

# Crossing the Boundaries – Agile Methods in Large-Scale, Plan-Driven Organizations: A Case Study from the Financial Services Industry

Sina Katharina Weiss and Philipp Brune<sup>(✉)</sup>

Neu-Ulm University of Applied Sciences, Wileystraße 1, 89231 Neu-Ulm, Germany  
swiss@kpmg.com, Philipp.Brune@hs-neu-ulm.de

**Abstract.** Selecting the software development methodology best-suited for a project or organization is a fundamental decision in the context of Information Systems (IS) engineering. In many industries and organizations, agile software development models are already well-established and commonly used for this purpose. However, large-scale, plan-driven organizations face additional challenges when implementing agile methods. To analyze how such organizations could make the implementation more effective, the results of a qualitative case study performed in a large-scale financial institution are presented in this paper. Based on these results, a best-practice model for their effective implementation in a complex environment is proposed. An organization-specific agile development framework and continuous stakeholder involvement are identified as crucial success factors. In addition, a successful implementation of agile methods in practice needs to be performed by dedicated individuals and cross-functional teams should be established in order to support a common understanding across organizational boundaries.

**Keywords:** Agile methods · Software development · IS engineering · Large organizations · Organizational change

## 1 Introduction

Traditional sequential software development methods very often do not provide the necessary flexibility for today's fast changing business environment. Therefore, in the last decade the more light-weight agile methods established as a better suited alternative in many companies and industries, which helped to shorten development cycles and reduce the time-to-market of new software [24].

Consequently, in recent years the application domain of agile methods has extended from the original small and co-located teams to a wider range of organizational settings [48]. This extension also received considerable attention by researchers discussing the general applicability of agile methods in various settings. Several studies indicated the suitability of agile methods also for plan-driven and large-scale organizations [9, 26], large and distributed teams [38, 46] as well as strongly regulated environments [16].

Their findings suggest that especially the implementation of agile methods in large-scale, plan-driven environments comes with additional challenges and constraints [32]. In particular, agile practices need to be integrated into the existing process environment and comply with various internal and external regulations [5, 16, 27]. Therefore, the use of a tailored agile development framework and the creation of a common understanding across stakeholders have been suggested to be crucial success factors in this context [32, 36].

However, the perception of such a tailored agile framework within a plan-driven organization and the creation of awareness and understanding with respect to it have not been studied so far. Therefore, in this paper results of a qualitative study are presented, which evaluates the role of an agile development framework within a large-scale, plan-driven financial institution and its perception by the relevant stakeholders. I.e., the interface between agile development teams and plan-driven release management and IT operations is found to be critical and challenging. In particular, it is analyzed how organizational boundaries between the stakeholders should be designed to implement such a framework effectively across all relevant organizational functions.

The rest of this paper is organized as follows: In Sect. 2 the related work from the research literature is discussed in detail, followed by the research design of the study in Sect. 3. Section 4 describes the used qualitative data collection and analysis procedure. In Sect. 5 the proposed resulting agile implementation model is presented. The limitations of the study and an outlook to further research are illustrated in Sect. 6. We conclude with a summary of our findings.

## 2 Related Work

Over the last decades, various software development processes have been proposed by researchers and practitioners. First, sequential, plan-driven models such as the Waterfall model [40] became popular, where each phase of the development process needs to be completed before the next one starts, resulting in a strictly sequential order of the development activities. However, this approach fails to accommodate late changes of requirements during development, which frequently occur in today's business environment [19, 22].

Driven by the need for adaptability to changing requirements, first iterative models like the Spiral model [8] were proposed, followed by evolutionary or agile methods such as Extreme Programming [6] and Scrum [42, 43]. Although these agile methods have become very popular, traditional plan-driven methods are not obsolete as every method can be effective and useful depending on the project characteristics and its environment [30].

Therefore, especially in large-scale organizations it cannot be expected that all teams and projects make the transition to agile methods, which can hinder the work of agile teams [2, 12, 32]. Consequently, it has been found that large-scale organizations are confronted with additional challenges as they need to integrate the agile practices into their existing, complex processual and organizational environment [5, 27, 28].

In order to be successful, it is therefore highly important to focus on the interfaces between agile development teams and their environment and to tailor agile practices to the specific organizational requirements [5,27]. In the course of this, not only the practices of the agile teams need to be adjusted. It is also important to focus on the practices of other organizational functions as agile teams rely on them and do not work isolated [32,37]. A study by van Waardenburg and van Vliet states that the adjustment of the practices on both sides is especially important in a plan-driven environment in order to successfully implement agility. However, the study also provides evidence that the adjustments made on the agile team level should not be exaggerated, as this might lead to the loss of benefits intended to achieve by agile methods [32].

