EXPLORING THE CUSTOMER PERSPECTIVE OF AGILE DEVELOPMENT: ACCEPTANCE FACTORS AND ON-SITE CUSTOMER PERCEPTIONS IN SCRUM PROJECTS

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Abstract

In recent years, agile development methodologies have attracted great attention. Although the success of agile development projects depends considerably on the willingness of customers to actively participate, little research has examined which factors of such methodologies customers perceive as benefits or drawbacks. Employing an exploratory, primarily qualitative study design and the Diffusion of Innovations Theory as theoretical lens, we identify several acceptance factors of Scrum as a specific methodology and describe how customers perceive them. As basis for our examination, we use empirical data that was collected at a world-wide leading insurance company and a mixed-method approach that combines qualitative with quantitative data analyses. The results suggest that customers found Scrum to deliver relative advantages. Furthermore, they indicate that Scrum is perceived as more compatible to the way customers prefer to work in development projects. Factors that characterize the perceived complexity of Scrum were viewed as potential acceptance barriers, however.

Keywords: Agile software development, customer satisfaction, software development, mixed-method research
Introduction

Ever more turbulent business environments make it increasingly difficult for information systems development (ISD) teams to meet the volatile requirements of their customers in a cost-efficient and timely way. To help solving this challenge, innovative agile methodologies such as Scrum or Extreme Programming (XP) have been proposed. They aim at improving the ability of ISD teams to adapt to changing requirements by promoting communication, close collaboration with customers, self-organization, and responsiveness to change over extensive up-front planning and codified processes (Nerur and Bajipally 2007). Agile methodologies are rapidly becoming popular and early studies already suggest that they can indeed enhance the flexibility of ISD teams (Fitzgerald et al. 2006; Mann and Maurer 2005).

The success of such methodologies depends considerably on the willingness of customers to actively support the agile development process, however (Conboy 2009; Karlström and Runeson 2005). In particular, they have to commit themselves to agile principles like close collaboration and tight communication. Such an intensive participation is sometimes said to be an advantage for customers as it allows them to better influence the development process (Iliev et al. 2004; Mann and Maurer 2005). However, as customers ideally have to be present on site continuously in order to give feedback and prioritize requirements, the necessary participation can also be viewed as “an exhausting activity” that they might try to avoid in practice (Karlström and Runeson 2005; Petersen and Wohlin 2009). It consequently ought to be investigated which factors of agile methodologies are perceived as benefits or drawbacks by customers and so facilitate or hinder the acceptance of agile methodologies. Yet, scientific interest is mainly geared towards evaluating agile development in terms of product quality, development costs, completion time, or developer acceptance (Lee and Xia 2010; Mangalaraj et al. 2009; Maruping et al. 2009; Port and Bui 2009). So far, little research has focused on examining how customers perceive agile development.

With the study presented in the work at hand, we contribute to closing this literature gap. Building upon an exploratory, primarily qualitative study design and using the Diffusion of Innovations Theory (Rogers 1995) as the lens for analysis, we address the following research questions: which factors determine the acceptance of agile methodologies by customers? Compared to traditional development approaches, are they perceived as benefits or drawbacks? To examine both questions, we use a mixed-method research approach that combines qualitative and quantitative methods in sequence. This allows us to obtain rich insights and use statistical evidence to cross-verify the qualitative results (Kaplan and Duchon 1988; Lee 1991). The data was gathered at a large, world-wide leading insurance company that began introducing and gradually rolling out Scrum as main development methodology in 2007. At the time of our study, 200 developers were using Scrum in 23 projects, which were driven by different in-house customers. The setting hence allowed us to study the customer perception of agile methodologies at the individual level in depth. In our study, we deliberately chose to focus on Scrum as a specific methodology for three reasons. First, Scrum is among the most widely used agile methodologies to date (VersionOne Inc. 2012). Moreover, Scrum concentrates on the planning and tracking of agile projects and on the continuous involvement of stakeholders while other methodologies mainly support the implementation of systems (Fitzgerald et al. 2006). As customers are primarily involved in planning and tracking activities, the use of Scrum appears to be particularly well suited to study the customers’ perception of agile methodologies. Finally, our strategy to examine the use of a concrete methodology follows a call for a practice-focused approach to study agile methodologies (Dyba and Dingsoyr 2008). Yet, we also acknowledge the need to examine the effects of agility as a theoretical concept (Conboy 2009), in the light of which our findings can be interpreted as well.

To further pinpoint the existing literature gap, we discuss Scrum and related work in the next section. In section 3, we set the theoretical background. The research approach is described in section 4. In section 5, we discuss the qualitative and quantitative results. Implications and limitations of our findings are described in section 6. We conclude by summarizing the work and presenting future research directions.

Research Gap

Agile methodologies such as Scrum differ significantly from traditional methodologies such as the waterfall model and its descendants. Their introduction consequently causes several changes for both
developers and customers. In the following, we specifically discuss the changes that Scrum introduces for customers and investigate in how far the customer acceptance of agile methodologies has been examined in the literature up to now.

**Scrum and Traditional Methodologies**

The agile manifesto values the role of the customer in its first principle where it states that the “highest priority is to satisfy the customer” (Beck et al. 2001). Following this principle, Scrum introduces a dedicated role for the customer, the so-called Product Owner, which is integrated tightly into the development process. The Product Owner determines the direction of the development project and is “responsible for maximizing the value of the product and the work of the development team” (Schwaber and Sutherland 2013). To achieve these goals, the Product Owner has to work closely together with the development team and to be present on site regularly (Schwaber and Beedle 2002). In the work at hand, we examine the perceptions of on-site customers who take the role of the Product Owner in Scrum projects. Accordingly, we will use the terms (on-site) customer and Product Owner interchangeably.

Scrum furthermore differs from traditional methodologies with respect to the project planning. Whereas traditional approaches typically proceed according to a predefined process model in which a work-breakdown structure with milestones, responsibilities and work packages is defined up front, Scrum assumes that the analysis, design, and implementation cannot be planned ahead because requirements are likely to change during the process (Schwaber 1995). Accordingly, Scrum introduces an empirical process control to manage development projects from iteration to iteration. Instead of extensive up-front planning, Scrum builds upon three levels of planning in which the customer is involved: Release Planning, Sprint Planning, and Daily Scrum. While the Release Planning is thought to cover only basic strategic aspects such as the overall functionality, operational details are to be discussed with the customers separately from iteration to iteration. Such iterations are called Sprints and are supposed to take about a month. During the Sprint Planning, the relevant details for the iteration are determined. Thereby, the development team discusses and prioritizes the requirements for the Sprint together with the customer before they are summarized in the Sprint Backlog. Sprint Planning meetings are suggested to take eight hours for a one month Sprint and shall be adjusted proportionally to the length of a Sprint (Schwaber and Sutherland 2013). The Daily Scrum represents the most detailed level of planning. During daily 15-minute meetings, the development team shall discuss with the customer how they plan to accomplish their work.

