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TEAM AGILITY AND TEAM PERFORMANCE – THE MODERATING EFFECT OF USER INVOLVEMENT

Karl Werder
University of Mannheim, werder@es.uni-mannheim.de

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Werder, Karl, University of Mannheim & Institute for Enterprise Systems, Mannheim, DE, werder@es.uni-mannheim.de

Abstract

Software development organizations increasingly adopt agile software development (ASD) in order to react to manifold challenges and respond to increasing user expectations. User involvement is mentioned as the most important success factor in software development projects. However, little is known about the right intensity of user involvement for development teams. The paper investigates the moderating effect of different dimensions of user involvement intensity are investigated, i.e. types, practices and continuity. While prior research in ASD focuses on the project or method, this paper adopts a team-theoretical view towards agility. In addition, the effect of user involvement on the relationship between team agility on team performance is investigated. A model for team agility and its empirical survey-based investigation is proposed. The expected results extend the nomological net of team research in IS and help scholars to extend ASD theory. Practitioners benefit by identifying the right intensity of user involvement for their development team.

Keywords: team, agility, development, user involvement.

1 Introduction

Software development organizations need to respond to manifold challenges, such as new customer requirements, market dynamics, mergers and technological innovation (Börjesson and Mathiassen, 2005). These challenges force software development organizations to improve their reaction to changes and shorten their delivery timeframe by increasingly adopting agile software development (ASD) as their development methodology (Baskerville et al., 2003; Beck et al., 2001; West and Grant, 2010). Given ASDs' reported benefits (cf. Sarker, Munson, Sarker, and Chakraborty, 2009; Vidgen and Wang, 2009) this is an ongoing trend over the recent years (West and Grant, 2010).

However, ASD does not easily extend to the idea of user involvement, which is an ongoing challenge for software development teams (Larusdottir et al., 2016). It challenges development teams for different reasons (Bano and Zowghi, 2014). I) Psychological reasons, such as the lack of motivation from users who may not wish to get involved (Doll and Torkzadeh, 1989), or the user's attitude towards their workplace that causes behavioral challenges (Hartwick and Barki, 1994; He and King, 2008). II) Managerial conditions, such as time constraints or the lack of management support can hinder the user involvement (Barki and Huff, 1990; Harris and Weistroffer, 2009). III) Also, methodological reasons, such as the identification of representative users provide challenges for software development teams (Iivari and Iivari, 2011). IV) Cultural and political reasons need to be addressed (Bano and Zowghi, 2014). For example, these may be caused by a new software implementation that leads to a change of the work environment (Carayon and Karsh, 2000).

Software development organizations can involve users in different ways (Damodaran, 1996). Three types of user involvement are identified, where the users can be seen as an information source, as a collaborator or as an innovator (Kaulio, 1998). In addition, scholars study different practices available for user involvement and their frequent utilization in the software development process (Bodker et al., 2009; Markus and Mao, 2004). Another important element of user involvement is the temporal aspect, i.e. the duration throughout different phases (Bano and Zowghi, 2014). The literature suggests a continuous involvement of users is preferable over a sporadic involvement (Brhel et al., 2015). Together, these dimensions form the intensity of user involvement. A low intensity of user involvement leads to non-representative conclusions, while a high intensity of user involvement can be costly and is likely to yield little or no new insights after a point of saturation (Nielsen and Landauer, 1993). Moreover, despite the importance of the user in the software development process, little is known about the different dimension of user involvement intensity, i.e. types, practices, and continuity Thus, identifying the effect of user involvement intensity is a challenge with theoretical relevance.

While a teams' agility improves its performance, this relationship is not independent from the intensity of user involvement. Hence, researchers investigate the extension of ASD with different ideas on processes and practices to involve the user in an agile environment (Brhel et al., 2015; Fox et al., 2008). This extension is subject to multiple dimensions that need to be considered when involving the user in ASD (Barksdale and McCrickard, 2012). Our objective is to investigate the moderating effect of user involvement due to the practical impact and theoretical relevance. From a theoretical perspective, this study presents an opportunity to understand the boundary conditions under which team agility affects team performance (Dingsoyr and Dyba, 2012; Dingsøyr et al., 2008; Sarker et al., 2009). It can also help to provide some clarity in the discussion weather agility is always improving the performance of software development, especially when considering different dimensions of user involvement intensity (Dybå and Dingsøyr, 2008). Practically, understanding the moderating effect of user involvement intensity helps to derive suggestions for software development teams (Larusdottir et al., 2016). While user involvement intensity is an important factor, depending on a team's agility the effect of its dimensions may vary (Larusdottir et al., 2016). Therefore, we can guide ASD teams in their adoption of user involvement towards more cost-effective implementations of user involvement intensity.