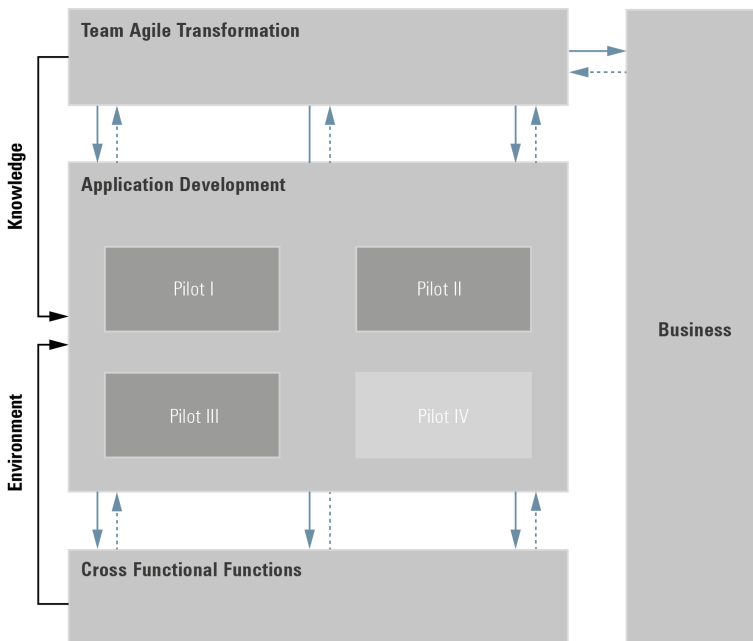
In order to achieve the continuous tailoring and improvement on both sides, especially communication is crucial [36]. Consequently, it is beneficial to plan and execute specific procedures in order to tailor agile practices to suit an organization's individual requirements. One example is the definition of clear feedback channels that provide the organization with valid information [4,37]. This approach might result in an organization-specific agile process model, which is claimed as being effective in providing guidance for agile teams [36,37].

Besides tailoring and integration on the project and organizational side, research has shown that awareness and common understanding of agile practices is essential during their implementation [4,32]. Education, training and coaching have proven to be suitable approaches in order to achieve a common ground [4,9,45]. Especially coaching of affected stakeholders should not be underestimated and be available right from the beginning of the implementation [45]. Without coaching and clear guidance, the implementation likely fails or only small plan-oriented projects just labeled "agile" are performed. Besides the actual development teams' also organizational stakeholders, such as the business side and other still plan-driven functions (like i.e. the IT operations department) should be involved when creating awareness and understanding of agile methods. If they are left out, they likely will not get actively involved in the agile process and their mindset remains traditional, which increases barriers and tension between them and the agile teams [32].

Although the current body of knowledge provides guidance for the complex process of implementing agile methods in large-scale and plan-driven environments, recommendations are rather general and isolated [9]. Correspondingly, van Waardenburg suggests that "[a] more systematic and in-depth study of the role of boundary spanning activities and artifacts could help to better align the simultaneous use of plan-driven and agile methods." [32].

Furthermore, although in general an organization-specific tailored agile development framework has been suggested as being beneficial [36], it has not investigated how the role of such a framework is perceived in organizations and how its implementation can be done effectively. In order to overcome this gap, in this paper the following research questions are addressed:

- RQ1: Is an agile development framework beneficial for the successful implementation of agile methods within a division of a large-scale, plan-driven organization?
- RQ2: How need organizational boundaries be designed when implementing an agile development framework within a division of a large-scale, plan-driven organization?



**Fig. 1.** Model of the unit of analysis illustrating the project context of the case study performed.

### 3 Research Design

#### 3.1 Project Context

In order to collect the relevant data for the qualitative analysis, a case study was performed within a division of a large-scale financial institution currently implementing an agile development framework. The division can be characterized as a forerunner regarding agile development within this organization and therefore is embedded in a generally plan-driven environment.

The agile methodology used is based on Scrum [42], mainly because it defines clear roles and responsibilities. It is tailored to support all relevant internal and external policies in order to ensure legal and regulatory compliance. The tailored methodology was designed by a dedicated team formed for this particular

purpose, including members of various functions as i.e. quality management, test management and release management. After its initial design the first version of the framework was piloted in several development teams from February 2016 onwards, before becoming mandatory for all development teams within the division in May 2016.

This project context is illustrated schematically in Fig. 1 by the model of the unit of analysis [7], including all relevant stakeholders for the implementation process and their relation.

