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Scaling agile on large enterprise level with self-service kits to support autonomous teams

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Abstract — **Organizations are looking for ways of establishing agile and lean delivery processes. In this paper, we propose a particular way which based on self-service kits (SSK's). The SSK approach can be used to share expert knowledge in an agile and scalable way to the teams by offering them approaches, methods and tools with background information about the addressed topic. An SSK is provided as a digital bundle of artifacts that help solving an issue related to agile teams. Built upon the pull-principle, it supports team autonomy during teams' delivery procedures. An SSK addresses generic as well as domain specific topics. As all SSK's share a common structured approach to supporting an agile organization, they help systematically scaling expert knowledge. This leverages establishing best practices elaborated by experts in a large scale organization in a native agile manner. As an SSK is structured as a "how-to" guide including templates for learning by doing, it helps emphasizing quality aspects too. We demonstrate an example of the systematic application of the SSK approach as well as its scaling in the Volkswagen Group IT.**

I. Introduction

To achieve the agile transition of large enterprises, approaches beyond coaching are needed for non-linear scaling. As coaches are limited resources that cannot be easily increased on demand, new ways for scaling agile know-how, methods and tools have to be identified and implemented. The challenge is that people involved in the transition have to learn and understand the new agile mindset with their specific -values and principles [1, 2] and its characteristic approaches. An inherent job of coaches is to facilitate these learning activities and the agile mindset adoption. In this context, the term self-service kit (SSK) shall denote an approach to enabling teams to handle specific topics of their product and service related work. The way of facilitation isagile without team external persons (coaches etc.) by providing relevant knowledge and artifacts in digital form and in a pull-based manner.

The objective of this work is to propose and evaluate such an approach within a large corporate environment. Based on observations of daily business during the facilitation of transitions, we derived the following requirements for approaches which support scaling without direct team-external human integration and interaction:

R1) The scope of the scaled facilitation, deliveries have to be designed as to offer a valuable outcome to the teams.
R2) To ensure scaling, the deliveries have to be completely digitalized and offered anytime (24*7).
R3) Guidance is needed for the teams during application and learning.
R4) Teams need background knowledge about the facilitation delivery to be able to make adaptations to their specific context.
R5) A feedback loop is needed to request an expert like coaches for additional support.
R6) Quality has to be built in the delivery procedure to avoid scaling of errors.

These requirements lead to a combination of different learning and facilitation approaches having to be considered during the development of a solution. In order to do so, we use the design science approach [3], taking into account the R1 to R6 systematically.

Section II introduces related work, section III provides an overview of the SSK approach and section IV characterizes examples of selected SSK's. Section V elaborates an experience report about the SSK application, while section VI concludes and section VII shows next steps and future work.

II. Related work

This section identifies related work based on key topics. The literature research has been conducted in alignment with Webster & Watson [4]. As the term SSK has not been used in literature so far, the search structure has been aligned with related concepts .

A. Blended Learning

Blended learning combines different web-based technologies with various pedagogical approaches. It integrates different instruction approaches and brings together working and training [5]. One of the web-based technologies of e-learning are labs [6]. Labs are used for practical training guided by instructions. However, labs are experimentation environments that normally represent only a limited set of

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real-world scenarios and their contexts. In the case of SSK's, the lab is replaced by the real-life context. Therefore, it is important that both the problem identification and the solution guidance is appropriate in order to avoid significant failures [7] leading to harm [8] either by misguidance, misuse or even by accident. Consequently and according to Bloom's model of learning [9], the minimum SSK objective has to be "applying" rather than "understanding" or even lower, which is typically the minimum learning target for Web-based trainings (WBT). WBT are established approaches to train people online. While WBT's transfer knowledge [10], they do not have the objective of guiding the transfer and re-contextualization of the transferred knowledge to a specific task or entire project. From that perspective, SSK's have learning objectives and maturity expectations that are significantly superior to common WBT. This further augments the need of setting SSK's into an adequate design [11] context, which depends on a lot of influencing factors.

B. Problem Based Learning

Problem-Based Learning (PBL) [12] is a topic related to SSK's because the latter address particular problems while supporting the SSK applicants in solving them. Approaches to providing guidance are analyzed in [13]. The SSK, however, does not pose a particular problem but rather provides the appropriate set of questions to ask to identify a problem in practice, and leverages on this problem identification process to propose methods that help in the problem resolution process motivated by [14]. As design patterns are widely used in industry [15] there is a difference in the application of a pattern to build a product, service or process flow by standardized patterns. The understanding and learning to be able to adopt the methods and tools is offered in SSKs is the additional objective.