In order to investigate the research objective, i.e. is the identification of the moderating effect of user involvement intensity, three process steps are conducted. First, we review the literature on team performance and user involvement with a focus on ASD. Second, we suggest a research model and formulate hypotheses. Third, we empirically investigate such model. Hence, we formulate the following research question: *What is the moderating effect of user involvement intensity on the relationship between team agility and team performance in ASD?*

2 Theoretical Foundations

2.1 Team Process and Team Performance

Teams have been researched in various contexts (Sundstrom and McIntyre, 2000), such as military operations or firefighting. Their common denominator is having a goal (Levi, 2014) or a common interest amongst the team members (Marschak and Radner, 1972). A team's objective is to generate an outcome that is of use to the organization (Goodman, 1986). The outcome of a team is often measured by the team's performance or its effectiveness (Mathieu et al., 2008). While project related literature often defines performance to be the sum of effectiveness and efficiency, team effectiveness can be split into different outcomes. Hence, it is suggested that team effectiveness is the sum of performance and viability (Sundstrom et al., 1990); performance and satisfaction (Goodman and Shah, 1992); or performance (e.g. efficiency, quality and customer satisfaction), attitude (e.g. employee satisfaction and trust in management) and behavior (e.g. turnover and safety) (Cohen and Bailey, 1997).

In order to study team performance, scholars build on the idea of the Input-Process-Output (IPO) framework (Mcgrath, 1964). Since then, the framework has received widespread attention and was subject to several incremental improvements (Mathieu et al., 2008). However, the framework is criticized for its lack of detail regarding the process dimension (Mathieu et al., 2008). As a result, the IPO Framework evolved and enhancements have been suggested. One example is the Input-Mediator-Output-Input framework, which mitigates the shortcomings of the IPO framework (Ilgen et al., 2005). One of the key differences is the framework's focus on the effects of the different factors. For our definition of a team process, we rely on the definition offered by Marks et al. (2001), who define team process “as members' interdependent acts that convert inputs to outcomes through cognitive, verbal, and behavioral activities directed toward organizing task work to achieve collective goals” (p. 357).

2.2 Team Agility

The ideology behind ASD document four key principles (Beck et al., 2001), suggesting a normative approach towards software development. They prescribe how developers ought to think about work and their environment. Therefore, these principles form agile team norms. Team norms in general regulate the behavior of the team, as they establish clear expectations for appropriate behavior (Hackman, 1987; Kozlowski and Ilgen, 2006). Establishing agile team norms sets clear expectations for behavior within the team. The resulting behavior is often described through the concept of agility, the core concept of the ASD approach (Lee and Xia, 2010). Establishing clear norms frees up time that otherwise would have been spent discussing and specifying the appropriate behavior (Wageman et al., 2005).

However, agility is a term not exclusively used by the Information Systems discipline. Others conduct research in related fields, such as product development, supply chain management, and organizational science (e.g. Volberda, 1996), to investigate this phenomenon. In manufacturing research, a reference model for agility has been proposed (Sharifi and Zhang, 1999). The agility model suggests agility drivers leading to agility and forming antecedents of agile capability, i.e. responsiveness, competency, flexibility, and speed. Within organizational science, the concept is often referred to as the ability to respond to change (e.g. Charbonnier-Voirin, 2011; Ganguly et al., 2009).