### 3.2 Research Methodology

The relevant organizational boundaries under investigation are highlighted by the arrows in Fig. 1. In order to provide clear results when answering the research questions, the design of the boundaries between these different organizational functions was viewed through the concepts of boundary objects [44], boundary spanners [1] and boundary events. Besides their general suitability when focusing on boundaries, these concepts have also been identified by other researchers to be suitable in this particular context [32,33,35,38]. With regard to the creation of common understanding Star and Giesmer describe boundary objects as an “analytical concept of [...] objects which both inhibit several intersecting social worlds and satisfy the informal requirements of each of them.” [44]. Consequently, they enable the satisfaction of potentially conflicting sets of concerns, the coexistence of heterogeneity and cooperation as well as the translation and alignment of different perspectives [3,44].

In contrast to boundary objects, which refer to artifacts, the concept of boundary spanners relates to particular roles that facilitate the exchange of information across boundaries [1]. In general, a boundary spanner can be described as a person connecting two different groups whereas belonging only to one of them [20]. However, neither boundary objects nor boundary spanners are effective through their mere existence at the boundary between two social worlds. Rather they have to be actively integrated. Therefore, Levina and Vaast introduced the concepts of boundary objects-in-use and boundary spanners-in-practice [26].

Beyond the concepts of boundary objects and boundary spanners, the terms boundary spanning actions [29] and boundary spanning activities can be found in current literature on the topic of boundary crossing [33,41]. Yet, they are in general attributed to a particular boundary spanning role, for example in form of the active coordination of task performance with other groups or the linking of information [29,47]. Therefore, the following study will introduce a variation of the concepts in the form of boundary events in order to also clearly cover installed training activities provided independently from one particular initiator. Such a variation is especially important in the context at hand considering the importance of training and coaching.

The two boundaries explicitly not under investigation within the unit of analysis were the boundaries between the development teams itself as well as the boundary between the IT and the business function. First, one reason for this is that the pilot projects within the division are relatively independent from

other projects, which made the inter-team boundaries irrelevant. Second, the boundary between the IT and business function has already been extensively investigated by other researchers applying the chosen concepts [39]. Here, agile methods and especially the related practices of the business requirements being communicated through user stories and the prioritization of these in the product backlog were identified to support the coordination of the two social worlds and enable the creation of a common understanding [34, 39].

For the qualitative analysis, the Grounded Theory Methodology (GTM) as introduced by Glaser and Strauss in 1967 was chosen [21]. Its main idea is to discover new theory based on the insights gained rather than verifying existing theory [21]. The approach is especially valuable in areas where theoretical explanation is limited [18, 32], as it is the case regarding the questions addressed by the study at hand.

## 4 Data Collection and Analysis

Referring to the concept of theoretical sampling in the GTM [13, 21], the participants were not defined prior to the start of the investigation. Instead the interview partners were selected based on information gathered during the iterations of the research process resulting in twelve interviews across all relevant groups. Table 1 shows a list of all interview partners which finally took part in the qualitative empirical study.

In line with the iterative procedure of the GTM, a specific guide for the semi-structured interviews was developed for each iteration based on the questions emerged during previous interviews. All four interview guides covered the following content:

- General information: Personal information and his or her experience with agility,
- Organization-specific agile development framework: Knowledge about its development, personal involvement in the development process, assessment of the framework and its necessity,
- Transformation process: Individual perception and assessment in general, knowledge about and assessment of specific concepts in place to support the implementation process, main facilitator for the transformation.

In addition, the agile development teams were asked about the most critical boundaries within the plan-driven organization, the concepts in place to cross these and their effectiveness. The interviewees of the cross-functional functions were asked if and/or how their processes have been adapted to suit the new agile development practice and also about the concepts and their effectiveness.

Due to the limited availability of the participants, the interviews lasted between 12 and 35 min. However, usable information was able to be obtained. Each interview was immediately transcribed and analyzed. As a starting point for open coding the concepts of boundary objects, boundary spanners and boundary events were assigned to the text. However, the majority of concepts were

derived from the interviews themselves, which is preferred when applying the GTM as it relates closer to the actual data [18]. After coding was performed on all data [14, 17, 18], in total a list of 534 codes was obtained.

After the recombination of the codes during axial coding [14, 18], the influences and effects governing the implementation of the agile development framework could be derived from the data. The resulting interconnections model is illustrated in Fig. 2.