Not only the planning, but also the identification and management of requirements are handled differently. Throughout a Scrum project, customers work closely together with the developers in order to continuously identify and refine all requirements and specify them in the Product Backlog, in which the requirements are prioritized. Customers can continuously change priorities or add new requirements to the Product Backlog while the development is ongoing. This continuous feedback of customers is emphasized as “one of the most valuable characteristics of agile methods” (Huo et al. 2004). It is viewed as a key mechanism that allows developers to meet the requirements of customers more accurately and to flexibly respond to changing requirements. In traditional methodologies, such procedures typically do not exist as the initial requirements are fixed for the rest of the project in a contract-like document. If customers realize that initially determined requirements are not sufficient anymore, a change-management process has to be initiated. By intensifying the communication within the development team as well as between customers and the development team, Scrum systematically facilitates the transfer of knowledge. Whereas Scrum favors implicit knowledge that is disseminated during the various meetings (Boehm 2002), traditional methodologies rely on codified knowledge in form of explicit documentation.

In order to control the project state, Scrum uses so-called Burndown Charts that make the progress during iterations transparent. In Burndown Charts, the remaining tasks are publicly depicted and updated on a daily basis. Customers are expected to additionally attend Daily Scrum meetings to obtain direct feedback on the progress as well as on individual tasks. Scrum moreover postulates that customers shall evaluate a working piece of software after the end of each Sprint. This is thought to give them the opportunity to gain insights into the current status of the development project and to quickly react to possible misunderstandings. Traditional methodologies instead use milestones and status reports. In contrast to Scrum, customers can inspect working pieces of software only in late project stages. There also exist differences with respect to the feedback mechanisms and learning processes. Scrum facilitates learning processes already after the first Sprint. To discuss the results of each Sprint, Sprint Review
meetings are established. In Sprint Review meetings, the customer discusses the Product Backlog with the team. Sprint Review meetings are scheduled to last four hours for a one-month Sprint. Compared to that, team members in traditional projects usually discuss so-called lessons learned only at the end of a project.

**Related Work**

The discussion shows that the introduction of Scrum significantly intensifies the collaboration between customers and developers. Moreover, several benefits of Scrum can only be realized if customers are committed to the agile philosophy and willing to intensively participate in the project (Cao et al. 2009; Fitzgerald et al. 2006). Ensuring the customer commitment hence becomes a critical success factor (Conboy 2009; Karlström and Runeson 2005). It is therefore acknowledged in literature that “factors associated with customers would be crucial to the adoption of agile methodologies” (Wang et al. 2012). To uncover in how far the customer acceptance of agile methodologies has been investigated, we conducted a literature review based on the recommendations of Webster and Watson (2002). We searched leading journals and conference proceedings of the information systems and software engineering disciplines to find relevant articles, which are concerned with the acceptance of development methodologies. In addition, we inspected the citations of identified articles to find additional publications that might have remained uncovered in the first step. Thereby, the literature reviews of Chan and Thong (2009), Petersen and Wohlin (2009), and Dyba and Dingsoyr (2008) provided a rich basis of citations.

Our review found that especially the acceptance of traditional development methodologies has been investigated in detail (e.g. Iivari and Huisman 2007; Khalifa and Verner 2000; Riemenschneider et al. 2002; Roberts et al. 2001). Both the Technology Acceptance Model (TAM, Davis 1989) and the Diffusion of Innovations (DOI, Rogers 1995) Theory have frequently been used as lenses of analysis. As agile methodologies take a significantly different approach than traditional methodologies, the results of such studies cannot easily be transferred, however. Instead, the assimilation of agile methodologies needs to be examined separately. In parallel with the growing popularity of agile methodologies, several initial studies began examining the acceptance of agile methodologies. Despite these efforts, it is criticized that this research “is yet to yield significant systematic and insightful knowledge that can either guide future research or inform effective adoption [...] of these methods in practice” (Wang et al. 2012). In particular, it is argued that many studies are missing a theoretical and conceptual foundation, which makes the current body of knowledge inconclusive (Wang et al. 2012). Moreover, most studies focus on factors that influence the adoption of agile methodologies from a developer perspective (Chan and Thong 2009; Dyba and Dingsoyr 2009; Senapathi and Srinivasan 2012; Vijayasarathy and Turk 2012). Even though the important role of the customers in agile development has been pronounced in the literature, their impact on agile projects often is analyzed only as an aside. In such studies, the taken perspective only leads to conclusions like “the work the customers did was considered very valuable by all programmers” (Tessem 2003). However, it is likely that both the factors that determine the acceptance of agile methodologies as well as their perceptions differ between developers and customers. Hence, it is necessary to explicitly examine which factors foster or hinder the acceptance of agile methodologies from a customer perspective.

Only a few studies explicitly include an analysis of the customer perspective. Ilieva et al. (2004) examined the use of a customized agile methodology that combines XP with the Personal Software Process (PSP). While they define a metric to measure the customer satisfaction with the new methodology, they do not elaborate on the results. It is mentioned that having constant control “was highly praised by the client at the project sign-off,” but no additional conclusions were derived. The study results are furthermore limited as the customers were not on site although “customer on-site practice is the leading practice [...] and therefore requires to be applied as much as possible” (Ilieva et al. 2004). Using semi-structured interviews, Martin et al. (2004) collected insights from three case studies in which they analyzed the role of customers in XP projects. Compared to the former study, they report results that are somewhat more critical as it turned out that the intensive involvement of customers also had drawbacks. They report that “the customers had the most pressured and stressful role in the project, requiring significantly more effort than the development team members” (Martin et al. 2004). It is unclear how many customers were interviewed and how the data was analyzed though. Next to other agile practices, Wang et al. (2012) have also examined the effects that the intensive collaboration with the customer has on the acceptance of agile methodologies. However, the studied teams did not interact with on-site customers. Instead, internal team members took the role of the Product Owners and worked as proxies, since the actual customers
were not available on site. With respect to the on-site customer practice of agile methodologies, the results are consequently somewhat limited.