C. Learning by Doing

Learning-by-doing is a useful approach in practice and industry [16]. SSK's foster the learning-by-doing method based on goal-based scenarios [17] by adopting a guided approach through the combination with other learning concepts, in particular blended learning. There exist many different blended learning approaches [11]. In this context, the focus is mostly on self-paced and asynchronous formats [18] extended by synchronous online formats for the online meetings of groups to work together on a topic.

D. Scaling Agile

Scaling Agile focuses on establishing a set of agile methods for a building complex systems within an organization [19]. Existing many different approaches for scaling agile with their specific benefits and issues [20]. However most of the established scaling methods and framework do no scope the how to establish the knowledge about the agile mindset and methods in the teams they focus on the demands for methods like [21] and their implementation order like in ASM [22]. Knowledge sharing and improvement is still a topic in scaling agile [23]. Coaching is the preferred knowledge transfer approach like in SAFe [24] with the certificated trainers and role specific trainings [25].

E. Agile Teams Demands

For example, the SAFe Lean-Agile Principle #8 recommends autonomy for employee engagement [26]. Other agile approaches emphasize T-shape [27] skills to form interdisciplinary, independent and autonomous teams. Team autonomy in large-scale corporate organizations is efficient if goals are well defined and transparent on a team-level [28]. For SSK's to be most effective, this implies that they have to support setting and achievement of goals in a effective way [29]. Furthermore, autonomy and self-organizing teams come together and need cross-functionality, which is based on sharing of knowledge [30] that is available both with and outside the teams.

F. Quality and Life-Cycle Management

To assure the quality of learning materials, embedding the latter in a life-cycle is useful [31]. Quality assurance is an established habit for learning materials for distance learning artifacts [32] like for the curriculum and instructions. To achieve organization-wide standardization, a systematic governance has to be established [33]. International standards have been elaborated [34] like for open and distance universities with UNIQUe.

III. Self-Service Kit Approach

To scale agile in an organization without explicit time intensive coaching of all teams SSKs are an alternative know-how transfer approach to the teams. In our context, an SSK is a combination of a web-based training (WBT) [35] and a digital tutorial [36] provided by domain-experts to a large number of – in general – geographically distributed users [37]. A WBT facilitates the delivery of specific knowledge to people needing it or asking for it. This pull of SSKs know-how by the teams supports autonomy. Furthermore the setting supports the agile mindset with the support of develop adoption know-how to enable the teams to enhance SSKs for their specific demands.

An SSK is designed to support teams to do their work with a high quality. To realize this, each SSK has to ensure that the relevant knowledge needed to perform the work is delivered to the team. The SSK approach supports autonomous teams in applying SSK's by its design. This lead to the point that SSK's can be used for autonomous knowledge scaling and as a key element of a flywheel approach for agile transitions. Depending on the individual scope of a specific SSK, the knowledge has to be identified, documented and integrated into supporting artifacts like checklists and other tools. As SSK's shall be used many times and in several different teams and places, assuring a high quality level of SSK's is important to avoid mistakes on a large scale. To this aim, SSK's need a rigorous design, production and delivery procedure, which experts of the specific SSK topic perform. As experts are not always good trainers and educators, they can themselves get support from SSK's for their SSK development. Figure 1

