Delay between planned completion of tasks in PI and actual delivery (e.g. delivered 1 sprint late)
Goal: Efficient and effective collaboration, internally and externally **Metrics:** • Email response time; weekly average value. • Perceived collaboration; average value, on a scale of 1-5. Presented every PI.

5.2.2 Evaluation of Procedure 1

The evaluation of Procedure 1 is presented below, divided into observations of workshops and findings from interviews. Each section is structured in accordance with the three workshops: Workshop 1 Goal Setting, Workshop 2 Identification of Information, and Workshop 3 Metric Definition.

Observations of Procedure 1: Goal Setting

During the discussion of the purpose, the team appeared to be careful and not very talkative. However, the discussion was intensified after a while. Everyone participated in the discussion and contributed their opinion. The team came to a conclusion quickly after a short session and mainly highlighted functional and technical issues. Prior to the data collection, instructions had to be repeated and the definition of key tasks and areas had to be clarified. Moreover, it had to be explained that the assignment was focused on the purpose of the team. A few minutes passed without anyone starting to write their ideas, it became clear that the team needed further guidance and a structure to relate to. Therefore, a short explanation of the goal dimensions was given, which clearly eased their process of generating ideas. All participants wrote at least a few post-its each. The notes were then discussed in group, no further clarification was needed. The clustering appeared to be easily carried out. The team managed the clustering activity entirely on their own, with good collaboration and discussions. The voting session went smoothly, and the participants appeared to have similar opinions. However, the task of formulating goals within the prioritized areas was more difficult than anticipated. The participants had divided opinions, both regarding the formulation of goals and what was considered to be most important. Thereby, the team had difficulties coming to an agreement and specifying the goals. It was noted that the team rarely took help from the initial ideas written on post-its. However, when these were considered, the process was eased substantially and the goals became more comprehensive.

Observations of Procedure 1: Identification of Information

The team appeared to understand the initial instructions and immediately began the discussions. However, some had difficulties capturing the underlying needs and the discussions were therefore prolonged during this stage. These discussions appeared to be helpful for the teams in understanding the reasoning behind their goals. The use of the Five Why Tool worked well in some groups, while others put too much focus on how to use the tool rather than the outcome. Furthermore, some began working on the root questions without being instructed to do so, thereby missing to use the test questions intended for this step. For some groups, the root questions therefore had to be re-formulated upon usage of the test questions, resulting in better formulated questions. In this case, the participants were provided with a structure to guide them in this step but failed to use it. It could be noted that some groups found it difficult to formulate the root questions with focus on the needs of the group. Hence, the groups were further instructed to formulate questions that could help the team reach their goals. During the sharing session, it became clear that the root questions of some groups still were outside of their control boundaries. This initiated discussions within the team and with the researchers, resulting in another reformulation of some root questions. Several participants initiated the last step without reading the instructions, leading to them misunderstanding the task. Instead of generating

proposals on data and information needed to help fulfil the goals, they generated solutions on how to answer the root questions.

Observations of Procedure 1: Metric Definition

Unfortunately, only half of the team members had the possibility to attend the final workshop. The evaluation of goal relevance was carried out without difficulties, the participants easily followed the instructions and voted instantly. One goal appeared to be irrelevant to all participants and was therefore removed from the goal set. Upon overviewing the visualization of team goal set in relation to the goal dimensions, a further description of the dimensions had to be given. When overviewing the goal set, none of the participants took initiative for a discussion even though a discussion was encouraged. The participants immediately agreed that no additional goals were needed. During the formulation of metrics, some participants had a hard time grasping how a metric should be formulated. Therefore, additional explanations and guidance were needed before they engaged in active discussions, suggesting that further structure would have been beneficial for the participants to relate to. Most of the participants carefully attempted to follow the step-guide in the instructions, but still mentioned that the task was tricky. Furthermore, due to the limited number of participants, each group were allocated more goals than anticipated.

Interview Findings of Procedure 1: Goal Setting

According to the interviewee, the participants agree that the team-focus of the first workshop was a good learning. However, they lacked an initial understanding of where everything would end up. Furthermore, the interviewee elaborates that all steps were considered as relevant, none of the tasks seem more important than others. The team states that the clustering of individual ideas was carried out more easily than other steps and included good discussions and collaboration. The participants are positive to the way the tasks were conducted and argue that the team cooperated well throughout the workshop. However, the interviewee points out that the participants sometimes found it difficult to get started and had a hard time grasping the softer aspects, such as motivation and work environment, considered during the workshop.

The participants believe that one goal, *Fulfil the Code of Conduct*, should be eliminated from the goal set. This goal is rather considered as a demand from management, and should not be part of the team goal set. The remaining goals are considered relevant and important to the team. However, the interviewee further points out that the goals seem general and would fit any team.

Interview Findings of Procedure 1: Identification of Information

The interviewee states that the discussion of the underlying needs and root questions, or more specifically the reasons why the goals exist and how to reach those, are considered as the most rewarding parts of the second workshop. However, the participants found the discussion of the underlying need to be difficult to conduct. The interviewee mentions that they had a hard time evolving the reasoning behind the goals several times without going beyond the scope of the team, often reaching a formulation that concerned the entire organization rather than the team. The interviewee further points out that there are a lot of important discussions concerning each why in the Five Why Tool, but it does not have to be the last one that generates the best

outcome. The interviewee suggests that the confusion in this step could be avoided by clearer instructions on the way the underlying needs and accompanying root questions should be formulated.

Interview Findings of Procedure 1: Metric Definition

According to the interviewee, it was not until the final workshop that the participants truly understood the purpose of the workshops as well as the benefit to the team. The interviewee adds that it is unfortunate that only a few team members had the possibility to attend the final workshop. Consequently, several members missed the most critical part of the procedure and the opportunity to understand the value it could bring to the team. The interviewee mentions that the outcome could have been different if the workshops were closer in time, foremost because there is a risk of forgetting between the sessions. Moreover, it would help the participants understand the logical flow between the various steps. The participants did not have much to add regarding the execution of the workshop. The interviewee states that, although the instructions were easy to follow and useful examples were provided to the participants, one member misunderstood the way metrics were to be formulated.

The members are doubtful to the amount of benefit the metrics will bring to their team. In general, the participants believe that all metrics are helpful to track fulfillment of the goals. However, only a few of them appear to be useful for improvement efforts. The interviewee mentions that although they can track if there is a need for improvement, the metrics are too general to indicate where to direct improvement efforts. To exemplify, perceived collaboration indicates whether the collaboration is at a desirable level. If the metric reaches a low level, it merely indicates that the collaboration needs improvement, but does not specify how it can be improved. The interviewee adds that arriving at such generic metrics could have been avoided if the researchers would have been more familiar with the specific work of the team when guiding them through the procedure.

5.3 Findings of Procedure 2

The findings of Procedure 2 are presented below, full instructions and distribution material of the procedure are found in Appendix 3 and 4. The initial section includes the outcome of the workshops, more specifically the goals, information proposals as well as metrics defined by Team B. The second section comprises an evaluation of Procedure 2, derived from observations and interviews of the workshops.

5.3.1 Outcome of Procedure 2

The outcome of Procedure 2 is presented in the following section. The result of the goal setting workshop is a prioritized list of goal areas as well as specified goals within the five most important categories, see Table 6.

Table 6. Prioritized list of team goals and related goal dimension.

Prioritized goals	Related goal dimension
1. Learn each other's role, to have a possibility to help each other	Team Support
2. No planned work in IP-sprint	Team Support
3. Plan for 80% of velocity	Self-Leadership
4. Break down stories, avoid stories over 5 points	Efficiency
5. Review the task earlier	Efficiency
6. To be more synchronized with other groups	Efficiency

The outcome of the second workshop is a list of selected strategies for how to fulfil the goals as well as information needed to track the progress of those strategies. Table 7 below presents the goals as well as accompanying strategies and information proposals.

Table 7. Information proposals and strategies belonging to each goal.

Goals	Selected strategies	Information proposals
Learn each other's role to have a possibility to help each other	Role exchanges	• Project status (if there are some important deadlines or delivery)
No planned work in IP-sprint	Using IP sprint for training and learning	• Project status (if there are some important deadline or delivery)
Plan for 80% of velocity	Be more strict in PI-planning Learn other things	• Velocity of the team for each sprint • Planned activities • Completed activities • Previous task progress • Development progress trend
Break down stories, avoid stories over 5 points	Discuss in the team and set better Acceptance Criteria	• Total story points / Number of tasks • Get bigger picture (to split task better) • Number of points you can do in one sprint
Review the task earlier	Notify management and ask for help if problem.	• Data from earlier tasks • Sequence the risk • Risk register
To be more synchronized with other groups	Communicate as soon as possible and have weekly meetings to follow up items and find dependencies	• Priority of other teams

The outcome of the third workshop is a set of metrics related to each goal, presented in Table 8.

Table 8. Formulated metrics belonging to each goal.

Goal: Learn each other's role, to have the possibility to help each other **Metrics:** • Number of experience-sharing occasions per team member each sprint. Visualized as trends in sprint review/retrospective.
Goal: No planned work in IP-sprint **Metrics:** • Story points completed during IP-sprint, presented per year. Visualized every IP-sprint review/retrospective.
Goal: Break down stories, avoid tasks over 5 points **Metrics:** • Total number of planned story points each sprint; visualized in relation to 40 points. • Total number of tasks below 5 point each sprint. Visualized as trends in staple diagrams each sprint.
Goal: Plan for 80 % of velocity **Metrics:** • Percentage of closed story points in relation to 100% velocity (total number of closed story points per sprint / by 40 points). Visualized as trends in staple diagram every sprint.
Goal: To be more synchronized with other groups Metrics: • Team opinion regarding perceived communication each sprint, on a scale of 1-5. Visualized in relation to defined condition at sprint retrospective.
Goal: Review the tasks earlier **Metrics:** • Single data points per week. Visualized as status in relation to a defined condition on daily stand-up once a week.

5.3.2 Evaluation of Procedure 2

The evaluation of Procedure 2 is presented below, divided into observations of workshops and findings from interviews. Each section is structured in accordance with the three workshops: Workshop 1 Goal Setting, Workshop 2 Identification of Information, and Workshop 3 Metric Definition.

Observations of Procedure 2: Goal Setting

The data collection could be initiated directly after the introduction, no additional instructions were requested. The team started generating ideas on post-its without needing long time for reflection. All participants contributed at least six ideas each, and happily shared their ideas with the rest of the group giving a detailed reasoning to each idea. Already at this stage, some patterns of commonality were noticed. It appeared that some had written several ideas on the same post-it, which at a later stage had to be re-written. The team needed some time to grasp the task, but then initiated the clustering by dividing the board into three areas, one for each goal dimension, without instructions to do so. The team split into smaller groups, each started clustering within one area. Everyone was engaged in the task, sharing their opinions and collaborated to reach agreements. One cluster included a large number of ideas, more than instructed, that could have been broken down further to create several separate categories. No considerate difficulties were observed during the formulation of goals. However, it was a time-consuming task. The team made use of the goal ideas for each cluster and ensured that all important ones were included in the categories. Due to time constraints, this step had to be finalized at the next session. Consequently, the team needed some initial time to remember the reasonings and start the formulation of new goals. However, after a while the task went smoothly and resulted in clear and concrete goals. The prioritization showed similar opinions within the team and was carried out without difficulties.