So far, the factors that influence the customer acceptance of agile methodologies mainly have been examined as an aside. Moreover, many studies suffer from a lack of theoretical and conceptual foundation (Wang et al. 2012). Despite the essential role that customers have in agile projects, it is hence not clearly apprehended yet which factors facilitate or hinder the customer acceptance of agile methodologies. With the work at hand, we aim at providing dedicated and theoretically grounded insights into the factors determining the customer acceptance of agile methodologies in order to help closing this literature gap.

**Theoretical Background**

As illustrated in the last section, Scrum differs from traditional development methodologies in several aspects. From a theoretical perspective, its new way to manage the development of information systems hence qualifies Scrum as a software process innovation (Conboy et al. 2007). An innovation broadly is defined as “an idea, practice, or object that is perceived as new by an individual or other unit of adoption” (Rogers 1995). The assimilation of innovations is explained by innovation diffusion theories, which describe the assimilation process and the factors that determine the rate of assimilation. To explain the process in which a technological innovation is assimilated by an individual, a group, or an organization, Gallivan (2001) introduces a model consisting of six stages. The assimilation process begins with the initiation stage, in which the overall suitability of the innovation for the adopting unit is determined. In the subsequent adoption stage, a decision to introduce the innovation is made. During the adaptation stage, the innovation is adjusted and members of the adopting unit are trained to use it. In the acceptance stage, the members of the adopting unit are committing to use the innovation. Its use is then encouraged as normal activity during the routinization stage. During the infusion stage, the innovation finally is used comprehensively. In the work at hand, we aim at investigating the effects of Scrum in use. We hence focus on the perception of Scrum during the late assimilation stages according to Gallivan’s process model.

Theories such as the Diffusion of Innovations (DOI) Theory, the Technology Acceptance Model (TAM), or the Theory of Planned Behavior (TPB) also describe generic factors, which determine the assimilation of innovations in general. Fundamentally, these theories have many factors in common. Moreover, they have already been used to successfully explain the assimilation of information systems, tools, and software process innovations (Riemenschneider et al. 2002). Such theories can hence provide a theoretical fundament and starting point for the identification of specific acceptance factors, which determine the assimilation of agile methodologies. For our study, we use the broadly applicable DOI Theory as a theoretical lens. The DOI Theory delivers a well-established perspective that has been widely used in information systems research already (Mustonen-Ollila and Lyytinen 2003; Prescott and Conger 1995; Riemenschneider et al. 2002; Tornatzky and Klein 1982). It defines five perceived attributes of an innovation as generic factors that affect the willingness of individuals to assimilate it (Rogers 1995):

- **Relative advantage:** the extent to which it is viewed as better than the concept that it supersedes.
- **Compatibility:** the extent to which it is viewed as consistent with actual needs or preferred practices.
- **Complexity:** the extent to which it is viewed as difficult to utilize.
- **Trialability:** the extent to which it is viewed as easy to experiment with.
- **Observability:** the extent to which it is viewed as visible to others.

The relative advantage of an innovation describes the degree to which it is perceived as providing benefits compared to the concept that it supersedes (Moore and Benbasat 1991). Among others, perceived benefits can result from a felt increase in effectiveness, efficiency, status, or economic gains. The compatibility of an innovation expresses the degree to which it appears to be consistent with the preferred method of working (Moore and Benbasat 1991). Amongst others, the preferred method of working is determined by the existing values, experiences, habits, needs, or preferred practices. The complexity of an innovation characterizes the degree to which it is considered as difficult to understand or use in practice (Moore and Benbasat 1991). The trialability of an innovation expresses the degree to which it is felt as easy to experiment with prior to adoption (Agarwal and Prasad 1998). This property of an innovation contributes to reducing the user’s perceived risk of assimilating a new concept. The observability of an innovation describes the degree to which its features and effects are perceived as being visible to other members of a social group (Moore and Benbasat 1991). The effects of this attribute are twofold (Rogers 1995). For the
observer, a high degree of observability makes it easier to assess an innovation prior to adoption. For the adopter, a high degree of observability facilitates gaining the social prestige that is associated with adopting the innovation. In general, all factors except complexity are positively correlated to the rate of assimilation. Complexity instead is negatively correlated (Moore and Benbasat 1991; Rogers 1995).

The perceived attributes of innovations have frequently been used in information systems research. Meta-analyses of the conducted studies have shown, however, that not all of the attributes are significant determinants for the adoption of software process innovations (Mustonen-Ollila and Lyytinen 2003; Tornatzky and Klein 1982). Regarding the willingness of individuals to use software development methodologies in organizations, especially trialability and observability were often found to be non-significant (Mustonen-Ollila and Lyytinen 2003; Riemenschneider et al. 2002). There seem to be mainly two reasons for this observation (Riemenschneider et al. 2002): first, the magnitude of behavioral change caused by the adoption of a methodology is far greater than that caused by the adoption of a tool. Second, the degree to which the adoption of the target innovation has been mandated is much greater for methodologies than for tools. The assimilation of development methodologies is hence not so much a matter of accessibility or personal standing. It rather seems to be a matter of relative advantage, compatibility, and complexity, which were consistently found to be significant determinants in the literature (Riemenschneider et al. 2002; Tornatzky and Klein 1982).

For this reason, we decided to use a consolidated model of the latter three determinants as a theoretical fundament to identify specific factors, which determine the customer acceptance of Scrum (Figure 1). Note that the conceptual difference between compatibility and relative advantage is still discussed somewhat controversially in the literature. Building on the definitions of the concepts that were originally introduced by Rogers (1995), some proponents argue that relative advantage encompasses compatibility. Yet, Karahanna et al. (2006) show that compatibility can in fact be treated as a multidimensional concept of its own and demonstrate how it relates to the other concepts. Following their argumentation, we chose to consider compatibility as a separate concept in our study as well.