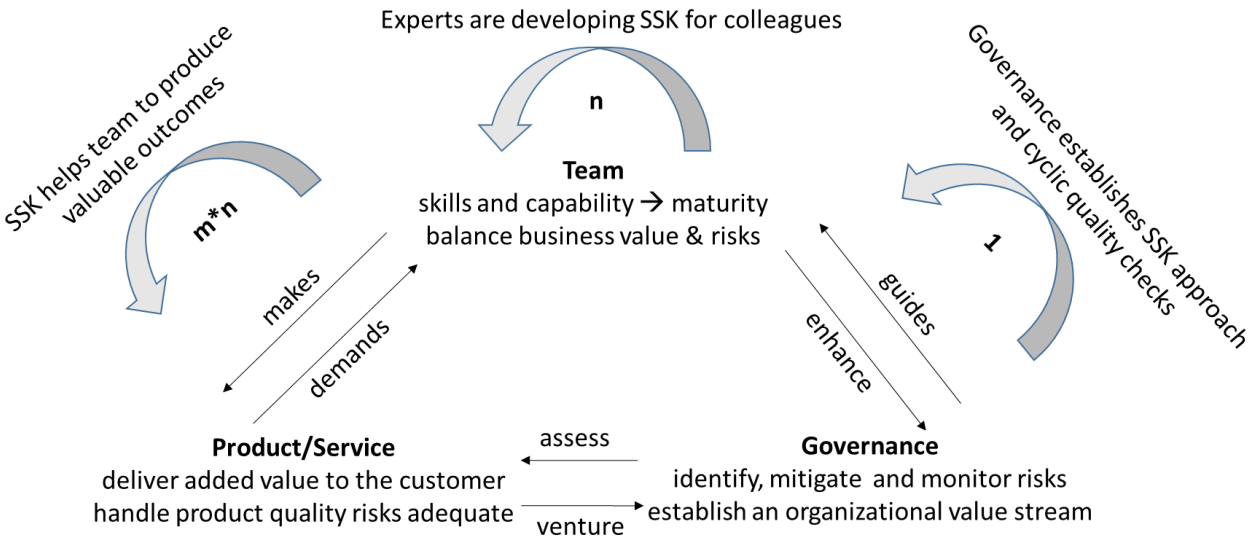

Fig. 1: Value chain of SSK delivery approach by one governance, n SSK's and n*m outcomes.

shows the relation between one (1) governance to a few (n) experts that develop a particular SSK, as well as many (m) applications of that very SSK. The basic structure with governance, team and product/service has been introduced in the context of the enterprise transition approach [38] and is enhanced to the SSK approach for autonomous scaling in this context.

The governance establishes the SSK approach with its development and delivery procedures. This includes templates and platforms for digital delivery of SSK's. Experts of different teams form a *development* team to develop an SSK for a specific topic. As the experts are "grounded" in normal teams of the organization they know about the latter's demands and issues and therefore can address them by design during the SSK development. For different SSK's, different experts work together in expert teams. They also have to ensure the cycle *updates* of the SSK (R5). These updates address feedbacks (R5) for improvement and the alignment with the development of the state-of-the-art (R6). The governance regularly checks that these updates are actually made for all SSK's which are in *delivery*. In case that an SSK has no experts for adequate maintenance, the SSK is marked as "*retired*" by the governance to show all users that they should not use this SSK anymore. Based on this generic approach with the life-cycle states for SSK *development, deliver, update* and *retired,* a framework is established to provide SSK's to the organization (R2).

This setting makes it easy for an organization to start with one lean governance for the SSK framework and scale to as many SSK offers as there are experts who produce and maintain SSK's. The instantiation of each SSK is independent of these in general highly limited human resources as long the SSK is delivered in a digital way to its consumers (users).

From a quality perspective and with respect to the objectives they want to help achieve, three types of SSK's shall be distinguished (R1):

- Product quality: the SSK's objective is to improve the product or service with its outcomes.
- Process quality: the SSK's objective is to improve the process of a service or product delivery.
- Team quality: the SSK's objective is to improve the team who produces and delivers a product or service.

All types of SSK's have as common objective to facilitate scaling knowledge within the organization in an agile manner. However, each type has some specific aspects to focus on. The following section presents examples for each type.

IV. Self-Service Kit

All SSK's shall include the following artifacts (R3):

- Introduction: a template for all SSK's to ensure their common structure including: scope, context, outcomes, application and references to further artifacts of the SSK.
- Working artifacts: one or more working artifacts are in an SSK. They are highly specific to the scope of that SSK. They are designed with the purpose to guide the teams during the outcome production.
- Background information: provides to the users information about the design requirements and constraints of the SSK and the development approach and evaluation context of the SSK. Furthermore it offers detailed descriptions of the working artifacts design.