Observations of Procedure 2: Identification of Information

The discussions regarding the underlying needs begun immediately after the instructions. The team appeared to be engaged in the discussions but needed more time than expected to complete this task. Everyone contributed in the generation of strategy proposals and appeared to think thoroughly before writing. During the selection of strategies, the smaller groups collaborated well and reformulated new strategies based their proposals. Before the team begun generating information proposals, they requested further instructions due to difficulties understanding the task. When the task had been clarified, the participants seemed to get ideas and started writing. The team members had to finalize the template outside of session hours due to lack of time.

Observations of Procedure 2: Metric Definition

During the evaluation of goal relevance, the participants looked through the goals individually and then suggested that a voting session was unnecessary. Everyone agreed that all goals in the set were relevant to the team. When presented with an overview of the goal set in relation to the goal dimensions, the participants initiated a discussion without requesting further explanation. One of the participants suggested that one goal could belong to another goal dimension but was not supported by the other members. Furthermore, the meaning and

formulation of another goal was thoroughly discussed by most of the participants. Eventually the group decided not to re-formulate the goal. The participants appeared to be engaged during the metric definition and held active discussions. However, the approach to the task and the results differed between the smaller groups. One group understood the instructions and delivered what was expected without guidance, resulting in specific and well described metrics. In contrast, the other participants showed to experience some difficulties in their metric definition. Some misunderstood the instructions and focused solely on the form of the numbers, time perspective and visualization of metrics mentioned in the distribution material, and missed to specify what to measure. Others made use of the researchers when facing difficulties and included them in the discussions to concretize their ideas into final metrics. Before ending the workshop, the participants engaged in discussions regarding how to integrate the metrics into the team routine and specified their thoughts on the template.

Interview Findings of Procedure 2: Goal Setting

The interviewee describes that the first workshop was good and useful for the team. This because the team got to discuss possible improvement areas, and clarify the different opinions regarding these, within the group. The participant states that it was beneficial to openly discuss their improvement potential, since the team does not usually have the time to carry out this kind of reflections. Further, the interviewee describes that it often was a bit hard to get the group started on the assignments and to get everybody engaged in the tasks. Often, only one or two team members do the main work and the rest watch. To avoid this, it is suggested to work in smaller groups with the tasks, so that all participants can contribute better. No activity in the first workshop was considered difficult to carry out, but the team experienced some trouble in understanding the purpose of each task, and what they would result in, during the workshop. The activity that the participants find most important was the clustering session of goal ideas, which the interviewee describes worked very well. However, the data collection of goal ideas was stressful and could preferably be carried out differently, in the opinion of the participants. The participants felt pressured to generate three goal ideas per goal dimension, which caused stress. The interviewee mentions that it would have been better if the participants could generate ideas freely, without being instructed to come up with a specific number of ideas per goal dimension. The participants state that they felt an extensive time pressure and that they would have needed a longer session.

The participants consider the goal set to be of high relevance to their team. None of the goals appears to be irrelevant to the participants, however the goal *Review tasks earlier* is considered to be a bit vague.

Interview Findings of Procedure 2: Identification of Information

During the second workshop the participants experienced a significant time pressure and the interviewee states that the session of one hour was too short. The generation of strategies worked well according to the team. The interviewee further describes that the discussions followed by the generation of strategy proposals was useful and worked well. However, the use of the 5 Why Tool when discussing underlying needs of their goals did not work as well. The interviewee states that the participants did not write anything down in this step, which made the discussion a bit unstructured and not as clear with the five why-loops as the example

presented by the researchers. The team did not mention anything in particular that was hard to perform during the workshop, but they felt pressured by the time constraints and describe that it was tricky to take in and get started on new tasks. Sometimes, the interviewee describes, it took the team half of the time allocated to a task just to understand it. The participant further states that this was not because of the instructions, but because of the team. The participants liked working in smaller groups of two to three people, but wishes that they would have been given the chance to share what they had worked on with the whole team.

The participants found the generation of strategies extra important during the second workshop, since they got the chance to discuss how to improve their team and hear each other's opinions regarding their improvement areas. Further the interviewee states that after conducting the second workshop it became clearer what all previous steps have been leading up to. The participants see the value of the tasks performed and of getting their discussions going, the interviewee believes that these discussions and insights will help the team in the longer time perspective. No task during the second workshop was considered irrelevant by the team, but they would have preferred to conduct the two first workshop together during the same day.

Interview Findings of Procedure 2: Metric Definition

The overall impression of the third workshop was good according to the interviewee, who further mentions that the tasks conducted in groups of three worked especially well. To work in smaller groups helped activate all participants. To grasp and get started on new tasks was sometimes somewhat hard, according to the team. But no step in particular was considered to stand out as hard to perform. The interviewee mentions that it was a bit tricky to start the formulation of metrics, but when they understood the task the formulation went well. The instruction for the metric formulation task was considered helpful for the participants. The interviewee stated that the agile and metric related terms used during the workshops preferably could be explained in the introduction of the session, to make sure everyone understands. Not everyone felt comfortable using terms such as stories and metrics, since the topic of metrics and the agile way of working is rather new to the team. Further, the team did not find any part of the workshop to be more, or less, important.

The team considers the final set of metrics to be useful for the team, and states that the metrics will be helpful in driving their development as a team. Further, they believe that the metrics will help them reach the defined goals. The interviewee describes that the team will see if they improve and get nearer their goals with help from the metric set. The team states that the fact that the procedure was divided into three workshops, with one weeks' paus in between, might have affected the results of the procedure. The interviewee argues that the metrics could have turned out differently if the workshops would have been performed in one session. This since the team experienced that they forgot what they had done on previous sessions when entering the second and third workshop. The team believes that it would have been better to have one longer session to perform the whole procedure, instead of dividing it into three workshops with long time periods in-between. The time constraints, on the other hand, are not considered to have affected the outcome.

The interviewee states that the team found it interesting to be part of the study, that they got to spend time reflecting on their way of working and create ideas on how to improve and act.

6. Analysis

The following chapter presents an analysis of the empirical study. The evaluations of the two procedures are discussed in relation to each other and presented in several sections. The initial section elaborates on general patterns observed between the two procedures, while the following presents more detailed reflections regarding each main step. The final section elaborates on the metrics in terms of usefulness to the team as well as their ability to help fulfil the goals and support team improvement efforts.

General Insights

Based on the evaluations of Procedure 1 and Procedure 2, both commonalities and differences between the two can be acknowledged. In general, the participants consider the steps included in both procedures to be relevant and state that the workshops mainly have been performed without considerate difficulty. Furthermore, both teams believe that the workshops have been an opportunity to reflect and think in terms of team and improvement, which is considered as useful in both short and long term.

Several common issues can also be observed when the two procedures are analyzed in relation to each other. Although an initial presentation describing the daily agenda and its contribution to the whole procedure was given at each workshop, participants of both procedures state that they lacked an understanding of the purpose of the workshops and the benefits they could gain from them. Participants of Procedure 1 further state that they would have preferred more initial guidance to acquire that knowledge. This is considered as especially important since only few members participated at the last workshop when the benefits became clear to the team. In addition, participants state that they often experienced difficulties getting started with a new task. The following reasons are considered as possible explanations to this: experienced time pressure, difficulties understanding the instructions, and unfamiliarity with the agile terminology. Consequently, it can be concluded that more information would be beneficial prior to start. This could either be a more thorough introductory presentation or a hand-out for the participants to read prior to the workshops.

Participants of both procedures believe that a combination of working together as a whole team and dividing the workload among smaller groups is an efficient way of working. However, participants also experienced that one could feel isolated working in the smaller groups and suggest that more discussions among the entire team would be beneficial to learn what the others have come up with. The researchers would have preferred that several sharing sessions among all participants took place to ensure that everyone understands, and agrees with, all contributions. However, due to time pressure, especially during the workshops belonging to Procedure 2, some of those sessions were eliminated. The time pressure may have affected the results, but there are split opinions regarding this. However, both teams agree that having the workshops in connection to each other, during a three-hour session, probably would have resulted in different outcomes. The participants mention that it was difficult to get started in the beginning of each workshop because they had a hard time remembering where they left off. Following these general insights, more detailed reflections regarding each main step are presented below.

Introductory Step

The two procedures are initiated with entirely different introductions. Procedure 1 begins with a focus on the specific team and their purpose, while Procedure 2 starts more generally with an introduction of the goal dimensions. The introductory step of Procedure 1, a discussion of the team purpose, appears to be a suitable first step to get the participants' minds going and break the ice. Team 1 emphasizes the value of getting into a team-mindset and shifting focus from the individuals. An initial discussion, like the one in Procedure 1, is an effective way to accomplish such a team focus and agile mindset. Although the participants engaged in relevant discussions during this introductory step, they do not acknowledge this during the interview. This implies that the team considers this introduction to be neither very important nor unimportant. Both researchers and team members agree that the teams have experienced difficulties getting started on new tasks, especially in the beginning of each workshop. It could thereby be considered beneficial to have an easy first step to start off the procedure, where the participants do not need to deliver anything concrete. In contrast to the immediate team focus in Procedure 1, the introductory step of Procedure 2 comprises a presentation of the general goal dimensions. The participants of Procedure 2 are provided with a thorough description of the three dimensions to give inspiration and guidance for the proceeding session. The insights gained from this introduction are considered to be helpful for the participants and important for the upcoming step. In conclusion, it is seen that an initial discussion, focusing on the specific team, is an effective icebreaker and helps the participants get into the agile way of thinking. Further, an introduction of the goal dimensions shows to bring inspiration and important insights that are useful in the following.

Brainstorming Session

The brainstorming session is conducted similarly in the two procedures, with one main difference. Procedure 1 evolves around the team's key tasks and areas, while Procedure 2 considers goal ideas. In Procedure 1 the participants are asked to generate proposals on their team's key tasks and areas immediately after the purpose discussion. However, it is clear that more guidance was needed in order for the team to be able to perform the task. Team 1 was thereby provided with a brief presentation of the goal dimensions to bring inspiration, thereafter the generation of proposals accelerated. The fact that the team was not capable of generating proposals on their own key tasks and areas without inspiration from the goal dimensions can be considered surprising, since they are expected to be well aware of their own responsibilities and work tasks. Team 2, that received an initial explanation of the goal dimensions, could begin their goal idea generation without difficulties. This shows that it is necessary to provide teams with some guidance before entering the brainstorming step, otherwise the idea generation is too hard to perform. Evidently the goal dimensions inspired the teams and provided enough guidance to perform the task in a successful way. Procedure 2 provides no opportunity for the participants to discuss with one another before writing their proposals, which might have made it more difficult for Team 2 to get started than for Team 1 who had already broken the ice. On the other hand, no prior interaction ensures that the group does not influence and limit the proposals of one another.