**Research Approach**

The objective of this research is to gain an understanding of both the factors that determine the customer acceptance of Scrum and their perception in practice. Consequently, we adopted an exploratory, primarily qualitative research design for our study. A qualitative stance is especially considered appropriate to investigate new and evolving fields in which little or no research has been conducted before (Rubin and Babbie 2006). It allows us to gain in-depth insights into the factors that influence the use of Scrum and to understand why certain aspects facilitate or hinder the acceptance of Scrum by customers (Given 2008). On this basis, we are able to derive a theory on the factors that influence the customer acceptance of Scrum. In order to increase the robustness of our qualitative findings, we decided to make use of a mixed-method approach that combines qualitative and quantitative methods in sequence. In general, such an approach helps mitigating the limitations of each individual research method as it allows researchers to triangulate results (Kaplan and Duchon 1988; Lee and Xia 2010; Trauth and Jessup 2000). In an exploratory setting such as ours, a sequential mixed-method approach allows to gain an in-depth understanding of the context and to cross-verify interpretations of qualitative data with quantitative data.
which the expert works, the experience the expert has with Scrum and traditional methodologies, as well as the time that the expert had been working in Scrum and traditional development projects. In the second part, we asked for factors that influence the customer acceptance of Scrum and wanted to know how the customers perceive these factors. Taking the DOI Theory and the consolidated model of generic principles, and help to apply them. One of their responsibilities is to coach Product Owners and Scrum Masters. Scrum Masters work as members of the development teams. They ensure that the team members collaborate smoothly and help them develop their interpersonal competences (Schwaber and Beedle 2002). They also make sure that the development team adheres to Scrum practices and rules (Schwaber and Sutherland 2013). Scrum Coaches are senior Scrum experts that work as counselors during the introduction and infusion of Scrum. They guide team members, make them familiar with agile principles, and help to apply them. One of their responsibilities is to coach Product Owners and intensively reflect gathered experiences together with them. Both expert groups are hence able to provide in-depth information about customer perceptions.

In total, we interviewed six experts: two had the role of Product Owners, three served as Scrum Coaches, and one worked as Scrum Master. The guideline for the semi-structured interview consisted of two parts. The first part contained general questions about the expertise of participants such as the department in which the expert works, the experience the expert has with Scrum and traditional methodologies, as well as the time that the expert had been working in Scrum and traditional development projects. In the second part, we asked for factors that influence the customer acceptance of Scrum and wanted to know how the customers perceive these factors. Taking the DOI Theory and the consolidated model of generic
acceptance factors (Figure 1) as a theoretical fundament, we asked which aspects of Scrum were perceived as relative advantages or disadvantages for customers, which aspects were viewed to be or be not compatible to the way customers prefer to work in development projects, and which aspects were felt to reduce or increase the complexity for customers in Scrum projects. Following our exploratory stance, we formulated open-ended questions and allowed the experts to specify their own answers. We did neither inquire the participants about specific acceptance factors nor mention any specific acceptance factors in advance during the interviews. For each aspect that an expert specified, we wanted to know why it was judged to be important, how it was perceived by the on-site customers in comparison to the traditional methodology that was used before, and how the perception of the aspect affects the commitment of the customers to agile development. Overall, the interviews closely followed the recommendations of Myers and Newman (2007).

We used the gathered data to identify specific factors that positively or negatively influence the customer acceptance of Scrum. Therefore, we analyzed the data collected in the second part of the interviews in three steps (Charmaz 2000; Miles and Huberman 1999). First, we used open coding to search the statements of the experts for recurring topics and to get an overview of the key points contained in the data. Second, we grouped statements of similar topic into segments in order to identify concepts that were repeatedly articulated throughout the interviews. As a result, we were able to derive several specific acceptance factors for Scrum that were consistently highlighted by the experts. Furthermore, we analyzed the topical segments for consistent and distinctive statements to find out if the concepts were perceived in a consensual manner. In a third step, we applied theoretical coding to categorize the identified acceptance factors according to the consolidated model of generic acceptance factors (Figure 1).

Following the analysis of the qualitative data, we collected quantitative data from the Product Owners of the company to cross-verify the factor perceptions and to fully utilize the sample of customers that we had access to. For this, we used the identified factors as elements of a survey. In so doing, it is important to ensure coherence between the concepts contained in the survey and the ones identified during the analysis of the qualitative data in order to keep the results traceable (Cronholm and Hjalmarsson 2011). We therefore chose to straightforwardly ask for the perception of each factor that we had identified. Since the participants were assigned to different headquarters, we conducted an online survey. All of the survey participants occupied the role of the Product Owner and were on site in their Scrum projects. They had several years of experience with ISD projects and had worked with traditional methodologies before. Since the participants hence had expertise in both methodologies, they were best suited to evaluate how much they differ. We therefore decided to ask comparative questions to examine if a factor was perceived to have changed positively or negatively with the introduction of Scrum. All questions in the survey had the same basic structure. For instance, we asked: “Compared to traditional projects, how do you perceive the time to market in Scrum projects to be”. Responses were measured on a five-point Likert scale, mostly with the following items: (1) much worse, (2) somewhat worse, (3) about the same, (4) somewhat better, (5) much better (Vagias 2006). The customers moreover were allowed to leave out questions they were not sure about. To analyze the data for statistical significance, we performed one-sample, two-tailed student’s t-tests (Walczuch et al. 2000). Such a t-test is able to deliver valid results for five-point Likert scales regardless of the discreteness and the possibly non-normal distribution of their values (de Winter and Dodou 2010). If the mean value of the responses significantly deviated from the middle value “3”, the factor asked for in the question was considered to have been affected by the introduction of Scrum.

Note that we did not use multiple quantitative measurements of the same phenomenon in order to ensure the validity of the quantitative results. Following recommendations to conduct mixed-method research, we instead rely on methodological triangulation, i.e. the use of multiple methods to study the same phenomenon, and data triangulation, i.e. the use of multiple data sources to study the same phenomenon, as alternative approaches (Denzin 1978). We achieve methodological triangulation by combining qualitative with quantitative data analyses and data triangulation by analyzing two distinct samples. For this reason, we excluded all interviewed Product Owners from the survey.

Results and Discussion

We present the results in the order the research was conducted in. First, we analyze the qualitative data. Then, we analyze the quantitative data to verify the qualitative results. Finally, we discuss the findings.
Analysis of Qualitative Data

The data gathered during the first part of the interviews shows that the six interviewees had profound experience in Scrum and traditional methodologies. On average, they had been working with Scrum for 4.1 years and with traditional methodologies for 20.3 years. On a scale from (1) marginal knowledge to (4) profound knowledge, they rated their expertise in Scrum at 3.7 and in traditional methodologies at 3.2. Based on the expert statements gathered during the second part of the interviews, we were able to identify seven specific acceptance factors for Scrum (F1-F7), which were all emphasized as important by two thirds or more of the experts. Besides that, two additional factors were described as significant by more than one expert. Since the two additional factors were both mentioned by merely two experts, we decided to limit our analysis to the former seven factors, on which the experts reached a broad consensus. For each factor, we depict the most substantial interview statements (which we faithfully translated into English language) and present our interpretation. To keep our interpretation separate and make the results traceable, we inserted anchors in squared brackets into the statements, which we reference to justify our interpretations.