Building on various definitions from Information Systems and adjacent disciplines, a definition of Information Systems Development (ISD) agility comprising flexibility and leanness has been suggested (Conboy, 2009). While this definition focuses on the method, others defined the concept as a team phenomenon. Sarker and Sarker (2009) define team agility “in a distributed ISD setting [to be] the capability of a distributed team to speedily accomplish ISD tasks and to adapt and reconfigure itself to changing conditions in a rapid manner by (a) drawing on appropriate IS personnel and technological resources; (b) utilizing appropriate ISD methodologies, mechanisms for bridging temporal distances, and routines to anticipate, sense, and react to changes in the distributed team’s project environment; and (c) forging and maintaining linkages across communicative and cultural barriers existing among the distributed team members. While this definition focuses on a distributed setting, it highlights the importance of flexibility through the adaptation and reconfiguration of the team (Bonner, 2008; Lee and Xia, 2010). The definition also mentioned the temporal elements of agility that require an evolutionary development approach (Bonner, 2008; Vidgen and Wang, 2009). Evolutionary development helps to bridge temporal elements over time. Both elements, process flexibility and evolutionary development, are also found in the definition by Lee and Xia (2010), who define team agility as the “software team's ability to efficiently and effectively respond to and incorporate user requirement changes during the project life cycle”. Similarly to the concept of team cohesion (Kozlowski and Ilgen, 2006), we suggest that team agility is a team process characteristic. Team agility describes an ability to respond to changes over time. Such ability characterizes how the team members interact in order to convert the requirements into the software.

2.3 User Involvement in ASD

The agile manifesto is the foundation for ASD (Beck et al., 2001). It provides a set of principles that guide developers and development teams in becoming agile. ASD has many advantages over traditional software development (Dybå and Dingsøyr, 2008). One of the main benefits is the embracement of changes (e.g. initiated by the user) and, therefore, enhancing the relationship in comparison to document driven approaches (Sillitti et al., 2005). In a similar vein, ASD prevents negative effects onto users by increasing the software development team’s understanding of the user and improving the communication between them (Ceschi et al., 2005). Moreover, environmental factors such as market dynamics and technological innovation drive software development organizations to adopt ASD. In particular, the need to deliver the products faster and in shorter timeframes, while providing additional value further fuel the adoption of ASD (Baskerville et al., 2003).

Prior studies suggest the multidimensionality of the concept of user involvement (Bano and Zowghi, 2014; Damodaran, 1996; Markus and Mao, 2004). These sources, generally agree on three dimensions, i.e. types, practices, and continuity. First, we identify different types of user involvement. The first operationalization of user involvement Tait and Vessey (1988) have already implied different hierarchical types of user involvement, as their measurement scale varies from no involvement to involvement by strong control. Other framework suggest three types of user involvement from a) the user as information source (design for), to b) the user as a co-creator (design with), to c) the user as an innovator (design by) (cf. Cui and Wu, 2015; Damodaran, 1996; Kaulio, 1998). All classifications have their hierarchical view in common that supports the three different types of activities we identify in a team process, i.e. verbal, behavior, and cognitive (Marks et al., 2001). Starting with the user as an informant where they have no authority requires only verbal activities. Second, the user is a participant in the process, collaborates with the software development team and influences design decisions. Third, the user is an innovator and makes their own design decisions. They conduct complex cognitive activities by weighting up's and down's of new ideas and comparing them to prior ideas. While the user as an innovator can greatly benefit from the provision of toolkits (Von Hippel, 2001), these toolkits require their own development. An example of a toolkit is the web page of sport shoe manufacturers, who allow users to customize their shoe to change colors, include text, etc.

While the types refer to the role of the user within the development and design process, practices provide the means for such involvement (Bano and Zowghi, 2014; Markus and Mao, 2004). Design practices in general are part of a broader field of user-centered design (Abras et al., 2004). More recently, scholars have suggested practices that are suitable for a combination with ASD (Brhel et al., 2015; da Silva et al., 2011). The practices help the team to get feedback, information, and knowledge about their software. Example practices include the evaluation of design with pilot runs and interim design reviews by the user through sketches or mock-ups. These trigger a learning process that helps the team to improve their design. As a result, the team will have a better understanding of the users' needs and therefore, is more likely to meet such needs efficiently and effectively (Damodaran, 1996).

Third, the user involvement may happen at different phases within the development project (Bano and Zowghi, 2014; Markus and Mao, 2004). ASD uses an iterative and incremental development process. While phases are often associated with traditional Waterfall model, also agile projects are subject to a lifecycle (Lee and Xia, 2010). Although the agile manifesto does not talk about phases, when teams develop software within organizations, they are subject to certain boundaries. These boundaries can be enforced by other functions, such as product management, who require strategic and temporal decisions. These temporal elements, e.g. planning of product releases, result in corresponding phases. Hence, user involvement can be sporadic and therefore, only happen in a certain phase, such as planning, development or implementation. However, the literature suggests user involvement is most beneficial when it happens continuously throughout the phases (Brhel et al., 2015). In sum, the dimension's type, practice and continuity indicate user involvement intensity.