All artifacts have information about the producer (author) and a version. Based on these three artifact types, all SSKs are build. However depending on their scopes, the specific instantiation is different (Table I). All SSK's have to be designed to offer the teams the opportunity to adopt the SSK to their specific demand by addressing Bloom's taxonomy domains with high learning objectives (R4). This is also important because the teams are working and learning by doing in a real life lab and should be able to see risks by mis-

TABLE I.
DIFFERENTIATION OF SSK TYPES ABOUT PRODUCT/PROCESS/TEAM-QUALITY

Aspect	Product	Process	Team
Scope of the SSK	Technology	Workflows and activities	Behavior
Outcomes of the SSK	Questions and checklists	Questions and methods	Questions and indicators
Evidences of (correct) usage of the SSK in the final instantiation	Objective evidences often persistent	Evidences depending on implementation and often temporary	Impressions often subjective (no/weak evidences) in a specific setting – non deterministic behavior
Bloom's taxonomy cognitive domain	*Evaluation* of product characteristics	*Evaluation* of adequate sequences of activities	*Evaluation* of adequate improvement action for the team
Bloom's taxonomy affective domain	*Organizing* of usage, features, capabilities of products	*Organizing* of workflows and activities for a specific purpose	*Organizing* the behavior and knowledge of the team to identify improvements
Bloom's taxonomy psychomotor domain	*Origination* of usage, features, capabilities of products	*Origination* of workflows and activities for a specific purpose	*Adaptation* of interacting/working methods to fit team potentials
Problem-based learning	Problems on tangible objects are good to measure and improve	Problems are mostly visible on their interface of activity outcomes and interactions	Problems are often related to behavior and their actions - outcomes can be used as indicators

using SSK's (R6). The following sections are showing examples for the three different quality types. Table I shows the product, process and team quality with the learning aspects within a SSK.

A. Product Quality

The development of product quality related SSK's is driven by outcomes for a specific product or service. These products are driven by technology that has to be handled adequately by the teams. To support the usage and adoption on a large scale of specific technologies that are new to the organization, such as machine learning [39] or serverless [40], SSK's can be useful. As presented in Table I, the SSK guides with questions about the technology adoption and offers checklists about the technology usage. As a product is a "real outcome", the valuable product related outcomes of the SSK are mostly persistent and measurable evidences. Mapped to Bloom's taxonomy, a product quality related SSK has to enable users in the cognitive domain for *evaluation* of product characteristics. This high learning level is not needed in every usage, however it is the objective of the SSK to support up to this level. In the affective domain, the high level of *organizing* of the product usage and its features or capabilities is a supporting objective. Furthermore, the psychomotor domain with *origination* is a valid objective to enable the agile teams to develop new ways of usability and interactions with the software. Not all product related SSK's need these high learning curve in all domains, but every SSK design has to check how much learning is needed (R4) to reach the expected outcomes (R3). With a problem-based learning view, a product related SSK makes it easy to learn as they related to tangible objects which typically can be measured and improved by observation of change impacts.

B. Process Quality

The development of process quality related SSK's is driven by outcomes that build workflows or activities in procedures. For example, our Level of Done approach derives organization specific procedures to be aligned with regulation [41]. In the context of our hybrid SSK for the systematic elicitation of product quality risks [42], a design thinking process is used to ideate specific product characteristics while being part of our Level of Done approach. As presented in Table I, the SSK guides with questions about workflows and activity adaption and offers methods to development and adoption. As a process is a "logical outcome", the valuable outcomes are descriptions and interfaces of workflows and activities. Depending on the implementation, the evidences are temporary (i.e., an interaction between individuals) or persistent (e.g. workflow logging). Mapped to Bloom's taxonomy, a process quality related SSK has to enable users up to the cognitive domain for *evaluation* of workflow sequences or activities. In the affective domain, the high level of *organizing* of the process workflow usage and its activities is a supporting objective. Furthermore, the psychomotor domain with *origination* is a valid objective to enable agile teams to develop new ways of usability and interactions with their workflows and procedures. Not all product related SSKs need such a high learning curve in all domains, however every SSK design has to check how much learning is needed (R4) to achieve the expected outcomes (R3). With a problem-based learning view, achievements of a process related SSK are mostly observable and measurable thanks to their interfaces and activity outcomes.