With respect to the relative advantages and disadvantages of Scrum, the interviewed experts consistently pointed to three factors. All six experts emphasized the meeting of requirements (F1) as an important factor: “It is a big advantage that only such functionality is built that is truly required. Superfluous functionality is being omitted early [1.1]. For a customer, it is difficult to specify requirements up front and from a purely theoretical perspective. Now, we can unveil what we really want to have in discussions with the developers [1.2]” (Product Owner 2). “As we now develop the requirements together with the developers, they become much clearer for all parties. Collaborating with them [the developers] helps us to understand the product and the developers tell you why a requirement might not be easy to fulfill [1.3]. Another positive point is that it is now possible to insert and trigger requirements flexibly using the prioritization. With the V-Model, we had to plan and fix everything up front [1.4]” (Product Owner 1). “The requirements specifications of former times seldom described what the customers actually needed. They did perhaps contain what the customers wanted to have. However, what they truly needed often was different. Now, this is investigated and found out during development. The customers appreciate this very much [1.5]. Another major improvement for the customers is that new requirements are accepted during development and that it is not necessary to realize change requests afterwards anymore [1.6]” (Scrum Coach 1). “The Product Owners appreciate the possibility to continuously sort out, reevaluate, and prioritize [1.7]” (Scrum Master).

From the interview statements, we can conclude that the customers feel their requirements to be met better in Scrum projects [1.1, 1.5]. In comparison with traditional development projects, the better meeting of requirements apparently is perceived as a relative advantage that positively affects the customer acceptance of Scrum [1.1, 1.4, 1.5, 1.7]. The better meeting of requirements seems to be caused especially by two measures. The collaborative development of requirements seems to help clarifying the development goals also for the customer side [1.3, 1.2]. Moreover, the customers seem to appreciate the possibility to flexibly evolve and reprioritize requirements during the development process [1.4, 1.6].

As a second factor, all of the interviewees described the economic value (F2) of the development project: “The customers have the impression to get more value for their money [2.1]” (Scrum Coach 1). “Regarding the outcomes, Scrum is very positive. We have a faster, more productive output [2.2]. When developers had finished their assignments in the past, they started twirling their thumbs until they got a new assignment. Now they take over their tasks flexibly using the task-board. This reduces idle times [2.3]” (Scrum Coach 3). “We do not have to sit down and write a long functional specification, which saves us some time [2.4]. But there is more. Of course, projects should be in budget. But it is also important that we now know why they might become more expensive if unexpected difficulties are encountered. Such projects can still be worth the money [2.5]” (Product Owner 1). “There is a proverb to describe the situation before: to live under the illusion of satisfying underperformance [2.6]. It is impressive that we can now cancel projects nearly anytime if priorities change and nonetheless we have a business value because usable products have already been created [2.7]” (Product Owner 2). “Doing only the right things and getting them done well with respect to the usefulness of the results turned out to be as important as doing things fast [2.8]” (Scrum Master).

The interview results indicate that the customers consider the economic value to be higher in Scrum projects [2.1, 2.4]. Compared to traditional development projects, the increased economic value seems to
be viewed as a relative advantage that positively influences the customer acceptance of Scrum [2.2, 2.6]. In part, the increased economic value is felt to come from a reduction of costs due to a reduced overhead and an improved utilization of developer capacities [2.3, 2.4]. However, it seems that the customers perceive economic value to be a broader concept, which does not only encompass efficiency gains. An increased accountability [2.5] and gains in effectiveness [2.7, 2.8] apparently contribute to the economic value as well.

As a third factor, the time to market (F3) was highlighted by five of the interviewees: “The customers very much appreciate that a good covering of requirements is already achieved early during the project [3.1]. The developers can now focus on what customers need most and defer less relevant features [3.2]. Hence, outcomes are delivered much earlier than before [3.3]. In Scrum projects, the customers already get 80% of the functionality that they want at an early stage and with a comparatively small budget. They can then decide if they also want to have the remaining 20%” (Scrum Coach 3). “The developers immediately begin implementing software [3.4] and the product is made available much faster [3.5]. It contributes much to our satisfaction that we get to see the realization earlier than before [3.6]” (Product Owner 2). “For me, the faster output in Scrum projects is an essential benefit [3.7]. We had a deployment after each Sprint [3.8]. Thanks to this iterative concept, we quickly learned to identify distinctive packages of functionality and prioritize them according to our needs [3.9]” (Product Owner 1). “The reduced time to market is a key benefit for the customers [3.10]. We deliver results faster and they can be readily used to conduct business” (Scrum Coach 2).

The interview statements suggest that the customers consider the time to market to be reduced in Scrum projects [3.3, 3.5, 3.7]. Compared to traditional projects, the reduced time to market apparently is viewed as a relative advantage that positively influences the customer acceptance of Scrum [3.1, 3.6, 3.10]. Above all, the better time to market seems to be caused by two mechanisms. The constant delivery of working software after each Sprint seems to facilitate an early product delivery [3.4, 3.8]. The continuous requirements prioritization obviously contributes to delivering mission-critical functionality first [3.2, 3.9].

Regarding the compatibility of Scrum to preferred work practices or actual needs of the customers in development projects, the interviewed experts consistently emphasized two factors. Four of the interviewed experts described transparency (F4) as a central factor: “The customers perceive the transparency of both the development problems and the progress to be better now [4.1]. For the customers, it is helpful that the progress of the entire team becomes easily visible, as they have to react according to the development progress [4.2]. Now this can be done more seamlessly. However, they do not really want to inspect a new product every few weeks because they have to prepare themselves for the reviewing process every time [4.3]” (Scrum Master). “Compared to projects which were carried out according to the V-Model there is an incredible increase of transparency [4.4]. It increases the satisfaction with the project to know what is being done [4.5]. I truly like that we can now respond even more instantaneously. We always know exactly where our projects stand and what has been done thanks to the Burndown Charts and the Product Backlog [4.6]. Nothing is lost sight of anymore and you can always look what you can additionally bring into the development process. On that basis, we can now even closely monitor how long a certain development activity takes and what it costs [4.7]” (Product Owner 1). “The true state that the project is in becomes obvious even if it might not always be in the interest of some developers” (Scrum Coach 1).