Participants belonging to Procedure 2 are requested to deliver at least three goal ideas in each dimension, with the purpose of acquiring a comprehensive set of goals, while Team 1 solely

used the goal dimensions to gain inspiration. Team 2 finds this directive stressful and mentions that they felt forced to deliver ideas within each of these. Instead they would have preferred to deliver as many ideas as possible without any directive regarding the dimensions. There is a risk of letting the participants generate ideas freely within any of the dimensions, as it could result in a goal set that misses important aspects. If the goal set does not cover all relevant areas, the final metric set eventually derived from the goals will not cover all relevant areas either. On the other hand, it is important not to obstruct the idea generation by putting pressure on the participants to generate a specific number of ideas within each dimension. It is desirable to have the participants think freely, but still generating ideas that covers several relevant dimensions. Based on this problematization, it is preferable to initially make the participants understand the benefits of having a comprehensive goal set, and then encourage them to consider all dimensions and generate as many proposals as possible, but avoid setting any limits.

The clustering of proposals is conducted with the same instructions for both procedures. It should however be noted that Procedure 1 manages proposals on key tasks and areas, while Procedure 2 manages goal ideas. This session went smoothly for both groups, indicating that the instructions are well formulated and the steps easy to follow. Both teams mention this step as successful and important, and delivered valuable discussions and useful results of their clustering. Reflecting over the entire process, it is clear that this activity is crucial for both procedures and the outcome of it provides a basis for all upcoming steps. The significance of this step is further supported by Team 2, who explicitly mentions the clustering as the most important activity in the second workshop. Therefore, it is important that this step is conducted thoroughly and without time constraints.

Before finalizing the brainstorming session in Procedure 1, participants are requested to vote on the key tasks and areas they find most relevant, resulting in a ranking list. Using this list, goals are later formulated within each of the key tasks and areas that are found to be relevant. This voting session shows not to be of much value, since the voting session focuses on the key tasks and areas instead of formulated goals. Even though a key task is considered relevant during this voting session, it does not necessarily imply that the goal to be formulated for the task in the next step will be relevant. The purpose of the voting session is to help in the process of defining relevant goals, but apparently fails to fulfil this purpose. This statement is strengthened by the fact that one goal in Procedure 1, *Fulfil code of conduct*, was later eliminated even if the related key area, *Work Environment*, was ranked to have high relevance. It can be concluded that the outcome of this voting session was not successful. However, the voting itself was easily carried out, indicating that there is no need to change the process of, or the instructions for, voting. The voting session for Procedure 2 is carried out at a later stage and is analyzed in the section Goal Specification below.

Goal Specification

The formulation of goals turned out quite differently in Procedure 1 and 2. Team 1 finds this step difficult, while Team 2 could specify their goals without any major difficulties. There are two possible explanations to this. Firstly, Team 1 did not make enough use of their initial proposals on the individual post-its when formulating the goals. Instead, the participants focused on the label of the categories, created during clustering, and formulated goals based on

the name of the category. Consequently, Team 1 did not always relate the goals to the important issues in their initial ideas. It should be noted that once the participants did make use of the initial ideas, the formulation of goals was substantially eased and the goals turned out more specific. In contrast, Team 2 used their initial ideas when formulating goals, trying to capture the important ideas within each cluster in their goal set. This eased their goal formulation and led to a set of more specific goals. Thus, it is beneficial to clearly instruct the participants to use the individual post-its in the goal specification step, both to ease the process and help make the goals more specific. Secondly, Procedure 1 implies moving from key tasks and areas to goals, which appears to be difficult and confusing to the team. Observations of Procedure 2 indicates that formulating final goals based on goal ideas, on the other hand, is a straightforward and easy task. Based on this reasoning, it is not beneficial to brainstorm about key tasks and areas and then formulate goals based on these categories. Another issue that affected the goal formulation in Procedure 1 was that the participants had some disagreements regarding what a goal is and what a goal formulation shall include. This implies that further and clearer instructions would be beneficial regarding what to deliver.

Following the goal specification, a voting session takes place in Procedure 2 to decide on which goals to include in the goal set. Team 2 carried out this voting session easily, and it worked as a screening to ensure that only the goals considered most relevant was selected into the goal set. The purpose of this session is to decide on a relevant goal set, and it shows to fulfil its purpose in contrast to the voting session in Procedure 1 as discussed above. It can be concluded that it is preferable to vote on goals at this stage, instead of voting on the key tasks and areas like in Procedure 1. This statement is further strengthened by the fact that Team 2's goal set still was considered relevant in the final Goal Set Overview later in the procedure, while Team 1 had to revise their goal set to ensure relevance before formulating the metrics.

Underlying Needs

The discussion regarding the underlying need is considered to be a difficult task, mainly because the Five Why Tool was not used as intended. The teams carried out this step in a similar manner and believe that, although it was a useful task, its execution was tricky. Participants of both teams question the way the tool was used and agree that they experienced difficulties reaching the concluding underlying need. Some participants were too focused on evolving the reasoning exactly five times, which resulted in underlying needs that laid outside the scope of the team. The only instruction that differs between the two procedures in this step is note-taking, participants of Procedure 1 were given material for note-taking while participants of Procedure 2 were asked to merely discuss freely. Material to take notes is explicitly stated as lacking from Procedure 2 and should thereby be regarded as a possibility for improvement. To conclude, the discussion regarding the underlying need could be beneficial for upcoming steps but the intended use of the Five Why Tool needs further clarification. The participants should not feel restricted to reach exactly five why's, but instead aim to evolve the reasoning as much as possible. The idea is for the tool to provide guidance rather than limit the reasoning of the participants. Furthermore, the participants should have the possibility to take notes.

Goal Fulfillment

The step of goal fulfillment differs between the two procedures, participants of Procedure 1 are requested to formulate root questions while participants of Procedure 2 are requested to determine strategy proposals. Based on the evaluation, it can be concluded that the identification of strategy proposals seems to be superior to the formulation of root questions. The generation of strategy proposals is considered to give useful outcome and is regarded as one of the most important activities in the procedure. In contrast, participants requested to formulate root questions mean that this task was difficult to carry out and agree that the root questions were commonly formulated outside the scope of the group. However, it should be noted that the generation of root questions may have implied a different result if the underlying needs would have kept team focus. To conclude, it is difficult to determine whether the formulation of root questions is an inferior task itself or whether the execution merely was affected by the poorly formulated underlying needs. Although Team 2 also experienced difficulties arriving at underlying needs, it can be concluded that the generation of strategies is considered to be useable.

Identification of Information

There are split opinions within the groups regarding this task. Many participants generated relevant information proposals, while others misunderstood the instructions. In both teams, several participants generated solutions rather than the information needed. Participants of Procedure 2 also experienced severe time pressure and were therefore asked to finish outside the session. It is difficult to determine whether the stressful circumstances and inability among these participants to ask for further clarification have influenced the results. However, based on the results, it can be concluded that both teams consider this task to be easily misunderstood. Due to difficulties among both teams, it is not possible to draw a connection to earlier steps. To avoid misunderstanding in the future and help the participants even more in their generation of proposals, it is suggested to provide the participants with the following: clear instructions to generate information instead of solutions, examples of different types of information, including softer aspects, and a brief explanation of how to use the information in the upcoming metric specification.

Goal Set Overview

It is crucial to ensure that all goals seem relevant and that a covered goal set is reached before the formulation of metrics is initiated. However, a goal set overview at this stage in the process appears to be of value only for Procedure 1. This can be explained by the fact that participants of Procedure 1 were not given the possibility to vote on goals, but on key tasks and areas, at an earlier stage in the process. The fact that one of their goals is considered to be irrelevant supports the necessity of this overview. This further indicates that although a key area is relevant to the team, the goal does not have to be. In contrast, the participants of Procedure 2 immediately agreed that all goals are of value to them. This is to be expected, since this team already voted on the relevance of their goals. To conclude, it is crucial to conduct a voting session to ensure that the goals, that provide the foundation of the entire procedure, seem relevant to the members. However, it seems more logical to carry out this step in connection to

the goal formulation. Otherwise, there is a risk of redundant work as time is spent on goals that are considered irrelevant to the team.

Apart from a voting session, the teams were also provided with an opportunity to view their goals in relation to the goal dimensions and complement if needed. Only the participants of Procedure 2 took the opportunity to discuss this, which could possibly be explained by their goals being more team specific. The discussion concerned both their specific goals and their goals in relation to the goal dimensions. This indicates that the team had a profound understanding both of their goals and the goal dimensions. In contrast, the participants of Procedure 1 did not take the opportunity to discuss neither the goals nor the connection to the goal dimensions. Unlike the participants of Procedure 2, they were only briefly provided with the goal dimensions in the first workshop. Therefore, it may have been difficult for them to grasp the meaning of each dimension as well as the benefit of having a comprehensive set of goals. In addition, this team has a more general set of goals which gives less foundation for a discussion. It can be concluded that the participants should be provided with a thorough presentation of the goal dimensions for them to truly understand the value of having a comprehensive set of goals. To ensure that the participants remember the meaning of all dimensions, it is also beneficial for the discussion regarding the goal set comprehensiveness to be conducted earlier in the process.

Formulation of Metrics

The participants among both teams had different ways of taking on the task of metric formulation. Although both teams agree that the instructions are useful, several members misunderstood the task. Participants of Procedure 1 also consider the examples to be of use in the specification of metrics. Based on the results, it is seen that the instructions effectively help the participants understand what to consider when formulating a metric, but lack guidance on what to specify on the templates. Some participants were too focused on the aspects in Table 1 (Appendix 1 and Appendix 3), including the time perspective of the metric, the form of numbers, and the visualization of results. Thereby, these participants missed to specify what to measure. To conclude, further instructions regarding what to deliver are suggested for future use.

Validation of Results

The two procedures have resulted in outcomes that differ to a large extent. The outcome of Procedure 1 is considered to be general, while the outcome if Procedure 2 is specific and more team focused. Furthermore, one goal belonging to Procedure 1 was later eliminated from the goal set since it is considered to lay outside the scope of the team. The procedures vary on several steps, thus there are numerous aspects that may have influenced the diverse results. Foremost, the differences between the first workshops are believed to play an important role in the varying results. While Procedure 1 focuses on specifying the key tasks and areas, and deriving goals from those, Procedure 2 immediately focuses on the goals of the team. It is possible that the step from key task and area to goal is considered to be too far, resulting in lost relevance. It should be noted that the participants of Procedure 1 are requested to vote on the importance of the key tasks and areas, not goals, and thereafter formulate goals within the prioritized areas. The participants formulated goals based on the labels of the categories, rather

than the important aspects of the category. This resulted in general goals that did not correspond to the issues that the team found to be important in the first place. As a consequence, they consider their goal set to be neither very important nor unimportant. To summarize, when moving from key tasks and areas to goals, the focus on what is relevant may be lost. Consequently, the metrics derived from those goals are rather generic than team specific. In contrast, the goals and accompanying metrics of Procedure 2 are more specific and team related. This can possibly be explained by the fact that Team 2 focused merely on goals and did not have to derive them from key tasks and areas.