C. Team Quality

We address team quality aspects with agile Team Work Quality (aTWQ) [43]. As presented in Table I, the SSK guides with questions about the indicators of behavior and interactions between individuals. Both behavior and interactions underlying subjective observations and impressions, the evidences are rather indicators. Furthermore, behavior is often specific for a situation or setting which makes it non-deterministic. Mapped to Bloom's taxonomy, a team quality related SSK has to enable users up to the cognitive domain for *evaluation* of adequate improvement action for the team. In the affective domain, the high level of

organizing of the team's behavior and knowledge to identify improvements is a supporting objective. Furthermore, the psychomotor domain with *adaptation* is a valid objective to enable the agile teams to leverage the potential for better fitting interactions and working methods to the specific team. Not all product related SSK's need such a high learning curve in all domains, however every SSK design has to check how much learning is needed (R4) to achieve the expected outcomes (R3). With a problem-based learning view, a team related SSK does not make this easy because only the outcomes of behavior or interactions can be observed. This is an indirection rather than a direct measure. However, the outcomes are what is used in the real life too. In this case, the intention of the behavior or interaction is not the fact that matters; only the outcome is the valuable factum. For learning, this indirection can be difficult in case of missing openness between the interacting people (in case of lack of trust etc.).

These three SSK types have proven useful to support the entire agile transition approach of Figure 1. The product quality SSK's support the product/service development. The team quality SSK's facilitate the teams by their maturity. The process quality SSK's are useful to establish processes and integrate those in the organizational governance. This leads to opportunities for the entire organization to scale all relevant parts at the same time thanks to the holistic SSK approach. SSK deployment in different organizations implies the challenge of identifying all relevant topics at the right time to have the SSK's developed just in time as they are demanded and needed by the organization and their teams. This has to be realized by the experts and innovators which are both producers and consumers ("prosumers") in cooperation with the governance as enabler and supporter of the SSK approach.

V. Experience Report

A. Evaluation

The Volkswagen Group IT has instantiated the SSK approach and has been actively using it for more than three years. The governance is established within the ACE [44] and supported by the Quality innovation NETwork (QiNET) [45]. An established internal wiki-like tooling is used as delivery platform for the digital SSK's. To ensure maintenance, SSK teams perform regular updates, a process that is verified by the governance through quality checks. The governance also checks for blind spots in the SSK portfolio and initiate the setup of SSK teams via Community of Practices (CoP) to close the blind spots. An additional point of the governance is to facilitate the integration of the SSKs into established procedures like the integration into trainings of the Group Academy.

The SSK teams are founded in a prosumer fashion. Each team member wanting to share some know-how in the organization can be part of an SSK team which produces the SSK content. Experts for a particular topic typically volunteer to create SSK initiatives and teams. Experts are organized in hierarchy lines like competence centers (example ACE), communities or networks (example QiNET). Both are sources for experts who are willing and able to develop an SSK. The SSK team typically is also the team that handles the updates over the life-cycle of the SSK. The SSK team is supported by the SSK for SSK development. This ensures that SSKs looking "similar" and reduces the work of the SSK team by using the templates and how-to's which are included in the SSK for SSK development. In the case that all relevant information and content for the SSK under development exists (typically a SSK is based on artifacts, which are used by teams for their work and now are "packaged" by the SSK for multiplication into the organization) an new SSK can be built by the SSK team in a few hours. Than the initial