The results indicate that the customers perceive the transparency to have increased in Scrum projects [4.1, 4.4]. The increased transparency seems to be more compatible to the way customers prefer to work [4.2, 4.5, 4.6]. Obviously, this perception facilitates their acceptance of Scrum [4.5]. The techniques to document the progress publicly appear to be particularly welcomed by the customers [4.6, 4.7]. The time consuming inspection of working software instead seems to be less valued as controlling instrument [4.3].

Five of the interviewed experts moreover referred to the communication with developers (F5) as an important factor: “A very important point is to have a good dialogue. We prefer to have an efficient communication with the developers in order to learn how our requirements can be realized [5.1]. This works very good with Scrum [5.2]. We have daily contact with the developers and can learn a lot from their perspective [5.3]. You get a direct feedback regarding the feasibility of your requirements. We do not only throw a product order over the wall and wait for the results to come back anymore. Instead, we now directly communicate what we want to accomplish with the product. Thereby, we also get a better understanding of the developer perspective and learn if we can rely on the developer team [5.4].
Altogether, this gives you a good feeling about what is done in your project [5.5]” (Product Owner 1). “Some Product Owners told me that for the first time they truly communicate with the developer team and that they like it [5.6]. During the Daily Scrum they discovered the actual requirements together with the developers [5.7]” (Scrum Coach 1). “Communication is faster, more direct, and more to the point [5.8]. You get much know-how from the developers that you would not have otherwise and in turn you can give better advice [5.9]” (Product Owner 2).

From the statements, we can conclude that the customers view the communication with developers to be better in Scrum projects [5.2, 5.6, 5.8]. The better communication seems to be more compatible to the way customers prefer to work [5.1, 5.4, 5.9]. The improved compatibility apparently facilitates the customer acceptance of Scrum [5.6, 5.5]. Especially, the better communication with the developer seems to facilitate the utilization of the different skills that developers and customers bring into the project [5.3, 5.4, 5.7, 5.9].

With respect to the complexity of Scrum, the interviewed experts consistently highlighted two factors. Five experts emphasized the process complexity (F6) as an important factor: “In Scrum projects, the working process generally is more fine-grained and portioned into smaller tasks that are easier to grasp and control [6.1]. As Product Owner, you can manage up to 10 or 12 developers, but then it can become critical [6.8]” (Product Owner 1). “In Scrum projects, the Product Owners do not need to plan distant tasks with the same level of detail as immediate tasks [6.2]. That the Product Owner in practice nevertheless has to look ahead and already plan for the next Sprint and the one thereafter is a different story. This adds a constant complexity that is not mentioned in textbooks as Scrum mainly concentrates on the effective organization of developer teams [6.3]. The Product Owner hence has to find out for himself how to achieve this task [6.4]. This hidden complexity can be a saddening surprise [6.5]. Another problem is that the starting phase of development projects is not supported by Scrum at all [6.6]. Before the project starts, the customer has to think ahead and to determine the functionality of the product. In Scrum, he is left alone with that task. We are just about to realize that we actually need a team to get a project started” (Scrum Coach 3). “We do not have sufficient experience with really large projects [6.7]” (Product Owner 2).

The interview results suggest that the customers have a mixed attitude regarding the complexity of the development process. On the one hand, they seem to perceive the complexity to manage individual development tasks as lower [6.1, 6.2]. A reason therefore seems to be that the individual tasks to be managed are more fine-grained than in traditional projects [6.1]. In addition, the level of up-front planning appears to be lower in Scrum projects [6.2]. On the other hand, the reduced up-front planning results in a constant pressure to stay ahead of the development in order to drive the process [6.3]. This seems to increase complexity and to hinder the customer acceptance of Scrum [6.5]. From a customer perspective, there especially seems to be a lacking methodological support of the planning process, which complements the development process [6.4, 6.6]. In addition, it appears to be difficult for customers to deal with large projects [6.7, 6.8]. As the perception of the process complexity varied considerably, no assumption about its effect on the customer acceptance of Scrum can be made.

Furthermore, five experts highlighted the required discipline (F7) to be a key factor: “Customers need to have a high discipline and this is sometimes viewed to be a problem [7.1]” (Scrum Coach 1). “A negative aspect of Scrum is the discipline required from the Product Owners [7.2]. Some Product Owners are uncomfortable with having to participate in the daily meetings [7.3]. Traditionally, we write a functional specification, give it to the IT department for calculation, and decide if we can afford it. Then we are done and can concentrate on other things again. We have given away the responsibility for the budget and have the promise that the product will be ready at the specified point in time. It is different with Scrum. Here we are constantly in the boat. When we realize that the progress is slowing down, we will have to reevaluate and justify the decision. We are more involved and we are more responsible [7.4]” (Product Owner 1). “It is a negative point that Product Owners have to be available all the time [7.5]. It is a challenge to live up to that responsibility every day [7.6]” (Product Owner 2). “There also were times in which the involvement of the Product Owner was unsatisfactory [7.7]” (Scrum Master).

From the interview statements, we can conclude that the customers find the required discipline to be higher in Scrum projects [7.1, 7.2, 7.5]. This perception obviously affects their acceptance of Scrum negatively [7.1, 7.3, 7.6, 7.7]. The reasons behind this assessment seem to be two-fold. On the one side, it appears to be difficult for the customers to ensure the required availability on site [7.3, 7.6]. On the other
side, it seems to be felt as a burden that customers have to take over a considerably higher responsibility for the success of the project than before [7,4].

In addition to the before-mentioned acceptance factors, on which the experts reached a broad consensus, two interviewees described the bidirectional knowledge transfer between customers and developers to be an important factor: “In my [Scrum] project, I learned a lot about the developer perspective. Whenever I propose a specific product feature, I get a direct feedback about its technical feasibility and possible alternative solutions. I like that a lot” (Product Owner 1). “The developers acquired a sophisticated domain knowledge which facilitated the collaboration. That was a huge benefit” (Product Owner 2). Two experts moreover referred to the emergence of trust as a key factor: “You quickly learn to trust each other in Scrum projects. I appreciate this a lot” (Product Owner 1). “There is a culture of mutual trust in the team and this contributes much to the satisfaction of both sides” (Scrum Master). However, we could not find confirmatory statements from the rest of the interviewed experts during our analysis.