**Table 1.** List of interview partners participating in the qualitative study.

		<b>Role/ Responsibility</b>	<b>Corporate Membership</b>
Iteration I	Agile 1	Coordinator Agile Transformation	since 2016
	Agile 2	Lead Framework Development	since 1997
	Agile 3	Coordinator Agile Transformation	since 1996
Iteration II	Dev 1	Scrum Master	since 2012
	Dev 2	Scrum Master	since 2016
	Dev 3	Functional Analyst	since 2001
	Dev 4	Product Owner (IT)	since 2002
Iteration III	CrossFunc 1	Release Manager	since 2015
	CrossFunc 2	Lead Production Services	since 1998
	CrossFunc 3	Test Manager/Tester	since 2013
Iteration IV	Business 1	Product Owner (Business)	since 1999
	Business 2	Product Owner (Business)	since 1997

In agreement with the literature [5, 9, 31], the main initial motivation to implement agile development methods was found to be the ability to react fast and flexibly to changing market requirements. However, as every development team performed agile development initially to the best of their knowledge, they were not conform with given processes and policies leading to many impediments and negative responses within the organization. Driven by that, an adapted agile development framework compliant with the corporate standards was designed, legitimizing agile practices and providing a certain degree of consistency. The design of the framework was mainly influenced by internal and external regulations, which are especially important for financial institutions. Therefore, the necessity of a division-specific agile development framework was perceived as given by all interviewees.

In line with this, Pikkarainen et al. state that companies should develop an agile development process model parallel to its implementation [36]. However, a

comprehensive framework is seen as result of the pilots' experiences rather than as a starting point for the implementation of agile methods [25,36,37]. This is supported by the study at hand, as the high complexity of the framework and its adaption to original Scrum practices were perceived in a negative way by the interviewees.

Therefore, it is recommended that an agile development framework is designed in parallel to the beginning of agile methods' usage, with its initial scope and complexity being low and as close as possible to pre-defined agile practices. Similarly this is recommended by Boehm and Turner, as they claim that it is more effective to "[b]uild up processes rather than tailoring them down." [9]. The resulting design builds the basis for feedback and consequently for building up the framework along with its implementation based on daily experiences.

Furthermore, it was stated that it is preferred that the framework presents a guideline rather than a set of strict rules. Such an approach is supported by previous findings, as for example Pikkarainen et al. state that teams should receive enough freedom to adapt agile methods to their specific needs as the full mandatory appliance of a model could cause increased resistance. This practice leads to the emergence of two learning cycles. One on the project and one on the organizational level with the latter being influenced by the feedback of the first [36].

Nevertheless, the negative assessment of the deviation from Scrum must be viewed critically as the implementation of hybrid approaches [5,49] or at least of tailored approaches [9,27] is an established standard, which the affected groups should be made aware of.

## 5 Resulting Implementation Model

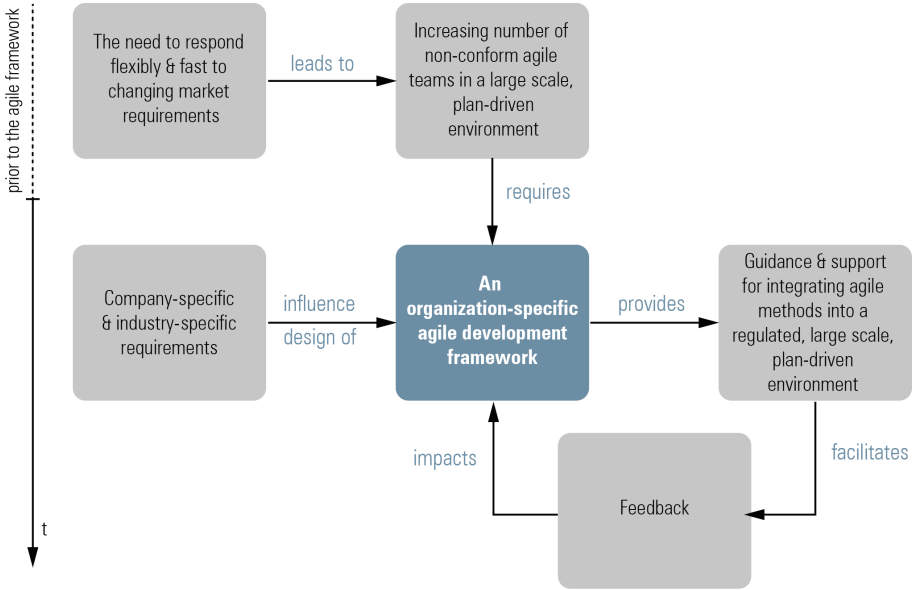
To describe how an agile development framework could be embedded within a large-scale, plan-driven organization, the implementation model illustrated in Fig. 3 can be used. This model uses the concepts of boundary objects [44], boundary spanners [1] and boundary events.

Overall, 49 concepts were named at the relevant boundaries under investigation. However, as not only their mere existence at the boundaries between different social worlds leads to the effective creation of awareness and common understanding, it is important to take their usage into account [26].