The two teams have split opinions regarding the benefits to be gained from the goals and accompanying metrics. The participants state that the metrics acquired from Procedure 1 could be useful in supporting the team and helpful in fulfilling the goals. However, they only find some metrics valuable for team improvement. This is considered to be related to two main issues. Firstly, since the goals are considered to be generic, not specific, the corresponding metrics follow up on general matters. This leads to feedback on an abstract level, making it difficult to use the information effectively. Although the metrics help track whether the goals are fulfilled, they do not necessarily indicate where team improvement efforts are needed. Secondly, the participants find the goal set itself too generic to be truly valuable to the specific team. Thereby, the participants are hesitant regarding the usefulness of the metrics derived from the goal set. It should be noted that high correspondence between goals and metrics does not imply valuable feedback for the team, if the goal set is irrelevant.

7. Discussion

Upon conducting the procedures in practice, the applicability of metrics in agile as stated in the analytical framework can be confirmed. The analytical framework states that agile teams are self-organizing, focused on continuous improvements as well as take responsibility for their work tasks and result. The fact that the teams themselves chose to participate in the study and engage in finding relevant metrics for their team, shows that there is a drive to evolve and work with continuous improvements. Throughout the procedures, the teams studied at Volvo Cars display self-organization and a willingness to take responsibility for their work, feedback and improvement efforts. This is clearly reflected in the comprehensiveness of their metric set, which covers several relevant aspects regarding their efficiency, team support and self-leadership. The participants also state that the developed metrics will be useful for their team, which even further strengthens this reasoning.

The analytical framework presents that metrics used to measure individual performance can lead to controlling effects on employees and hindered learning, as well as selfishness and cooperation-barriers. Further, the framework states that these effects are avoided when metrics are applied to fit the agile setting, due to a focus on the team and their opportunities for improvement. To clarify, the metrics should follow up on team level rather than individuals, as well as focus on improvement opportunities rather than remark unsatisfactory efforts. In practice, this assumption has proven valid. The participants find the metric sets developed in the procedures at Volvo Cars to be useful in supporting their team as well as reaching their goals. The metrics aim to help the teams improve and perform better as a group, which is completely in line with the agile way of working. It is apparent that the development of metrics is essential for the application of metrics and their fit with agile. A desirable application is accomplished when the development of metrics is carried out by the team itself and steered by an agile mindset. Teams that establish their own set of metrics understand its relevance and experience a sense of ownership of it which, in turn, increases commitment to use it. Agile practitioners do not value, or find it relevant to use, metrics that measure individual performance efforts. Thus, metrics in agile will not be applied to have the unfavorable effects described above. To conclude, the empirical findings support the analytical framework in this aspect.

The main part of the analytical framework, concerning the development of metrics in agile, are supported by the empirical findings. The analytical framework suggests that the process of developing metrics in an agile setting should be iterative. Based on the situation of the automotive industry, and Volvo Cars in particular, there is a need for flexibility to stay aligned with the market. This, in turn, points towards a need for a circular process of developing and revising metrics to create value over time. Moreover, the analytical framework emphasizes a risk of having a one-size-fits-all tool for measuring, instead suggesting the value of developing the metrics around the specific conditions of the team. This is accomplished by delegating the development of metrics to the teams themselves. Upon conducting the procedures in practice, two main conclusions regarding this can be drawn. First, having a set of metrics that is team specific, rather than generic, makes it easier to see the value of using it. This is supported by the fact that Team 1, having a generic set of metrics, finds the true benefit of using it less apparent, while Team 2 clearly considers the metrics to be of real value to the team and their

improvement. Second, delegating the development to the team, and beginning the procedure with team related issues, is a successful way to accomplish useful metrics. It is the differences in the procedures and possible individual variances between the teams, rather than the team delegation, that are explanations to the varying results between the two groups. Furthermore, an initial focus on team goals, including discussions of underlying needs and revisions of relevance, ensures a coherence among team members regarding the intentions of the metric set. The team members have shown to value reaching consensus throughout the procedure. This implies that unintended consequences due to unclear intentions are avoided when the procedure is initiated with goal setting and performed by the team itself. Furthermore, this indicates that the intentions and metrics are updated in synchrony, avoiding the risk of mismatch, by repeating the procedure. Consequently, the analytical framework shows valid in these aspects.

The analytical framework suggests the process of developing metrics in an agile setting to begin with acquiring goals, thereafter identifying information and finally deriving a set of metrics. The feasibility of this series of steps is supported by the empirical study. The participants mention that there is a logical pattern in the procedures and further state that the metrics are relevant. The main phases of the procedures therefore appear to be well accepted in practice. However, the empirical results oppose the analytical framework on one of the involved steps. The framework presents two actions following the establishment of goals: root question and strategy proposals. In practice, the strategy identification is superior to the formulation of root questions under these circumstances. This can be regarded as surprising as the framework points towards the use of root question, rather than strategy proposals, since there are more researchers supporting this action. A possible explanation to this is that the participants found more incentives to identify strategies, which can be useful in the long term. In contrast, formulating a root question can be considered as a redundant sub-step to the discussion of the underlying need.

The analytical framework presents Efficiency, Self-Leadership and Team Support as the categories of features to include in a metric set for agile development teams. The metric sets generated in the case study includes metrics within all of the categories, implying that the mentioned areas are considered relevant in practice as well. The reason behind excluding strategic issues from the Management Perspective, and creating the new category Self-Leadership in the analytical framework, is that agile development teams are assumed not to handle strategic decisions. This assumption can be questioned. No strategic issues were mentioned or inquired during the discussions of key tasks and areas in Procedure 1, indicating that the participants find strategy-level matters to lie outside of their team's scope of responsibility. However, the team cannot be expected to mention all relevant aspects of their work under these circumstances. Thereby, the assumption can neither be confirmed nor rejected. Further, the category Effectiveness found in theory is excluded in the analytical framework, since the prioritization of work tasks are to be performed by the Product Owner and not by the development team. In practice, this assumption appears to be valid. It has been seen that the development teams at Volvo Cars have a Product Owner that prioritizes their work, which corresponds to the agile way of working as described in the analytical framework. During the course of the procedures, issues of team effectiveness have not been included in the metric set developed by the participants. However, the level of perceived effectiveness, belonging to the Team Support category, within the team has been discussed. Perceived effectiveness corresponds to the team opinion regarding the value of their work and whether it

is correctly prioritized by the Product Owner. These discussions included how low perceived effectiveness could be communicated to the Product Owner for improvement purposes. This reasoning indicates that the categories of features presented in the analytical framework are valid in practice.

It is apparent that measurements guide actions. This study presents how to develop metrics in order to be applicable in an agile setting and guide actions accordingly. This includes establishing a comprehensive metric set to provide feedback that captures various relevant aspects of the team's work. It should be noted that the comprehensiveness of these metric sets is solely determined based on the mentioned categories of features, rather than to what extent the metrics reflect reality. This means that there could be important aspects missing. The question is whether aspects are left out because they are unimportant or because they are not measurable. If the metric set excludes important aspects as a consequence of being unmeasurable, actions are guided on measurability rather than importance. This, in turn, places the focus merely on measurable aspects, leading to sub-optimization. To determine whether there is any truth to this reasoning lies outside the scope of this research. Although this is an interesting reflection to acknowledge since it could have influenced the metrics developed in the case study, it is not decisive for the conclusions. Merics developed to fit an agile setting have proven to result in a favorable application that avoids controlling effects and hindered learning, as well as selfishness and cooperation-barriers. Further, the unintended consequences due to unclear intentions behind the metric set are eluded. When applied in an agile setting, metrics are valuable and the main arguments of the skeptics lack justification.

8. Conclusions

Existing research mentions various alternatives for developing metrics. However, some commonalities regarding the features of a metric set and the way metrics are generated can be observed. Theory emphasizes the value of a comprehensive metric set, which shall include four perspectives: Effectiveness, Efficiency, Worker Perspective, and Management Perspective. As for the procedure of developing metrics, three main phases are identified. The metric generation is initiated by defining a relevant set of goals, followed by an identification of information needed to track goal fulfillment. The goals and accompanying information provide the foundation for the final definition of specific metrics.

It can be concluded that the application of metrics needs to be adjusted to achieve compatibility with an agile setting. This is accomplished by delegating the development of metrics to the teams and letting the development be steered by agile values. To clarify, the development of a metric set is crucial for its application. The procedure of developing metrics in agile contains the same main phases as described above, though adjusted to form a circular process. The iterativity of the procedure ensures relevance of the metric set and supports the agile development teams over time. Establishing a comprehensive set of metrics is essential in agile, but the features to include differ from existing research. Effectiveness and strategic issues are considered to lay outside the scope of the development teams and are therefore excluded. Instead three new categories of features to include in an agile metric set are identified: Efficiency, Self-Leadership, and Team Support. The recommended procedure for establishing metrics to support agile development teams is illustrated in Figure 10. The procedure is designed to provide the teams with valuable feedback and drive team progress. A detailed description of the procedure is provided in Chapter 9.

Figure 10. Recommended procedure for developing metrics to support agile development teams
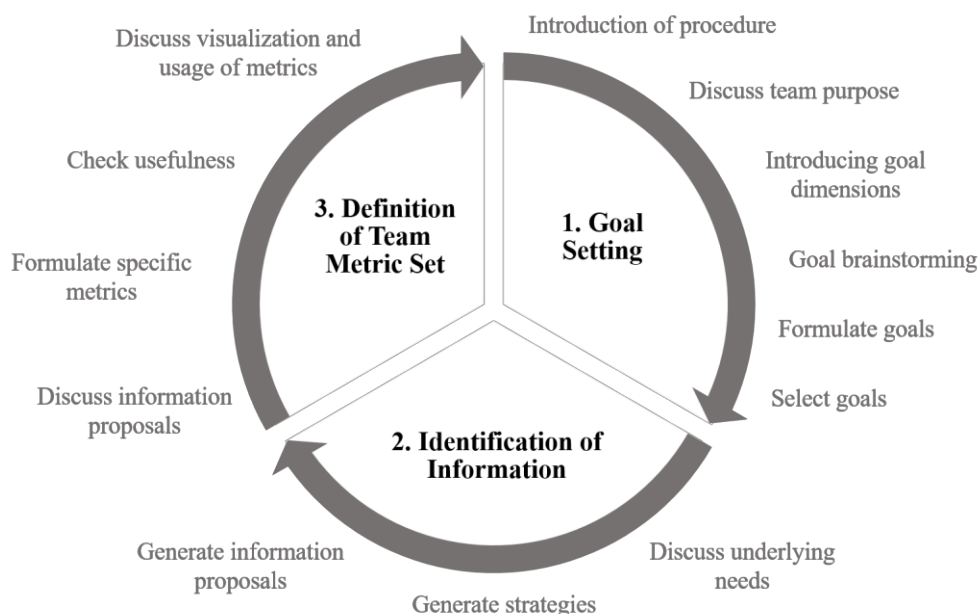
9. Recommended Procedure

The following chapter presents the recommended procedure, developed based on the findings in this study. The procedure is outlined in chronological order and is divided into three main phases, an overview of the procedure is illustrated in Figure 10. It is recommended that the procedure is conducted at one occasion in order to ease the transition between the phases. The following section elaborates on the reasoning behind the design of the phase and the involved tasks. Full procedure instructions, for participants and workshop facilitator, are presented in Appendix 5 and 6.