Taking a broad expert consensus as a prerequisite, we could hence identify seven factors that determine the customer acceptance of Scrum from the interview statements. Moreover, we obtained an in-depth understanding of their perception by the customers. To cross-verify our interpretations regarding the perception of the identified acceptance factors, we analyze the results of our online survey in which we asked the customers of the inspected company about their perception of each factor F1-F7.

**Analysis of Quantitative Data**

We received completed responses from 20 Product Owners who were asked to participate in the survey. As depicted in Figure 2, the participants had considerable experience with software development. About 80% of them had worked in software development projects for more than five years, mostly with traditional methodologies. On an eight-point scale from (1) very little experience to (8) very much experience, they accordingly ranked their experience with traditional methodologies at 6.75 on average. Since Scrum was not introduced in the company until a few years ago, the participants had less experience with it. However, they still had considerable expertise in Scrum as 75% already had worked with it for more than six months. 20% of the customers had worked with Scrum for more than one year and 5% for more than 2 years. On an eight-point scale, they ranked their experience with Scrum at 4.55 on average.

![Figure 2. Experience of participants](image)

We statistically analyzed the customer perceptions of each factor. The analysis results and summary statistics are depicted in Table 1. Since participants could skip questions if they felt unsure of the answer, the number of actual responses varied between 17 and 20. Regarding the meeting of requirements (F1), no customer stated that Scrum had a negative impact. Instead, 65% of the customers explained that the software delivered in Scrum projects met their requirements somewhat or much better. The conducted t-test attested that customers felt the outcomes of Scrum projects to meet their requirements significantly better. This strongly supports our qualitative findings. With respect to the economic value (F2), the results differ somewhat more. Four customers felt that the introduction of Scrum negatively affected the economic value of their projects and ranked Scrum worse than traditional methodologies. However, 65% of the customers said that the economic value was either somewhat or much better. Overall, the mean
value of the responses was significantly larger than three. Hence, the economic value of Scrum projects was perceived to be better than that of traditional projects, which corroborates our qualitative results.

When asked about the time to market (F3) of their projects, two customers stated that it is somewhat worse with Scrum. Nine customers instead noted that the time to market is somewhat or much better in Scrum projects. The t-test showed that the mean value was significantly higher than three. Consistent with our qualitative findings, the customers found the time to market to be better in Scrum projects.

With respect to the perceived transparency (F4), the results show a noteworthy difference between Scrum projects and traditional projects. All respondents stated that the transparency in Scrum projects is at least somewhat better than in projects that employ traditional methodologies. As 55% of the customers perceived the transparency to be much better, the corresponding t-test revealed a high level of significance, thus confirming the results of our qualitative analysis. A comparably strong support for our qualitative findings could be observed regarding the communication with developers (F5). The survey participants perceived the communication to be significantly better within their Scrum projects. Only one customer perceived the communication to be equally good in traditional projects. The rest felt that the communication was either somewhat (55%) or even much better (40%) when using Scrum.

### Table 1. Test and summary statistics for the conducted survey

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>t-value</th>
<th>p-value</th>
<th>Mean≠3?</th>
<th>Min.</th>
<th>Max.</th>
<th>Mean</th>
<th>Median</th>
<th>Std. dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1: Meeting of requirements</td>
<td>19</td>
<td>5.715</td>
<td>0.000*</td>
<td>✓</td>
<td>3.00</td>
<td>5.00</td>
<td>3.74</td>
<td>4.00</td>
<td>0.56</td>
</tr>
<tr>
<td>F2: Economic value</td>
<td>19</td>
<td>2.535</td>
<td>0.021</td>
<td>✓</td>
<td>2.00</td>
<td>5.00</td>
<td>3.53</td>
<td>4.00</td>
<td>0.90</td>
</tr>
<tr>
<td>F3: Time to market</td>
<td>18</td>
<td>2.474</td>
<td>0.024*</td>
<td>✓</td>
<td>2.00</td>
<td>5.00</td>
<td>3.50</td>
<td>3.50</td>
<td>0.86</td>
</tr>
<tr>
<td>F4: Transparency</td>
<td>19</td>
<td>13.568</td>
<td>0.000***</td>
<td>✓</td>
<td>4.00</td>
<td>5.00</td>
<td>4.58</td>
<td>5.00</td>
<td>0.51</td>
</tr>
<tr>
<td>F5: Communication with developers</td>
<td>20</td>
<td>10.283</td>
<td>0.000***</td>
<td>✓</td>
<td>3.00</td>
<td>5.00</td>
<td>4.35</td>
<td>4.00</td>
<td>0.59</td>
</tr>
<tr>
<td>F6: Process complexity</td>
<td>17</td>
<td>1.571</td>
<td>0.136</td>
<td>✓</td>
<td>2.00</td>
<td>4.00</td>
<td>2.71</td>
<td>3.00</td>
<td>0.77</td>
</tr>
<tr>
<td>F7: Required discipline</td>
<td>20</td>
<td>4.765</td>
<td>0.000***</td>
<td>✓</td>
<td>2.00</td>
<td>5.00</td>
<td>3.70</td>
<td>4.00</td>
<td>0.66</td>
</tr>
</tbody>
</table>

Legend: ***: 0.1% significance, **: 1% significance, *: 5% significance

As to the process complexity (F6), no judgment in either direction can be made from the quantitative data. While three customers perceived the process complexity to be somewhat higher in Scrum projects, six said it was about the same and eight customers found the process complexity to be somewhat lower. Although the customers on average perceived the complexity of Scrum projects as slightly lower, the result was not significant. This result confirms our interpretation that the customers have a somewhat mixed impression of the process complexity in Scrum projects. Regarding the required discipline (F7), the survey participants reported a significant increase with the introduction of Scrum. With only 25% noting that the required discipline was about the same and 5% saying it was somewhat lower, the majority of customers perceived the required discipline to be somewhat (65%) or even much (5%) higher. The t-test revealed a high level of significance. This strongly supports our corresponding qualitative interpretation.