In total, 17 boundary objects were identified, of which a detailed overview of the agile development framework in terms of roles, responsibilities, activities as well as deliverables was identified as the most effective boundary object-in-use. It is used to retrieve ideas from it or in order to review and verify the own practices. Furthermore, it served as the main foundation for feedback, with personal communication being the preferred channel. In comparison to this, a high-level overview of the framework which was also offered was rarely used.

Furthermore, 17 boundary spanners were identified at the boundaries under investigation. These are considered highly effective with regard to the creation of awareness and common understanding and therefore the effective implementation of the framework.



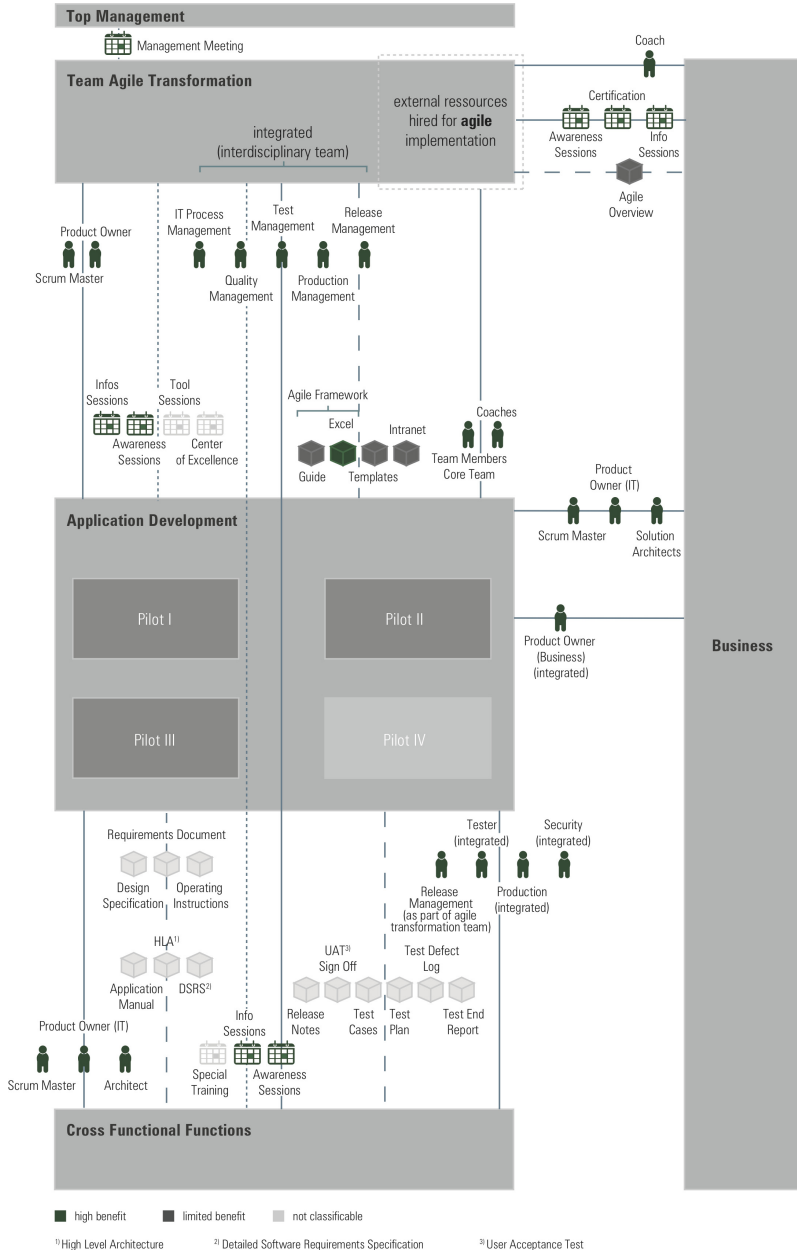


**Fig. 2.** Interconnections model describing the influences and effects governing the implementation of the agile development framework as obtained from the empirical data.

Levina and Vaast in addition found that boundary objects rely on boundary spanners in-practice to be effective with regard to the crossing of boundaries [26]. The study at hand supports this, as the effectiveness of boundary crossing with respect to the framework is mainly facilitated by active roles applying, assessing and gathering feedback on it.

In the present study, the boundary spanners at the boundary between the team designing the framework and the development teams can be identified as being the Scrum Master and Product Owner as well as the core team members of the team that is designing the framework. The boundary spanning roles of the Scrum Master and Product Owner have also been identified in previous studies, but rather in the context of bridging the boundary between the business function and the development teams [39]. This is supported by the study at hand as the two roles were additionally identified as boundary spanners at the boundary to the business function and in addition at the boundary to other relevant organizational functions.