Phase 1: Goal Setting

1. Introduction of procedure

To create an initial understanding of the value of each step and how it relates to the outcome, it is recommended to begin the procedure with a thorough introduction of the workshop. The introduction should include the aim as well as a step-wise description of the procedure. Furthermore, it is crucial that the participants understand how the outcome of each step contributes to the final set of metrics. An initial understanding is expected to ease the process of getting started as well as improve the final outcome of the team.

2. Discussion of team purpose

It is beneficial to have an easily performed first team activity in the procedure to break the ice, thereby a short discussion is recommended without the participants having to deliver anything concrete. Discussions can be an effective way of getting the participants into a certain desired mind-set which is beneficial for the upcoming session. To get the individuals to adopt a team focused and agile mind set, it is recommended to discuss the team's purpose, as well as their key tasks and areas. By letting the participants elaborate on their team purpose and responsibilities in an easygoing manner, they take on a beneficial and agile approach that is favorable for the rest of the procedure and at the same time eliminate possible initial tension.

3. Presentation of goal dimensions

To create pre-requisites for a comprehensive goal set, it is recommended to give a presentation of the goal dimensions prior to the generation of goal ideas. Moreover, the presentation is expected to provide the participants with inspiration useful to get started and identify valuable goals.

4. Goal brainstorming session

As an initial step in the development of a goal set for the team, a brainstorming session is recommended. To start the brainstorming, all individuals reflect and generate ideas for possible team goals. By letting them think individually, all participants are activated and they get to think freely without influencing each other's ideas. Additionally, individual brainstorming leads to generation of a bigger number of ideas, which is beneficial in order to develop a comprehensive goal set. In an attempt to ease the development of a goal set that covers all relevant aspects, it is recommended to encourage the participants to deliver goal ideas within all goal dimensions. However, it shall not be forced to generate ideas within all of them.

After individually generating goal ideas, the brainstorming session is recommended to continue with a clustering of the proposals. The aim of this step is to find potential patterns and categorize the ideas for team goals. To enable all participants to engage in the clustering, and ease the visualization of the three goal dimensions in step 6, the whiteboard should be split to separate the goal dimensions. Clustering the ideas related to the goal dimensions in separate enables smaller groups to work within the different dimensions in parallel.

5. Formulation of goals

To ensure that the goals keep the correct focus, it is crucial to make use of the initial goal ideas when formulating finalized goals. Therefore, it is recommended to instruct the participants to thoroughly read through all ideas prior to formulation. The goals should be formulated for each cluster and isolated ideas within the three dimensions, preferably on the whiteboard. As the step is finalized, the goals can be visualized on the whiteboard in place of the initial ideas.

6. Selection of goals

A voting session is recommended in order to prioritize the goals on relevance and eventually arrive at a feasible number of goals. It is crucial that goals considered to be irrelevant are removed from the goal set to avoid redundant work and confusion. If a team has arrived at a large number of finalized goals, some may have to be eliminated in spite of relevance to the team.

To ensure that consensus among the participants and that a comprehensive set of goals is reached, it is recommended that the goals are overviewed in relation to the goal dimensions. This is also an opportunity to reformulate or remove goals as well as complement the goal set if anything is considered to be missing.

Phase 2: Identification of Information

7. Discussion of underlying needs

A discussion of the needs behind the goals is recommended to help the participants in upcoming steps. A thorough understanding of why the goals are established will help the participants determine how the goals can be fulfilled. In the remaining steps it is recommended to divide the goals among smaller groups, to enable everyone to participate. The groups are recommended to discuss the underlying needs of the allocated goals using the Five Why Tool. However, the participants should be clearly instructed to use the tool as guidance rather than a restriction. To make use of the discussions in upcoming steps, note-taking should be encouraged.

8. Generation of strategies

To concretize and ease the team's striving towards the goals, it is recommended to decide on strategies for how to achieve the goals in the set. This strategy generation starts with all participants individually writing down strategy proposals to the goals they have been allocated in the previous step. Letting the team think and generate ideas for strategies individually, helps to get all participants activated, gather a larger number of proposals and avoid the team members to influence each other's ideas. After the idea generation, the participants turn to their smaller groups from the discussion of underlying needs and share their strategy proposals. The

smaller groups then discuss all options, elaborates on relevant proposals and choose the best strategy for each of their allocated goals. Lastly, a sharing session with the whole team is recommended where all groups presents their selected strategies and the reasoning behind them. This sharing session further invites to discussions regarding the selected strategies, before the team agrees on what strategies to use. This final agreement is important to make all team members feel a sense of ownership regarding all strategies, not only the ones they have worked with within the smaller groups, and to increase motivation to follow the strategies.

9. Generation of information proposals

Identifying the information needed to track the fulfillment of goals is recommended as the final step before the metric formulation. The outcome of this step provides the foundation of the formulation of metrics. Thus, it is crucial that any ambiguity regarding what to deliver is avoided. The participants should be clearly instructed to generate points of information, not solutions, and aim to deliver as many as possible. Following the structure in the previous steps, the participants continue with the goals allocated to their group. To enable everyone to participate and create an extensive foundation for the metric formulation, all participants are requested to individually generate information at this stage.

Phase 3: Definition of Team Metric Set

10. Formulation of metrics

To create pre-requisites for formulating useful metrics, it is crucial that the goals, the accompanying strategies and related information are well understood. Thus, it is recommended that the participants continue working with the same goals that they have discussed in previous steps. Using the goals, strategies and information proposals the smaller groups are now to formulate metrics that help the team track if they are proceeding in fulfilling their goals. This is done by first overviewing the information proposals and choosing the information that in the best way reflects the progress towards the goal. Then the participants elaborate on this information and define the specific metric. Before deciding whether to include the metric in the final metric set, the participants are recommended to check if the metric is helpful for the team in fulfilling their goal. This process is then repeated for all goals until the metric set is complete. Upon formulation of metrics, the smaller groups share their metrics with the entire team to ensure consensus among all members.

To guide the team in their formulation of metrics, it is recommended to provide the participants with clear instructions on what to deliver. In particular, the metric should include a specific data point, its time perspective and form of numbers (e.g. average, accumulated). In order to enhance the usefulness, the participants are also recommended to consider how the metric could be visualized and integrated into the team routine.

When circumstances change and the metric set shifts out of relevance, the procedure is to be repeated. The iterativity of the procedure is in line with the agile approach and enables the team to continuously acquire relevant feedback to support their improvement.

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Appendices

Appendix 1. Workshop Instructions Procedure 1

<u>Workshop 1: Goal Setting</u>

The purpose of this workshop is to define team goals as a starting point in the development of metrics. The material needed: 1 printed workshop instruction to each participant, yellow post-its, pink post-its, blue post-its, 1 red pen, 1 blue whiteboard pen, 1 green whiteboard pen, 1 red whiteboard pen, regular pens to all participants, Template 1.1 Goal Formulation.

STEP 1: Introduction of workshop

STEP 2: Purpose of the job

- Take a few minutes to discuss why your job as a team exists.
- Nothing is written down.

STEP 3: Collecting data

- Question: What are our key tasks and key areas?
    - What do we do/need in order to fulfil our purpose?
    - Key tasks: what do we do?
    - Key areas: what do we need? (important circumstances/aspects)
- Presentation of goal dimensions
- Each participant writes ideas on post-its (one idea per post-it). Try to write at least 6 ideas each.
    - Do not overthink, write down whatever pops into your head. It is better to have too many than too few ideas.
    - Write more than one word, but not necessarily a complete sentence.
- Hand in all post-its.

STEP 3: Clarifying the meaning

- Everyone takes place in front of the board to be able to read all ideas.
- All post-its are read out loud one by one to establish a common understanding.
- If needed the post-it is clarified with a short explanation in red.

STEP 4: Grouping

- Everyone participates in finding patterns among key tasks and key result areas, the post-its are then relocated to create clusters.
    - The post-its can be moved several times by different individuals before consensus is established.

- o Try not to put more than 3 post-its in a group. If one idea is isolated, it is accepted to leave it alone.
- Write a label for each group containing more than one idea. The heading should represent the ideas below.
- If needed, grouping is repeated one more time.

STEP 5: Prioritization of key tasks and key areas

- Each participant votes for the goals they find the most important. This is done by assigning points to the top most important ideas according to the following system.
  - o Red: 3 points (most important)
  - o Blue: 2 points (second most important)
  - o Green: 1 point (third most important)

STEP 6: Define goals

- The team is provided with X minutes to discuss and finally decide on goals for each key task/area.
  - o Use *Template 1.1 Goal Formulation* to specify goals.

Workshop 2: Identify Data & Information

The purpose of this workshop is to identify data and information needed to help fulfil our goals. The material needed: 1 printed workshop instruction to each participant, pens to all participants, Template 1.2 Underlying Needs and Root Questions, Template 1.3 Information and Data Proposals.

STEP 1: Introduction of workshop

STEP 2: Understand underlying needs

- Groups of 3 people are created and each is allocated goals from the last workshop
- Use Five Why Tool to discuss the underlying need behind each goal
- Feel free to take notes, not required but could be useful.
- Use *Template 1.2 Underlying Needs and Root Questions*.

STEP 3: Formulate Root Question

- Continue in the same groups. Each group generates a root question per goal based on the underlying need.
- Test root question with the 3 questions in Table 1.
- When you have come up with a good root question, write it on the template. Use *Template 1.2 Underlying Needs and Root Questions*.

Table 1. Tests for root questions.

	Question	How to interpret answer
Test 1	"Is the "root" question actually asking for information, measures, or data?"	If yes, then the question might not be a good root question. A root question shall address the underlying need for information, measures or data, but not directly express a request for data.
Test 2	"Is the answer to the question going to be simple?"	If yes, the question might not be a good root question. A good root question shall not be possible to answer with yes or no.
Test 3	"How will the answer be used?"	If there are no predefined expectations on how to use the answers, then the question might not be a good root question.

STEP 4: Share with the group

All groups share the needs and root questions they have come up with in short.