3 Hypothesis Development

The study investigates the effect of team agility on team performance. Within team research, the IPO framework suggests that team characteristics affects the team outcome through a team process as a mediator (Ilgen et al., 2005; Mcgrath, 1964). Here, we focus on the functioning relationship (Ilgen et al., 2005) and therefore, focus on the effect of the team agility on team performance. Given the user's importance to the software development team as a stakeholder and source of requirements, we suggest a moderating effect of three user involvement dimensions on the relationship between team agility and team performance. The resulting research model is depicted in Figure 1.

The normative approach of the agile manifesto suggests the team to favor some elements over others. An example is the valuation of individuals and interactions over processes and tools (Beck et al., 2001). Principles guide and regulate the acceptable behavior within the team. The idea of regulating behavior is otherwise conceptualized as team norms (Hackman, 1987; Kozlowski and Ilgen, 2006). While the existence of team norms have a positive effect on team performance, the absence thereof leads to an increased need for communication and alignment across the team members and therefore, reducing the team performance (Hackman, 1987; Kozlowski and Ilgen, 2006). Hence, establishing team norms sets clear expectations for the behavior within the team. Following these norms frees up time that otherwise would have been spent in discussion and specifying the appropriate behavior within the team (Wageman et al., 2005). Team norms are shared expectations by all members across the team and facilitate the implementation of the team task (Hackman, 1987; Kozlowski and Ilgen, 2006; Tait and Vessey, 1988; Wageman et al., 2005). These norms develop over time and require subsequent refinement. Once established, they define boundaries for appropriate behavior within the team. Here, agile team norms are derived from the agile manifesto and manifest themselves in team agility.

Team agility is a core concept relevant to ASD teams (Lee and Xia, 2010; Sarker and Sarker, 2009). It is comprised of process flexibility and evolutionary development. Process flexibility helps the team to improve their reaction to changes. In the agile context, these are often invoked by changing user requirements. An improved reaction to such changes helps the team to meet users' needs and therefore improve development success (Sarker et al., 2009). Evolutionary development speaks towards the temporal elements of agility. While scholars refer to the lifecycle of a project (Lee and Xia, 2010), a Microsoft team reports a timeframe of 4 years to become highly mature in ASD (Bisson, 2015). Conducting evolutionary development in smaller iterations helps the team to deliver better software in shorter timeframes and therefore, improve the development performance (Lee and Xia, 2010; Maruping et al., 2009). Moreover, ASD has already found adoption in practice for its positive effects in software development teams (Vidgen and Wang, 2009). More precisely, agility has been found to positively influence on-time completion and development effectiveness (Sarker et al., 2009). Both, on-time completion and effectiveness, are important elements of team performance (He et al., 2007). These findings suggest that there will be a positive effect of team agility on team performance. Hence, we formulate the following hypothesis:

H1: We suggest a positive effect of team agility on team performance.

The benefits of agility are enhanced for teams that conduct user involvement. Research has shown that user involvement plays an important role in software development (Bano and Zowghi, 2014; He and King, 2008). Moreover, a positive effect of user involvement on system success has been established (e.g. Bano and Zowghi, 2014; Harris and Weistroffer, 2009; Markus and Mao, 2004). Within software development, the user represents an important stakeholder and is a source for requirements. When developers are involved in requirements gathering, a direct communication between the developers and users is established (Keil and Carmel, 1995). This direct link also results from the direct involvement of users in the development processes. The contact between developers and users improves development effectiveness (Keil and Carmel, 1995). However, the user involvement is not unidimensional. Rather, it is a multidimensional concept (cf. Bano and Zowghi, 2014; Markus and Mao, 2004). Prior research suggests three dimensions that are important to understand the overall user involvement intensity. User involvement requires the assessment of three categorical types that can be distinguished, the frequency with which user involvement practices are applied and the continuity of the user involvement throughout the project lifecycle.