Although boundary spanners are identified as being effective with regard to the creation of common understanding, the integration of environmental roles into the actual development teams was claimed to even increase their general effectiveness. The integration of roles is in addition capable of solving the issue of the business side being a separate line organization and therefore difficult to reach with specific boundary crossing activities, as it is the case in this case study context.



**Fig. 3.** Implementation model for embedding an agile development framework within a large-scale, plan-driven organization. The model uses boundary objects (cube symbols), boundary spanners (person symbols) and boundary events (calendar symbols). Colors indicate the perceived importance of the respective concepts. (Color figure online)

Pries-Hejes also identified such social integration as being beneficial and in addition argue “[...] that Scrum is plastic enough to allow such roles to be part of the Scrum team.” [39]. Such an integrative approach is also supported by Fitzgerald and Stol as they argue that the added value of agile software development is limited if related organizational functions stay rigid. Consequently, they state the “[...] need for a holistic and integrated approach across all the activities that comprise software development.” [15]. Referring to this and the results at hand, companies need to assess if their existing organizational structure is suitable for agile development as cross-functional teams combining all relevant roles are preferable.

Overall, the interviewees named eleven boundary events, with the most effective being sessions introducing the original version of Scrum, sessions focusing on the division-specific framework as well as certification courses. However, the differentiation between the sessions introducing Scrum and the ones introducing the framework lead to confusion and rejection and therefore should be viewed critically.

Furthermore, although six of nine interviewees during the iterations II - IV (those not being members of the agile framework team) mentioned that they participated in at least one of the two sessions, these participants indicated that strong and visible top management support would increase the adoption of agile practices and the framework as well as increase the participation, which is also in agreement with the literature [11, 23].

## 6 Limitations and Further Research

The validity of the findings presented in this paper is generally limited by the qualitative methodology used and the case of a single, large-scale financial institution studied. As usual for qualitative studies, the transferability of the results is limited due to the nature of the project context studied and the assumptions made by the researcher. Therefore, further qualitative and quantitative studies are needed to confirm the findings and discuss their general validity.

In particular, although the concepts of boundary objects, boundary spanners and events are well established and suitable theoretical constructs in the area under investigation, the generalization of the findings may be questioned, as boundary object which are effective in one setting might limit boundary crossing in another [10]. In addition, the implementation of the agile development framework in the company under consideration is still in a comparably early stage, which might affect the validity of the findings as it can take up to two or three years until a new development framework is actually widely adopted within an organization [36].

With respect to that, it would be interesting to apply the findings to another financial institution implementing agile methods. Furthermore, other large-scale, plan-driven organizations operating in a highly regulated environment should be analyzed, i.e. from the pharmaceutical industry. In general, the applicability of agile methods in highly regulated environments should be further investigated as there is still rather limited scientific evidence for it found in the literature.

## 7 Conclusion

In conclusion, in this paper we qualitatively evaluated the role and effectiveness of an agile development framework in a large-scale, plan-driven organization. In particular, it was studied how organizational boundaries should be designed in order to effectively create awareness and common understanding between the relevant stakeholders. Therefore, a qualitative study using a Grounded Theory approach was performed at a division of a large-scale financial institution.

The results show that a customized agile development framework designed specifically to the needs of the organization is beneficial for the implementation of agile methods in a complex setting. This holds in particular true if this framework is designed by involving all relevant organizational stakeholders right from the beginning. This early involvement is crucial not only for the common understanding of all stakeholders but also for their motivation to apply the framework.

The evaluation revealed the importance of implementing boundary spanners at the organizational boundaries between relevant stakeholder groups. The establishment of these functional roles in the organization should be supplemented by a detailed overview of the framework and respective events introducing it to the affected stakeholders. The results indicate that organizational boundaries should be resolved as far as applicable in order to establish cross-functional agile development teams including members of all stakeholder groups relevant for the successful development of the product.

## References

1. Aldrich, H., Herker, D.: Boundary spanning roles and organization structure. *Acad. Manag. Rev.* **2**(2), 217–230 (1977)
2. Ambler, S.W.: Agile software development at scale. In: Meyer, B., Nawrocki, J.R., Walter, B. (eds.) *CEE-SET 2007*. LNCS, vol. 5082, pp. 1–12. Springer, Heidelberg (2008). doi:[10.1007/978-3-540-85279-7\\_1](https://doi.org/10.1007/978-3-540-85279-7_1)
3. Arias, E.G., Fischer, G.: Boundary objects: their role in articulating the task at hand and making information relevant to it. In: *International ICSC Symposium on Interactive and Collaborative Computing (ICC 2000)*, Wollongong, pp. 567–574 (2000)
4. Bannink, S.: Challenges in the transition from waterfall to scrum - a case study at portbase. In: *Proceedings of the 20th Twente student Conference on IT*, Eschende, pp. 1–10 (2014)
5. Barlow, J.B., Giboney, J.S., Keith, J.K., Wilson, D.W., Schuetzler, R.M.: Overview and guidance on agile development in large organizations. *Commun. Assoc. Inf. Syst.* **29**(2), 25–44 (2011)
6. Beck, K.: Embracing change with extreme programming. *IEEE Comput. Soc.* **32**(10), 70–77 (1999)
7. Bhattacharjee, A.: *Social Science Research: Principles, Methods, and Practices*. CreateSpace Publishing, 2 edn. (2012)
8. Boehm, B.: A spiral model of software development and enhancement. *Computer* **21**(5), 61–72 (1988)
9. Boehm, B., Turner, R.: Management challenges to implementing agile processes in traditional development organizations. *IEEE Comput. Soc.* **22**(5), 30–39 (2005)