STEP 5: Information and data proposals

- Each individual writes suggestions on data and information needed to answer the root questions. Start with the ones you have worked on.
- Use *Template 1.3 Information and Data Proposals*.

Workshop 3: Specifying Metrics

The purpose of this workshop is to specify the metrics needed to help fulfil our goals and discuss how these can be used. The material needed: 1 printed workshop instruction to each participant, pens to all participants, whiteboard pen, overview of the team goals in relation to the goal dimensions, Hand-out 1.1 Metric Definition, Template 1.4 Metric Definition.

STEP 1: Introduction of workshop

STEP 2: Evaluate relevance of goals

- Everyone takes a few minutes to read through the stated goals and decide on the relevance of each.
- Each individual marks all goals they find relevant by placing a dot next to it on the whiteboard.
- If any goals are found to be irrelevant after the voting, they are eliminated from the team goal set.

STEP 3: Compare to goal dimensions

- An overview of all goals in relation to the goal dimensions are shown to the team.
- The team now has the possibility to add complementary goals if needed to cover all relevant aspects.
- If satisfied, move on to the next step of the workshop.

STEP 4: Metrics definition

- The team is given a short introduction on how to define metrics and what to consider in the process.
- The team is divided into smaller groups and assigned a few goals each. For each goal, one or more metrics are to be formulated.
- Use the following steps as well as the provided hand-out and template when specifying your metrics.

A) The goals and information proposals are carefully read through on *Hand-out 1.1 Metric Definition*.

B) Start with one goal, the group discusses which information that could be most valuable when fulfilling the goal. Take inspiration from the existing ones and discuss if there are other alternatives.

C) Based on the information you find most relevant in fulfilling the goal, formulate specific metrics on *Template 1.4 Metric Definition* using Table 1 below.

Table 1. Aspects to consider when formulating a metric.

Consider the following when specifying metrics:		
1) In what form should the numbers be presented to bring most value? *Average, median, accumulated, single data points*	2) Which time perspective should be used to bring most value? *Weekly, monthly, sprintly*	3) How should the data be presented to bring most value? *Trends over time, status in relation to condition*

D) Check that the metrics are helpful in fulfilling the goal, otherwise re-formulate. Move on to the next goal and repeat procedure from step B.

STEP 5: Visualization and usage of metrics

Within the smaller groups, discuss how each metric could be visualized and integrated into the team routine to support improvements.

Appendix 2. Distribution Material Procedure 1

The distribution material is included in the appendix to support the procedure to be repeated, as well as provide complete transparency regarding its outline. The templates have been shortened to eliminate superfluous repetitions of information, but still display its original structure. N.B: For future use, the templates need to be adjusted by repeating the sections.

Template 1.1 Goal Formulation
Workshop 1 step 6

Use this template to fill in the goals related to each key task/area. One template for the entire team. The template should be adjusted to match the number of defined key tasks/areas.

Key task/area:_____

Related goals:

_____

_____

_____

Key task/area: _____

Related goals:

_____

_____

_____

Additional Goals:

_____

_____

Template 1.2 Underlying Needs and Root Questions
Workshop 2 step 2 & 3

Use this template to take notes when discussing the underlying needs and formulating root questions. One template per group of approximately three persons. The template should be adjusted to match the number of defined goals allocated to each group.

Goal: _____

Notes Underlying Need:

_____

_____

_____

Root Question: _____

Goal: _____

Notes Underlying Need:

_____

_____

_____

Root Question: _____

Template 1.3 Information and Data Proposals
Workshop 2 step 5

Use this template to formulate information proposals related to each root question. One template per individual. The template should be adjusted to match the number of formulated root questions in the previous step.

Root Question: _____

Information and data proposals:

- _____
- _____
- _____

Root Question: _____

Information and data proposals:

- _____
- _____
- _____

Root Question: _____

Information and data proposals:

- _____
- _____
- _____

Template 1.4 Metric Definition

Workshop 3 step 4

Use this template to formulate metrics related to each goal. One template per group of approximately three persons. The template should be adjusted to match the number of goals allocated to each group.

Goal: _____

Metrics: _____

_____

_____

_____

Goal: _____

Metrics: _____

_____

_____

Hand-out 1.1 Metric Definition

Workshop 3 step 4

Use this hand-out to ease the formulation of specific metrics. The goals are evenly divided among groups of approximately three persons.

Development

Goal: To meet target costs
Root question: How can we save money by selecting parts and solutions with quality and safety in mind, and also satisfy the markets?
Information Proposals:

- Relation between estimated/calculated costs and target costs
- Supplier solutions (product specifications)
- Cost breakdowns
- Supplier evaluation material

Goal: Deliver in time according to time plan
Root question: How do we make sure we deliver our product in time with the right planning strategy to fit in Volvo's launch strategy?
Information proposals:

- Detailed delivery plans
- Delivery dates
- Supplier time plan
- Volvos time plan
- Development chain

Goal: Deliver functional products according to specification
Root question: How do we collect user cases in order to create a proper specification?
Information proposals:

- Customer feedback
- Updated specifications
- Updated usecases (with references from old cars)
- Customer satisfaction reports

Work Environment

Goal: Fulfil code of conduct
Root question: How do we make sure that employees and consultants behave correctly at work?
Information proposals:

- Records of performed Code of conduct E-learning.
- Complaints to TM or HR to log incorrect behavior
- Violation reports

Goal: High motivation
Root Question: How can we have higher productivity?
Information proposals:

- Timeliness of delivery
- Storypoints finished
- Overtime hours
- Number of meetings vs action
- Stress levels (winning temp)
- Perceived meaning of work
- Proudness of work

Inspiration

- Experienced motivation of team members

Collaboration

Goal: Ensure efficient and effective collaboration both internally and externally
Root Question: How do we reduce obstacles & friction at work?
Information proposals:

- current work situation of employees
- Obstacle awareness
- Waiting times (for answers)
- Time to resolve misunderstandings

Inspiration:

- Experienced collaboration during the sprint within the team
- Experienced collaboration during the spring with other teams
- Team opinion regarding if you have helped each other during the sprint

---

Requirements

Goal: Customer Satisfaction
Root question: How do we make more turnover by increasing customer satisfaction? How can we make sure our customers are satisfied?
Information proposals:

- Customer needs (from surveys/polls)
- Quality overview
- Number of customer complaints

Inspiration

- Customer feedback

Goal: Clear requirements
Root question: How do we make clear requirements to enhance customer satisfaction? How can we ensure clear requirements to avoid misunderstandings?
Information proposals:

- Clear functions
- Customer centric requirements

Inspiration:

- Number of occasions where requirements are misunderstood

Communication

Goal: Ensure clear and good communication, internally and externally
Root question: How does clear/good communication relate to reduced costs and increased customer satisfaction? How do we communicate to avoid losing information?
Information proposals:

- Happiness of employees
- Information about occurred mistakes (from not having all info)
- Costs of misunderstandings
- Time spent filing issues linked to interpretation
- Number of customers affected by problems

Inspiration:

- Experienced communication within the team
- Experienced communication with other employees
- Team opinion regarding waiting times for responses

Appendix 3. Workshop Instructions Procedure 2

Workshop 1: Goal Setting

The purpose of this workshop is to define team goals as a starting point in the development of metrics. The material needed: 1 printed workshop instruction to each participant, yellow post-its, pink post-its, blue post-its, 1 red pen, 1 blue whiteboard pen, 1 green whiteboard pen, 1 red whiteboard pen, regular pens to all participants, 1 copy of goal dimensions to each participant, Template 2.1 Goal Formulation.

STEP 1: Introduction of workshop

STEP 2: Collecting data

- Each participant writes goal ideas on post-its (one idea per post-it). Try to write at least 3 ideas per goal dimension. It is not necessary to write ideas for self-leadership, but it is welcome.
    - Do not overthink, write down whatever pops into your head. It is better to have too many than too few ideas.
    - Write more than one word, but not necessarily a complete sentence.
- Hand in all post-its.

STEP 3: Clarifying the meaning

- Everyone takes place in front of the board to be able to read all ideas.
- All post-its are read out loud one by one to establish a common understanding.
- If needed the post-it is clarified with a short explanation in red.

STEP 4: Grouping

- Everyone participates in finding patterns among goal ideas, the post-its are then relocated to create clusters.
    - The post-its can be moved several times by different individuals before consensus is established.
    - Try not to put more than 3 post-its in a group. If one idea is isolated, it is accepted to leave it alone.
- Write a label for each group containing more than one idea. The heading should represent the ideas below.
- The groups and isolated ideas form categories to use in the following.

STEP 5: Specify goals

- Specify one or more goals for each category.
- Try to make the goals as specific as possible. This will ease the process later on.
- Use *Template 2.1 Goal Formulation*.

STEP 6: Prioritization of goals

- Each participant votes for the goals they find the most important. This is done by assigning points to the top most important ideas according to the following system.
    - Red: 3 points (most important)
    - Blue: 2 points (second most important)
    - Green: 1 point (third most important)

Workshop 2: Identify Data & Information

The purpose of this workshop is to identify data and information needed to help fulfil our goals. The material needed: 1 printed workshop instruction to each participant, pens to all participants, Template 2.2 Strategy Proposals, Template 2.3 Information and Data Proposals.

STEP 1: Introduction of workshop

STEP 2: Underlying needs

- Groups of 3 people are created, and each is allocated goals from the last workshop.
- Use Five Why Tool to discuss the underlying need behind each goal.

STEP 3: Strategy proposals

- Continue in the same groups. Each individual writes suggestions on strategies for how to fulfil the goals.
- Use *Template 2.2 Strategy Proposals*.
- Within the smaller group, decide on top 2 strategies.

STEP 4: Share with the group

- All groups share the underlying needs in short and present top strategies they have come up with.
- Now the whole team picks the most promising strategy for each goals. Mark the chosen strategy on the template.

STEP 5: Information and data proposals

- Each individual writes suggestions on data and information needed to track the progress in fulfilling the goals. Start with the ones you have worked on.
- Use *Template 2.3 Information and Data Proposals*.

Workshop 3: Specifying Metrics

The purpose of this workshop is to specify the metrics needed to help fulfil our goals and discuss how these can be used. The material needed: 1 printed workshop instruction to each participant, pens to all participants, whiteboard pen, overview of the team goals in relation to the goal dimensions, Hand-out 2.1 Metric Definition, Template 2.4 Metric Definition.

STEP 1: Introduction of workshop

STEP 2: Evaluate relevance of goals

- Everyone takes a few minutes to read through the stated goals and decide on the relevance of each.
- Each individual marks all goals they find relevant by placing a dot next to it on the whiteboard.
- If any goals are found to be irrelevant after the voting, they are eliminated from the team goal set.

STEP 3: Compare to goal dimensions

- An overview of all goals in relation to the goal dimensions are shown to the team.
- The team now has the possibility to add complementary goals if needed to cover all relevant aspects.
- If satisfied, move on to the next step of the workshop.