The positive effect of agility is improved in teams that value the user. User involvement and the methodologies for software development have evolved over time. Traditional software development is associated with a sequential and waterfall-like development process. In this process, users are only seen as a source of information from which developers extract their requirement (Boehm, 1988). Thereafter, iterative methodologies emerged, such as the spiral model (Boehm, 1988), which implemented a more collaborative approach. Stemming from another domain, the user-centered design approach also implements an iterative development approach building on the element of user involvement. Nowadays, agile methodologies in various forms consider the user as more than just a collaborator. It acknowledges that the user can also be an important factor in the innovation process (Von Hippel, 2001). The different roles of the user in the development process and the corresponding team's view affect team performance (Cui and Wu, 2015). It is important to create a fit between the development process and the type of user involvement. Hence, we suggest that the extent to which team agility improves team performance varies with the type of user involvement.

H2: There will be a positive effect of the type of user involvement on the relationship between team agility and team performance.

When using a moderate frequency of user involvement practices, the benefits of team agility are higher. In order to involve the user, the development team can choose from a plethora of different practices available (Vredenburg et al., 2002). As a result, the team creates different deliverables, such as mock-ups, user stories or working prototypes (Brhel et al., 2015; Ferreira et al., 2007). Such deliverables provide a mean to evaluate concepts and ideas. Through this evaluation, the team is able to analyze whether or not their developments meet the user's needs. The evaluation provides an important feedback mechanism for the team. Based on this feedback, the team may decide to continue its course of action, or adjust its course in order to improve their performance. This adjustment works best when the team is flexible and benefits of these adjustments over time in an evolutionary process. However, the challenge for the team remains in finding the right frequency of such practices. Little or limited use of practices leads to non-representative conclusions (Nielsen and Landauer, 1993). To the contrary, after a point of saturation, additional practices yield little or no new insights (Nielsen and Landauer, 1993). The generation of information and feedback through frequent user involvement is an example of the information overload phenomenon, where both, too little and too much information reduces the decision accuracy (Eppler and Mengis, 2004). We suggest that the extent to which team agility increased team performance varies with the frequency of practices used to involve the user.

H3: There will be an inverted u-shaped effect of user involvement practice frequency on the relationship between team agility and team performance, so that team performance is higher when user involvement practices usage is moderate and lower when user involvement practices is either lower or higher.

Teams that continuously involve the user improve the benefits offered by ASD. In comparison to traditional software development, agile pushes failures towards earlier phases in the development process (Hoda et al., 2011). The methodology encourages the team "to fail often and early" with ideas as part of an evolutionary development approach. Rather than pushing the involvement to specific phases within the development, recent literature suggests the continuous involvement of users throughout the development (Brhel et al., 2015). Teams that utilize a continuous involvement of users maximize the benefits of an evolutionary development approach. Such continuous feedback also improves the comprehensiveness of the user involvement, e.g. through the evaluation of screens developed in the last iteration. In addition, the software development team needs to establish an ongoing and direct communication with their users in order to meet their needs and identify possible failures throughout the project lifecycle (Keil and Carmel, 1995). This direct communication has shown to avoid miscommunications and improve the team's understanding of the users. Given the cost escalation factor of 5:1 within software development projects (Boehm et al., 2005), the identification of failures early in the process reduces the overall development efforts of the team and therefore, increase its performance. While it might be tempting to shift the involvement to critical milestones, a continuous involvement throughout the lifecycle assures an early identification of failures and reduces uncertainty (Maruping et al., 2009). Hence, we suggest that the extent to which team agility enhances team performance varies with the duration of user involvement throughout different phases of the project lifecycle.

H4: There will be a positive effect of user involvement continuity on the relationship between team agility and team performance, so that team performance is higher when user involvement is continuous through various phases and lower when user involvement is sporadic at different phases.

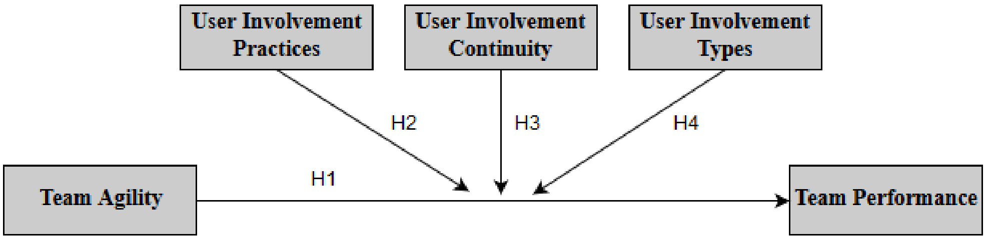

Figure 1. Research Model.