10. Carlile, P.R.: View of knowledge and boundaries: boundary objects in new product development. *Organ. Sci.* **13**(4), 442–455 (2002)
11. Chan, F.K.Y., Thong, J.Y.L.: Acceptance of agile methodologies: a critical review and conceptual framework. *Decis. Support Syst.* **46**(4), 803–814 (2009)
12. Cockburn, A., Highsmith, J.: Agile software development: the people factor. *Computer* **34**(11), 131–133 (2001)
13. Corbin, J., Strauss, A.: *Basics of Qualitative Research*, 4th edn. SAGE Publications, Thousand Oaks (2015)
14. Doering, N., Bortz, J.: *Forschungsmethoden und Evaluation*, 5th edn. Springer, Berlin (2016)
15. Fitzgerald, B., Stol, K.J.: Continuous software engineering and beyond: trends and challenges. In: *Proceedings of the 1st International Workshop on Rapid Continuous Software Engineering - RCoSE 2014*, Hyderabad, pp. 1–9 (2014)
16. Fitzgerald, B., Stol, K.J., O’Sullivan, R., O’Brien, D.: Scaling agile methods to regulated environments: an industry case study. In: *35th International Conference on Software Engineering (ICSE)*, San Francisco, pp. 863–872 (2013)
17. Flick, U.: *Introduction Research Methodology*. SAGE Publications Ltd., London (2011)
18. Flick, U.: *An Introduction to Qualitative Research*, 5th edn. SAGE Publications Ltd., London (2014)
19. Fowler, M., Highsmith, J.: The agile manifesto. *Softw. Dev.* **9**, 28–35 (2001).  
<http://www.pmp-projects.org/Agile-Manifesto.pdf>, [http://andrey.hristov.com/fht-stuttgart/The\\_Agile\\_Manifesto\\_SDMagazine.pdf](http://andrey.hristov.com/fht-stuttgart/The_Agile_Manifesto_SDMagazine.pdf), <http://www.pmp-projects.org/Agile-Manifesto.pdf>
20. Friedman, R.A., Podolny, J.: Differentiation of boundary spanning roles: labor negotiations and implications for role conflict. *Adm. Sci. Q.* **37**(1), 28 (1992).  
<http://www.jstor.org/stable/2393532?origin=crossref>
21. Glaser, B.G., Strauss, A.L.: *The Discovery of Grounded Theory: Strategies for Qualitative Research*. Aldine Publishing Company, New York (1967)
22. Highsmith, J., Cockburn, A.: Agile software development: the business of innovation. *Computer* **34**(9), 120–122 (2001)
23. Hoda, R., Noble, J., Marshall, S.: Supporting self-organizing agile teams. In: Sillitti, A., Hazzan, O., Bache, E., Albaladejo, X. (eds.) *XP 2011. LNBP*, vol. 77, pp. 73–87. Springer, Heidelberg (2011). doi:[10.1007/978-3-642-20677-1\\_6](https://doi.org/10.1007/978-3-642-20677-1_6)
24. Kettunen, P.: Adopting key lessons from agile manufacturing to agile software product development—a comparative study. *Technovation* **29**(6–7), 408–422 (2009)
25. Kettunen, P., Laanti, M.: How to steer an embedded software project: tactics for selecting the software process model. *Inf. Softw. Technol.* **47**(9), 587–608 (2005)
26. Levina, N., Vaast, E.: The emergence of boundary spanning competence in practice: implications for implementation and use of information systems. *MIS Q.* **29**(2), 335–363 (2005)
27. Lindvall, M., Muthig, D., Dagnino, A., Wallin, C., Stupperich, M., Kiefer, D., May, J., Kähkönen, T.: Agile software development in large organizations. *Computer* **37**(12), 26–34 (2004)
28. Livermore, J.A.: Factors that impact implementing an agile software development methodology. In: *Proceedings 2007 IEEE SoutheastCon*, Richmond, pp. 82–86 (2007)
29. Marrone, J.A.: Team boundary spanning: a multilevel review of past research and proposals for the future. *J. Manag.* **36**(4), 911–940 (2010)
30. Mishra, A., Dubey, D.: Suitability analysis of various software development life cycle models. *Int. J. Electron. Commun. Comput. Eng.* **4**(6), 98–101 (2013)