STEP 4: Metrics definition

- The team is given a short introduction on how to define metrics and what to consider in the process.
- The team is divided into smaller groups and assigned a few goals each. For each goal, one or more metrics are to be formulated.
- Use the following steps and the provided template when specifying your metrics.

A) The goals and information proposals are carefully read through on *Hand-out 2.1 Metric Definition*.

B) Start with one goal, the group discusses which information that could be most valuable when fulfilling the goal. Take inspiration from the existing ones and discuss if there are other alternatives.

C) Based on the information you find most relevant in fulfilling the goal, formulate specific metrics on *Template 2.4 Metric Definition* using the Table 1 below.

Table 1. Aspects to consider when formulating a metric.

Consider the following when specifying metrics:		
1) In what form should the numbers be presented to bring most value? *Average, median, accumulated, single data points*	2) Which time perspective should be used to bring most value? *Weekly, monthly, sprintly*	3) How should the data be presented to bring most value? *Trends over time, status in relation to condition*

D) Check that the metrics are helpful in fulfilling the goal, otherwise re-formulate. Move on to the next goal and repeat procedure from step B.

STEP 5: Visualization and usage of metrics

- Within the smaller groups, discuss how each metric could be visualized and integrated into the team routine to support improvements.

Appendix 4. Distribution Material Procedure 2

The distribution material is included in the appendix to support the procedure to be repeated, as well as provide complete transparency regarding its outline. The templates have been shortened to eliminate superfluous repetitions of information, but still display its original structure. N.B: For future use, the templates need to be adjusted by repeating the sections.

Template 2.1 Goal Formulation
Workshop 1 step 5

Use this template to fill in the goals related to each category. One template for the entire team. It is recommended that the template fits at least 10 categories, but it could be beneficial to have one extra template at hand.

Category: _____

Goals:

_____

_____

_____

Category: _____

Goals:

_____

_____

_____

Template 2.2 Strategy Proposals
Workshop 2 step 3

Use this template to formulate strategy proposals related to each goal. One template for each individual. The template should be adjusted to match the number of allocated goals.

Goal: _____

Strategy proposals:

- _____
- _____
- _____
- _____

Goal: _____

Strategy proposals:

- _____
- _____
- _____
- _____

Template 2.3 Information and Data Proposals
Workshop 2 step 5

Use this template to formulate information proposals related to each goal. One template per individual. The template should be adjusted to match the number of allocated goals.

Goal: _____

Information and data proposals:

- _____
- _____
- _____

Goal: _____

Information and data proposals:

- _____
- _____
- _____

Goal: _____

Information and data proposals:

- _____
- _____
- _____

Template 2.4 Metric Definition
Workshop 3 step 4

Use this template to formulate metrics related to each goal. One template per group of approximately three persons. The template should be adjusted to match the number of goals allocated to each group.

Goal: _____

Metrics: _____

_____

_____

_____

Goal: _____

Metrics: _____

_____

_____

_____

Hand-out 2.1 Metric Definition
Workshop 3 step 4

Use this hand-out to ease the formulation of specific metrics. The goals are evenly divided among groups of approximately three persons.

Knowledge Sharing

Goal: Learn each other's role to have a possibility to help each other.

Strategy: Role exchanges

Information proposals:

- Project status (if there are some important deadline or delivery)

Inspiration

- Hours spent on tasks outside regular role boundaries
- Storypoints finished outside regular role boundaries
- Number of experience sharing occasions
- Team opinion regarding if you have helped team members with tasks outside your roles this sprint

---

Goal: No planned work in IP-sprint.

Strategy: Using IP sprint for training and learning

Information proposals:

- Project status (if there are some important deadline or delivery)

Inspiration

- Hours spent on regular work tasks in IP-sprint
- Storypoints finished during IP-sprint
- Team opinion regarding if you have used the IP-sprint in a useful/valuable way this time

---

Commitment

Goal: Plan for 80% of velocity

Strategy:

- Be more strict in PI-planning and learn other things

Information Proposals:

- Velocity of the team for each sprint
- Planned activities
- Completed activities
- Previous task progress
- Development progress trend

Create smaller tasks

Goal: Break down stories, avoid storypoints over 5 points

Strategy:

- Discuss in the team and set better Acceptance Criteria

Information Proposals:

- Total story points / Number of tasks
- Get bigger picture (to split task better)
- Number of points you can do in one sprint

Inspiration

- If any task has over 5 points

Identify risks

Goal: Review the task earlier

Strategy:

- Notify management and ask for help if problem.

Information proposals:

- Data from earlier tasks
- Sequence the risk
- Risk register

Inspiration

- Time elapsed between receiving a task and reviewing the risks
- How many risks are detected in time
- How many risks are detected too late

Communication

Goal: To be more synchronized with other groups

Strategy: Communicate as soon as possible and have weekly meetings to follow up items and find dependencies

Information proposals:

- Priority of other teams

Inspiration

- Team opinion regarding perceived communication (well in some sprints, maybe poor in sprints where many misunderstandings occurred)

Appendix 5. Participant Instructions for Recommended Procedure

<u>Phase 1: Goal Setting</u>

The purpose of this phase is to define a goal set relevant to the team. Based on the situation and needs of the team, the participants reflect on improvement opportunities and agree on a set of team goals.

STEP 1: Introduction of procedure

STEP 2: Discussion of team purpose

Take a few minutes to discuss why your job as a team exists as well as your key responsibilities. Nothing needs to be written down.

STEP 3: Presentation of goal dimensions

An introduction of the goal dimensions is presented by the facilitator to give inspiration.

STEP 4: Goal brainstorming session

A) Collection of data

- An introduction of the goal dimensions is presented by the facilitator to give inspiration.
- Each participant reflects individually and writes goal ideas on yellow post-its (one idea per post-it). Write as many ideas as possible, preferably within all goal dimensions. Do not overthink, write down whatever pops into your head. It is better to have too many than too few ideas.
- Write more than one word, but not necessarily a complete sentence.
- Hand in all post-its.

B) Clustering of data

- The board is divided into three sections, one for each goal dimension: Efficiency, Team Support, and Self-Leadership. The post-its are placed in the right category on the board.
- Everyone participates in finding patterns among goal ideas, the post-its are then relocated to create clusters within each goal dimension.
  - o The post-its can be moved several times by different individuals before consensus is established.
  - o Try not to put more than 3 post-its in a group. If one idea is isolated, it is accepted to leave it alone.
  - o Any unclear goal ideas are to be clarified.
- Write a label for each group containing more than one idea on pink post-its. The heading should represent the ideas below.

- The groups and isolated ideas form categories to use in the following.

STEP 5: Formulation of goals

- Formulate one or more goals for each category or isolated idea by carefully considering the related goal ideas. The goals for each category are written on the board within the right goal dimension.
- Try to make the goals as specific as possible. This will ease the process later on.

STEP 6: Selection of goals

- Each participant votes on the goals they find the most important. This is done by assigning points to the top most important ideas according to the following system. The goals considered irrelevant after the voting are excluded from the goal set.
  - Red: 3 points (most important)
  - Blue: 2 points (second most important)
  - Green: 1 point (third most important)
- The selected goal set is overviewed in relation to the goal dimensions to determine whether the set is comprehensive enough. The team now has the possibility to add complementary goals if needed to cover all relevant aspects. If satisfied, move on to the next step of the workshop.

Phase 2: Identification of Information

The purpose of this phase is to concretize goal fulfilment. By determining strategies for goal fulfillment, the information needed to track goal fulfillment can be identified.

STEP 7: Discussion of underlying needs

- Groups of approximately 3 people are created, and the goals are divided among the smaller groups.
- Use Five Why Tool to discuss the underlying need behind each goal to understand why it is important, and take notes on *Template 3.1 Underlying needs and Strategies.*

STEP 8: Generation of strategies

A) Formulation of strategy proposals

- Continue with the goals allocated to your group. Each individual writes suggestions on strategies for how to fulfil these goals, use *Template 3.1 Underlying Needs and Strategies.*
- Within the smaller group, all individuals share their strategy proposals. Discuss all options to eventually arrive at a suitable strategy. This selected strategy is written down at the template.

B) Sharing session

- All groups share the recommended strategy, and the reasoning behind, to each allocated goal with the whole team. Members of the team now have the opportunity to question the selected strategies and initiate discussions. Only when consensus is reached, move on to the next step.

STEP 9: Generation of information proposals

- Continue with the goals allocated to your group. Each individual writes suggestions on information needed to track the progress in fulfilling the goals.
- Use *Template 3.2 Information Proposals*.

Phase 3: Definition of Team Metric Set

The purpose of this phase is to decide on a team metric set that will track goal fulfillment and support team improvement.

STEP 10: Formulation of metrics

Continue working with the allocated goals within the smaller groups. For each goal, one or more metrics are to be formulated. Use the following steps and the provided template when specifying your metrics.

A) Discuss information proposals

The smaller group reads through all goals, as well as accompanying strategies and information proposals. Start with one goal, the group discusses which information that could be most valuable when fulfilling the goal. Take inspiration from the existing information proposals and discuss if there are other alternatives.

B) Formulate a specific metric

Based on the information you find most relevant in fulfilling the goal, formulate specific metrics on *Template 3.3 Metric Definition* using Table 1 below.

Table 1. Aspects to consider when formulating a metric.

Specify the following regarding your metric:		
1) What specific data point is to be measured?	2) In what form should the numbers be presented to bring most value? *Average, median, accumulated, single data points or other*	3) Which time perspective should be used to bring most value? *Weekly, monthly, sprintly or other*

C) Check usefulness

Check that the metrics are helpful in fulfilling the goal and can support team improvement, otherwise re-formulate. Move on to the next goal and repeat procedure from step A.

D) Visualization and usage of metrics

Within the smaller groups, discuss how each metric could be visualized and integrated into the team routine to support improvements.

Appendix 6: Facilitator Material for Recommended Procedure

The following material is a complement to the instructions in Appendix 5 and is intended to support the facilitator in leading the procedure. On several occasions throughout the procedure, the facilitator is expected to hold short introductory presentations. The content to include in the presentations along with the material needed for each phase is found below.

Phase 1: Goal Setting

Material needed: 1 printed workshop instruction to each participant, yellow post-its, pink post-its, 1 blue whiteboard pen, 1 green whiteboard pen, 1 red whiteboard pen, regular pens to all participants, 1 copy of goal dimensions to each participant.

Preparation: Place one workshop instruction, one pen and a bunch of yellow post-its in front of each seat. Divide the board into three sections of equal size, one for each goal dimension. Write the name of each goal dimension at the top of each section.

STEP 1: Introduction of procedure

Before starting the first phase, the facilitator should give a short introduction of the whole procedure, including:

- A clarification of the benefits the team will acquire from conducting the procedure, in particular: the opportunity to reflect on team issues and formulate team goals, as well as acquire metrics that provide helpful feedback to support and improve their team.
- An overall description of the whole procedure with focus on the three main phases. Each main phase and its outcome as well as how they contribute to the development of a final metric set are briefly described. Table 1 presents a summary of the purpose, outcome and contribution of each phase.