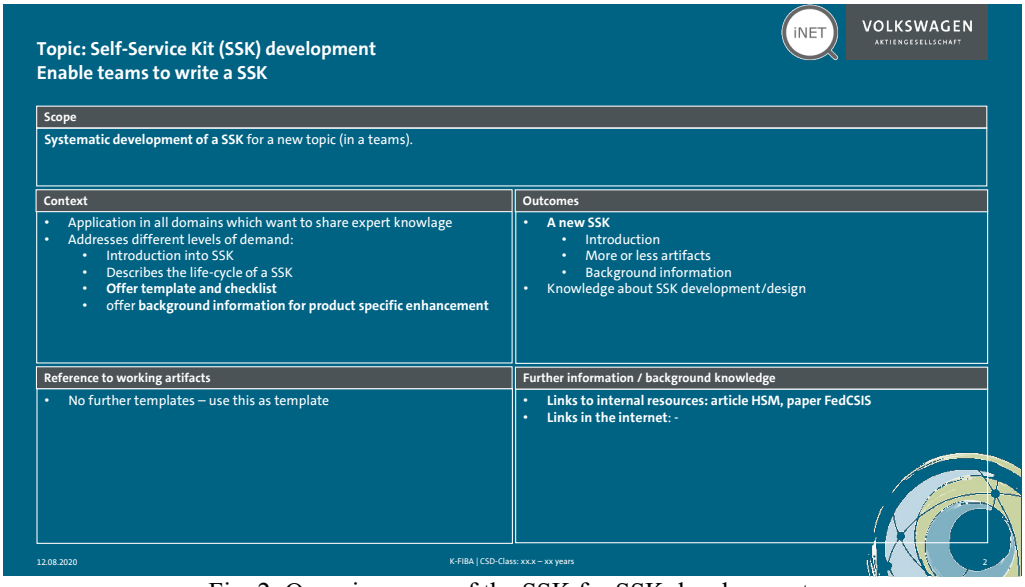

Fig. 2: Overview page of the SSK for SSK development.

application of the new SSK should be done under observation of an SSK team member to see that everything works as intended. Focus of the observation is that the usage is as intended and the time to understand and learn about the application is short. For a fast learning the SSK how-to template is the key to focus on the application and is supported by the offered templates. Most SSKs are ready for a first application by a "new product team" in less than one hour. If everything look good the SSK is ready for publishing. More details about the content of a SSK is shown in [42] and the associated conference presentation which is based on the SSK artifacts an impression gives Figure 2. More about the detailed structure of SSKs is described in [46] which leads to the SSK for SSK development.

All employees of the Volkswagen AG can consume any time any SSK offered by the platform by simple download and use, or by adaptation to the specific context of the product or service offered by the team. Moreover, each consumer can improve any SSK with feedbacks anytime.

Three years ago, the Group IT started with the development of the first SSK. Over time, the iterations of improvement and enhancement of established SSK's – SSK versions up 6 are released - accompanied by the development of new SSK's has led to a holistic SSK approach implementation – the SSK for SSK development. This "meta" SSK is offered to scale the SSK approach itself by its own approach (recursively). This shows that the SSK approach is continuously improved and enhanced. Currently, there is a two-digit amount of SSKs in the portfolio. The trend to more digitalization and blended learning will further propel the SSK approach and produce a bigger portfolio. An important point at the beginning was that the SSK development could be initiated bottom up without big resource allocation and funding. The SSK approach is an agile approach by design: an autonomous team of experts can be the initial spark to enflame an organization by its first SSK.

B. Limitations

The application was conducted in an enterprise with mostly European culture. Other cultures may behave differently. The feedback mechanism for improvement is weakly implemented through voluntary feedbacks. However, the "sound of silence" [47] in this case indicates that there are no significant issues with the implemented approach. Furthermore, the views/downloads figures are weak metrics for the learning impact and application intensity, since not every download leads to a valuable outcome. Moreover, the approach has been developed continuously and improved with the design science approach. However it is difficult to demonstrate explicit effectiveness of SSKs in the agile scaling of the organization because there are many other parameters impacting the scaling. This highly applied and productive context provided a constrained space to change design parameters and observe their impacts. On the other hand, this setting has been facilitating the SSK approach's development and adoption synchronized with the organization's digitalization and agile transition.

VI. CONCLUSION

The presented SSK approach combines different learning and training approaches to a specialized learning approach for agile organizations by focusing on agile values and mindset by design. The SSK approach offers an agile way to scale agile transitions in an organization. It offers a systematic learning by doing and gives the background information for adoption to specific demands of the application domain of its users. This leads to knowledge and experience creation in the teams. Furthermore, the approach values mature agile teams as prosumers who are able to improve not only their teams with established methods like the retrospective. In addition, they can improve the organization with their experience, knowledge sharing and elaboration artifacts for SSK's. This is an essential element for an agile organization that needs to step from self-organization of teams to self-organization of organizations in the long-term. The SSK approach which supports all the three quality dimensions from product, process to the team provides a key lever to achieving this goal.

VII. NEXT STEPS AND FUTURE WORK

Future work will address current blind spots and limitations of the current SSK approach to evolve them further. In a next step, the limitation of the voluntary feedbacks for improvement will be investigated [48]. Also, we want to determine how useful metrics like downloads or views of SSK are to derive the impact of a specific SSK in the organization. Furthermore, metrics for the establishment of the self-organizing organization has to be developed to make the current state of the agile transition transparent and to measure the impact of specific contributions to the transition goal.

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