31. Nerur, S., Mahapatra, R., Mangalaraj, G.: Challenges of migrating to agile methodologies. *Commun. ACM* **48**(5), 72–78 (2005)
32. van Nes, F., Abma, T., Jonsson, H., Deeg, D.: Language differences in qualitative research: is meaning lost in translation? *Eur. J. Ageing* **7**(4), 313–316 (2010)
33. Nguyen-Duc, A., Cruzes, D.S., Conradi, R.: On the role of boundary spanners as team coordination mechanisms in organizationally distributed projects. In: 2014 IEEE 9th International Conference on Global Software Engineering, Shanghai, pp. 125–134 (2014)
34. O’heocha, C., Conboy, K.: The role of the user story agile practice in innovation. In: Abrahamsson, P., Oza, N. (eds.) *LESS 2010. LNBIP*, vol. 65, pp. 20–30. Springer, Heidelberg (2010). doi:[10.1007/978-3-642-16416-3\\_3](https://doi.org/10.1007/978-3-642-16416-3_3)
35. Pernerger, T.V., Hudelson, P.M.: Writing a research article. *Int. J. Health Care* **16**(3), 191–192 (2004)
36. Pikkarainen, M., Salo, O., Kuusela, R., Abrahamsson, P.: Strengths and barriers behind the successful agile deployment—insights from the three software intensive companies in Finland. *Empir. Softw. Eng.* **17**(6), 675–702 (2012)
37. Pikkarainen, M., Salo, O., Still, J.: Deploying agile practices in organizations: a case study. In: Richardson, I., Abrahamsson, P., Messnarz, R. (eds.) *EuroSPI 2005. LNCS*, vol. 3792, pp. 16–27. Springer, Heidelberg (2005). doi:[10.1007/11586012\\_3](https://doi.org/10.1007/11586012_3)
38. Pries-Heje, L., Pries-Heje, J.: Agile & distributed project management: a case study revealing why scrum is useful. In: *European Conference on Information Systems (ECIS2011)*, Helsinki, pp. 20–28 (2011)
39. Pries-Heje, L., Pries-Heje, J.: Why Scrum works: a case study from an agile distributed project in Denmark and India. In: *Agile Conference (AGILE)*, 2011, pp. 20–28 (2011)
40. Royce, W.W.: Managing the development of large software systems. In: *ICSE 1987 Proceedings of the 9th International Conference on Software Engineering*, Monterey, pp. 328–338 (1970)
41. Scheerer, A., Hildenbrand, T., Kude, T.: Coordination in large-scale agile software development: a multiteam systems perspective. In: *HICSS 2014 Proceedings of the 2014 47th Hawaii International Conference on System Sciences*, Auckland, pp. 4780–4788 (2014)
42. Schwaber, K.: SCRUM development process. In: Sutherland, J., Casanave, C., Miller, J., Patel, P., Hollowell, G. (eds.) *Business Object Design and Implementation*, pp. 117–134. Springer, London (1997)
43. Schwaber, K., Beedle, M.: *Agile Software Development with Scrum*, 1st edn. Prentice Hall, Upper Saddle River (2001)
44. Star, S.L., Griesemer, J.R.: Institutional ecology, ‘Translations’ and boundary objects: amateurs and professionals in Berkeley’s Museum of Vertebrate Zoology, 1907–39. *Soc. Stud. Sci.* **19**(3), 387–420 (1989)
45. Sureshchandra, K., Shrinivasavadhani, J.: Moving from waterfall to agile. In: *Proceedings - Agile 2008 Conference*, Toronto, pp. 97–101 (2008)
46. Sutherland, J., Viktorov, A., Blount, J., Puntikov, N.: Distributed Scrum: agile project management with outsourced development teams. In: *Proceedings of the 40th Hawaii International Conference on System Sciences*, Waikoloa, p. 274a (2007)
47. Tushman, M.L., Scanlan, T.J.: Boundary spanning individuals: their role in information transfer and their antecedents. *Acad. Manag. J.* **24**(2), 289–305 (1981)
48. VersionOne Inc.: The 10th annual State of Agile report. VersionOne Incorporated (2016)
49. West, D., Grant, T.: *Agile Development: Mainstream Adoption Has Changed Agility*. Forrester Research, Cambridge (2010)