Table 1. Purpose, outcome and contribution of each main phase

	Purpose	Outcome	Contribution
Goal Setting	To define a goal set relevant to the team. Based on the situation and needs of the team, the participants reflect on improvement opportunities and agree on a set of team goals.	An understanding of team improvement opportunities and a set of team goals.	The goal set provides the basis for all upcoming steps. Based on the team goals, metrics will eventually be derived to support the team in fulfilling them.
Identification of Information	To concretize goal fulfilment. By determining strategies for goal fulfillment, the information needed to	Goal fulfilment strategies, and information proposals for tracking goal fulfillment.	Identification of information is an essential transition phase to ease the movement from goal to metric. The information proposals will provide input in the metric

	track goal fulfillment can be identified.		formulation. Understanding what information that could be used to track goal fulfilment eases the formulation of specific metrics in upcoming phase.
Definition of Team Metric Set	To decide on a team metric set that will track goal fulfillment and support team improvement.	A team metric set, as well as an understanding of how to use and integrate it into the team routine.	Based on the contributions of previous phases, the metric set is defined and the procedure is finalized.

Phase introduction: An overview of the steps included in the first phase, as well as brief clarification of the purpose of each step:

- discuss team purpose to break the ice and get into a team-focused mindset
- present the goal dimensions to bring inspiration to the participants and facilitate the creation of a comprehensive goal set
- brainstorm and cluster goal ideas to identify what the team considers important
- formulate goals based on the ideas
- to acquire a relevant and comprehensive set of goals, the goals are prioritized on importance, as well as selected and compare to the goal dimensions.

STEP 3: Presentation of goal dimensions

The dimensions presented in Table 2 should be included in a metric set, therefore it is important to include these in the team goal set. Before initiating the data collection, the participants shall be given an introduction of these to get inspired and ease the creation of a comprehensive goal set. The value of having a comprehensive set of metrics is to provide the team with feedback that captures various relevant aspects of their work. The more comprehensive, the better it reflects the situation of the team. This insight needs to be transferred to the team.

Table 2. Overview of the goal dimensions

Efficiency (How we do our job)	**Team Support** (What we need to do our job)	**Self-Leadership** (How we lead ourselves in doing our job)
This dimension considers: - Cost - Time - Resource Allocation - Quality of processes - In-process efforts	This dimension considers: - Employee Satisfaction - Training - Work Environment - Reward - People Skills - Mindedness	This dimension considers: - Project Status - Planning - Goal Attainment - Priority Setting

• Communication with customers • Resolution of problems • Ease of doing business • Cash Management • Productivity • Success at providing renewal	• Reliability • Potential for promotion • Support • Resources allocated to innovation • Preconditions for innovation	

STEP 6: Selection of goals

Based on the results of the voting, the goals to include in the set shall be selected. It is recommended to include approximately 8 goals, but it is up to the facilitator to determine which of the goals to include in the specific case. To make the goal set feasible, it should not include more than 10 goals.

Phase 2: Identification of Information

Material needed: 1 printed workshop instruction to each participant, pens to all participants, Template 3.1 Underlying Needs and Strategies, Template 3.2 Information Proposals.

Phase introduction: The purpose of this phase is to concretize goal fulfilment. By determining strategies for goal fulfillment, the information needed to track goal fulfillment can be identified. An overview of the steps included in the second phase, as well as brief clarification of the purpose of each step:

- discuss the underlying need to understand why the goals are important
- generate strategies to concretize how to fulfil the goals
- identify information needed to track goal fulfilment

STEP 7: Discussion of underlying needs

Introduce the Five Why Tool as a method to evolve the reasoning behind the goals and truly understand why the goal is important. The question "why" is asked five times, for each iteration the statement is evolved one step further. An example is presented in Table 3 to illustrate how the tool works. It should be noted that this example is based on a goal on an organizational level, not on team level. It is recommended to show an example like this to the participants to clarify the use of the tool without influencing their reasonings.

Table 3. Example to illustrate the use of Five Why Tool

Goal: Recruit more people to our company

Why? Because we need more people

Why? Because we have too much to do

Why? Because the workload is starting to affect the quality of our products

Why? Because now we have to deliver larger volumes

Why? Because we are expanding our sales volumes and cannot keep up

It is crucial that the participants are instructed to evolve the reasoning within the scope of the team and use the tool merely to guide their reasoning, not limit them. They do not necessarily have to evolve the reasoning exactly five times, it could be both less and more. The point is that they truly understand the underlying need behind the goals within the scope of the team.

STEP 9: Generation of information proposals

Some instructions are needed before the participants start generating information proposals. Clearly state that the participants are to deliver proposals on information that could help the team determine if they proceed in fulfilling the goals. This should not be confused with delivering solutions on how to fulfil the goals, as they did in the previous step. It is recommended to provide the participants with an example like the one illustrated in Table 4.

Table 4. Example to illustrate the relation between goal, underlying need, strategy and information proposals

Goal: Recruit more people to join our company

Underlying Need: Our sales volumes are expanding. We need to avoid too heavy workload for our employees to deliver high quality products.

Strategy: Recruit in a pace that stabilizes working hours at a desirable level without jeopardizing the quality of our products.

Information needed:

- Workload status
- The need for recruitment
- Quality Control reports

Phase 3: Definition of Team Metric Set

Material needed: 1 printed workshop instruction to each participant, pens to all participants, filled out Template 3.1 Underlying needs and strategies, filled out Template 3.2 Information Proposals, Printed Template 3.3 Metric Definition.

Phase introduction: The purpose of this phase is to decide on a team metric set that will track goal fulfillment and support team improvement. The team is given a short introduction on how to define metrics and what to consider in the process. Shortly present the step-guide (A-D) to the participants and ensure that they understand each step. Regarding STEP D, the participants

should be instructed to discuss when to follow up on the metrics. This could vary between the metrics; some might be relevant to track often (e.g. at Daily Stand-up) while others are suitable to review less frequently (e.g. at Sprint Retrospective or IP-planning). The participants should also consider how the data shall be presented to bring most value (e.g. trend over time or status in relation to condition). It is recommended to document the integration routine.

It is recommended to present an example to the participants to clarify what they are expected to deliver. See the example in Table 5 below. It should be mentioned to the participants that metrics could represent both qualitative and quantitative information, as shown in the example.

Table 5. Example to illustrate the formulation of specific metrics

---

Goal: Recruit more people to join our company

Underlying Need: Our sales volumes are expanding. We need to avoid too heavy workload for our employees to deliver high quality products.

Strategy: Recruit in a pace that stabilizes working hours at a desirable level without jeopardizing the quality of our products.

Information needed:

- Workload status
- The need for recruitment
- Quality Control reports

Metrics
Perceived working situation

- Specific Data Point: perceived working situation among team members on a scale of 1-5.
- Form of Numbers: Average.
- Time Perspective: Per sprint.

Average employee working hours at department X

- Specific Data Point: Total working hours for department X / number of employees within department X
- Form of Numbers: Average.
- Time Perspective: Per month.

Appendix 7: Distribution Material for Recommended Procedure

Template 3.1 Underlying Needs and Strategies
Phase 2 Step 7 & 8

Use this template to take notes when discussing the underlying needs and formulating root questions. One template per group of approximately three persons. The template should be adjusted to match the number of defined goals allocated to each group.

Goal: _____

Notes Underlying Need:

_____

_____

_____

Strategy Proposals:

- _____
- _____
- _____

Selected Strategy: _____

Template 3.2 Information Proposals

Phase 2 step 9

Use this template to formulate information proposals related to each goal. One template per individual. The template should be adjusted to match the number of allocated goals.

Goal: _____

Information and data proposals:

- _____
- _____
- _____

Goal: _____

Information and data proposals:

- _____
- _____
- _____

Goal: _____

Information and data proposals:

- _____
- _____
- _____

Template 3.3 Metric Definition

Phase 3 step 10

Use this template to formulate metrics related to each goal. One template per group of approximately three persons. The template should be adjusted to match the number of goals allocated to each group.

Goal: _____

Metric: _____

    Specific Data Point: _____

    Form of Numbers: _____

    Time Perspective: _____

Goal: _____

Metric: _____

    Specific Data Point: _____

    Form of Numbers: _____

    Time Perspective: _____

Appendix 8: Interview Question Template

Before the interview, please discuss these questions in your group and select a person to represent the team. The representative shall preferably have been present during both workshops.

Questions regarding workshop 1

Procedure 1: During the first workshop you carried out the following: Discussion of the purpose of your team, brainstorming session where you wrote ideas on key tasks/ areas, clustering and prioritization of those, and finally definition of goals within each category.

Procedure 2: During the first workshop you carried out the following: With an understanding of the goal dimensions (efficiency, team support, self-leadership), you generated goal ideas and clustered those on the whiteboard, formulated goals for each category and finally prioritized the goals.

1. What did you think about the workshop?
2. What worked well?
3. What did not work well?
4. Was there any activity that you found difficult?
5. Was there any activity that you found extra important?
6. Was there any activity that you found unnecessary?
7. What did you think about the collaboration in the team?
8. Do you think that these goals represent the team's key tasks and areas in a good way?
9. Do you think that there are any goals that do not bring value to your team? In that case, do you think that the goal has the wrong focus or is it the key area that is not important anymore?

Questions regarding workshop 2

Procedure 1: During the second workshop you carried out the following: understanding underlying need, formulation of root question and generating information and data proposals to answer the root question.

Procedure 2: During the second workshop you carried out the following: discussing the underlying needs, generating strategy proposals and selecting the most relevant one, and finally generating information and data proposals to track the progress of reaching your goal

10. What did you think about the workshop?
11. What worked well?
12. What did not work well?
13. Was there any activity that you found difficult?
14. Was there any activity that you found extra important?

15. Was there any activity that you found unnecessary?
16. What did you think about the collaboration in the team?

Questions regarding workshop 3

Procedure 1 & 2: During the third workshop you carried out the following: evaluated the relevance of goals, compared goal set to goal dimensions (efficiency, team support, self-leadership) and were given the possibility to complement, finally you defined metrics.

17. What did you think about the workshop?
18. What worked well?
19. What did not work well?
20. What did you think about the collaboration in the team?
21. In your opinion, was the instruction useful when defining metrics? (please see step 4 in the attached instruction)
22. Do you think that the metrics could be useful to support the team's work?
23. Do you think that the metrics could be useful to support team improvement?
24. Do you think that the metrics could be useful in fulfilling the goals?

Concluding questions

25. As participants, what is your impression of the overall study?
26. Are there any key takeaways or learnings from these workshops that could be useful for the team moving forward?
27. The three workshops have been carried out every other week. Do you think that the outcome (goals, information, metrics) would have been different if the workshops were closer in time?
28. During the workshops, the steps have been carried out under a slight time pressure. Do you think that the outcome (goals, information, metrics) would have been different without this time constraint?