4 Research Method

The paper aims to collect data from ASD teams in the software industry. For the software industry software development is a core activity. Thus, the organizations participating in the study are likely to have a vital interest in the results. A larger variance in terms of team members' experiences and software development maturity can be expected, given the time needed for teams to become truly agile.

4.1 Sampling

The teams will be part of a larger software development organization. Multiple organizations will be approached in order to gather sufficient data. We will actively approach companies that are relevant to our study, i.e. we will conduct a purposive sampling approach. The teams will be sampled based on their industry association, response rate and composition. Each team will be required to respond with at least three different roles in order to assure a representative sample of each team.

4.2 Measurement

All constructs build on prior research and are measured on a 5-point Likert scale, unless noted otherwise. The measure for team norms is adopted from Wageman et al. (2005) and is measured by three reflective items. User involvement types are measured using reflective items by Cui and Wu (2015). Five items reflect the user as an information source, six items indicate the user as a co-creator and five items indicate the user as an innovator. User involvement practices are measured through four reflective items adopted from Menguc et al. (2014). The user involvement continuity are measured using five reflective items from Potter and Lawson (2013). For the measurement of agility, we use the operationalization as proposed by Bonner (2008). Hence, we measure agility as a second order construct using process agility and evolutionary development as the first order constructs. Evolutionary development is measured using 8 items, out of which 7 items are formative using another reflective item for validity. Process agility consists of 5 items, whereas 4 are formative and one additional item reflective. The outcome variable team performance is measured by 5 items (He et al., 2007). The items indicate the amount of work, efficiency, adherence to schedule, quality and effectiveness. In addition, we adopt the control variables team longevity, team size, gender diversity, nationality diversity, tenure diversity, role diversity, academic diversity and age diversity suggested by Kearney et al. (2009). In addition, we control for top management support (Rai et al., 2009) and changing requirements (Maruping et al., 2009) as known influential factors for agile development.

4.3 Data Collection and Data Analysis

The study suggests to use a questionnaire for data collection. A pre-test has been conducted with 13 individuals, whereas 8 provided online feedback and 5 provided in-person feedback. For our pilot-test, we approach software development organizations in Germany. We focus on the software product teams and offer the survey as a service to them. Most variables are measured from the software development team's perspective. The survey gathers and requires data from at least three different roles (cf.

Zhang et al., 2007). These roles would encompass the team leader, a designer and a developer. A representative sample of the software development team can be cross-checked through the within-group agreement of the teams' responses (LeBreton and Senter, 2007). Moreover, in order to mitigate possible bias from the development organization on our dependent variables, we measure the variable from the team leader. Therefore, we are limiting potential threads of a common method bias by changing the examiner and the incentive to participate in the test (MacKenzie and Podsakoff, 2012).

In order to validate our model, we follow the data analysis process as described by Urbach and Ahlemann (2010). Therefore, we assess reflective constructs for their validity testing for reliability, convergent and discriminant validity. Formative constructs are tested for using, indicator and discriminant validity tests. In order to analyze the model, we will employ Partial Least Square (PLS) analysis as one approach to assess a Structural Equation Model. We opt for an analysis of PLS, given the exploratory nature of this research with its expected smaller sample and the use of formative constructs. We analyze the coefficient of determination (R^2) and calculate the effect size (Cohen's f^2).

5 Contribution

Through this study, we intend to contribute to the literature by adopting a team-theoretical view towards ASD. First, the study investigates the extension of ASD with an emphasis on the user, rather than the customer as an important source of requirements. Here, a closer look at the different subdimensions of user involvement are especially helpful to improve their integration into the development process. Second, we provide a step towards more theory in the software development domain by building on mature reference disciplines. In particular, we build on team related research with a long history and related studies in psychology. Third, given the context of software development, we focus on teams and hence provide further insights into the human and social aspects of the agile phenomenon. Fourth, we provide empirical evidence for the relationships of our research model. Establishing team agility as a team process would allow further research angles on the team performance of development and other teams following an agile approach. In addition, we compare the software teams along their performance and level of agility. The practical contribution of this study is the learnings and results, helping managers to target their investment in software development teams in general and to improve the link to their users in particular.

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