Altogether, the quantitative results corroborate our qualitative findings and hence lend additional support to our interpretation of the factor perceptions. Furthermore, we wanted to know if the perceptions of customers vary depending on how much experience they have with Scrum and traditional methodologies. Therefore, we conducted an analysis of covariance (ANCOVA) in which we measured the correlation of the factor perceptions with the time the interviewees had worked in traditional or Scrum projects and with the experience that they had. We found that the perception of the required discipline was significantly positively correlated with the time the customers had worked with Scrum (p=0.001) and with the experience they had with Scrum (p=0.024). The more customers were accustomed to Scrum, the more they apparently felt that using it requires additional discipline of them. Additionally, the perceived process complexity was significantly positively correlated with the time the customers had worked in traditional projects (p=0.013) and the experience they had with traditional methodologies (p=0.009). The more the customers were used to traditional development, the more they obviously felt the development process in Scrum projects to be complex. In addition, the perceived economic value was significantly positively correlated with both the experience that customers had with traditional methodologies (p=0.041) and the time they had worked in traditional projects (p=0.035). The more the customers were accustomed to traditional methodologies, the higher they apparently rated the economic value of Scrum.
projects. Finally, the communication with developers was significantly positively correlated with the experience the customers had with Scrum (p=0.019) but not with the time they had worked with it. The more self-confident they felt with Scrum, the better they perceived their communication with the developers to be.

**Discussion**

Together, the qualitative and quantitative study results provide comprehensive information about the factors, which determine the customer acceptance of Scrum, and their perception in practice. The interview results moreover contribute rich insights into the context of the factor perceptions, which allows us to investigate the reasons behind the individual perceptions.

Both the qualitative and quantitative results indicate that customers find the development with Scrum to bring relative advantages. The results suggest that customers perceive their requirements to be better met in Scrum projects (F1). Our findings hence support the claim that Scrum facilitates “building software that meets business needs,” which is emphasized as the central goal behind its creation (Schwaber and Beedle 2002). In Scrum projects, a better meeting of requirements should mainly be achieved by giving customers the opportunity to constantly add, change or reprioritize requirements (Schwaber and Beedle 2002). Judging from the interview results, the studied customers indeed appreciated this mechanism as helpful. However, they also found the collaborative development of requirements on site to be valuable as it helps clarifying the requirements for every party, including the customers themselves. The qualitative and quantitative study results moreover suggest that customers perceive the economic value of Scrum projects to be higher (F2). Concluding from the interview statements, the perceived economic value in part seemed to be rooted in efficiency gains such as a reduced overhead or an improved utilization of developer capacities. Our findings thus indicate that Scrum helps reducing the development costs, which is emphasized as an important aim of agile methodologies in literature (Fitzgerald et al. 2006; Schwaber and Beedle 2002). According to the interview results, however, the customers perceived economic value to be a broader concept that also encompasses goals such as increased effectiveness or better accountability. Our findings hence emphasize that mixing up agile with lean development and assessing its economic value solely in terms of efficiency gains may be a “critical misconception” (Conboy 2009). Both the qualitative and quantitative results furthermore indicate that customers feel the time to market to be reduced in Scrum projects (F3). The interviewed experts particularly corroborated the claim that Scrum reduces the time to market by delivering readily usable software early in the process (Beck et al. 2001). However, the possibility to continuously prioritize requirements was deemed as equally important to achieve this goal.

Although Scrum has been created having primarily the developers’ perspective in mind, the qualitative and quantitative study results suggest that customers also view it to be more compatible to the way they prefer to work in development projects. In comparison to traditional projects, they seem to perceive the transparency to be higher (F4). From a customer perspective, transparency is essential to facilitate project management and to control the development progress (Fitzgerald 1997). In order to increase the transparency of the project state, Scrum introduces Burndown Charts and advocates the delivery of working software after each Sprint (Schwaber and Beedle 2002). The interview results indicate that this strategy is partially effective. The customers especially appreciated the use of Burndown Charts and Product Backlogs, which facilitate the controlling. The regular inspection of working software seemed to be less valued, though, as it burdened the customers with additional effort. Both the qualitative and quantitative results furthermore suggest that customers view the communication with the developers to be better in Scrum projects (F5). As ISD is an inherently creative process, a close collaboration of the different stakeholders is crucial to facilitate the utilization of their different skills and expertise (Beath and Orlikowski 1994; Sawyer et al. 2008). Scrum promotes collaboration by establishing an immediate, informal communication of all stakeholders (Schwaber and Beedle 2002). Judging from the interview statements, this measure effectively supports the collaboration of customers and developers too.

Seen through the lens of the DOI Theory, the perceived relative advantages (F1-F3) and the apparent aspects of increased compatibility (F4-F5) facilitate the customer acceptance of Scrum (Rogers 1995). According to the DOI Theory, however, we also identified potential barriers to acceptance as we found that customers perceive the complexity (F6-F7) in total to be higher in Scrum projects. In the literature, Scrum is claimed to be a “management and control process that cuts through complexity” (2002). Among
others, this should be achieved by keeping planning horizons short. Both the qualitative and quantitative study results indicate, however, that the customers did not perceive the process complexity to be lower than in traditional projects (F6). As the interview results show, the customers indeed viewed individual tasks to be less complex. But they felt overburdened with having to constantly think ahead, to manage the planning process, and to handle large projects. Especially, they felt that there was not enough methodological support to help them complete such tasks. The survey results moreover show that the more the customers were accustomed to traditional methodologies, the more they viewed the process complexity in Scrum projects to be high. One reason for this observation may be that Scrum has been created mainly to facilitate the developers’ tasks. So far, only little attention has been paid to the repercussions for customers. The literature also does not say much about the discipline that is required from customers during their participation on site. Both the qualitative and quantitative results of our study indicate that customers perceive the need for discipline to be significantly higher than in traditional projects (F7). Judging from the expert interviews, both the required on-site presence and the increased responsibility for project decisions were felt as burdens by the customers. The survey results even show that the longer customers had worked with Scrum, the more they felt that discipline was required of them. These observations raise questions as to the sustainability of Scrum-based ISD from a customer perspective.

Implications

The results of our exploratory study contribute to gaining an understanding of both the factors that determine the customer acceptance of agile methodologies and their perception in practice. Based on the collected empirical data, we identified seven specific factors that influence the customer acceptance of Scrum. Moreover, we presented rich insights into their perception by the customers and investigated the reasons for the perceptions. The presented findings have implications for academia and practice alike.

For academia, the results of our study yield a theory on the factors that influence the customer acceptance of agile methodologies. To our best knowledge, this is the first theory dedicated to explain which factors determine the customer acceptance of agile methodologies. In order to achieve this goal, we decided to build upon the DOI Theory and to expand its generic constructs with the specific concepts that explain the customer acceptance of Scrum (Figure 3). The findings of our study suggest that the perceived attributes of innovations as introduced in the DOI Theory can also be used to explain the acceptance of agile methodologies, thus underpinning their generic applicability. In line with previous results in information systems research (e.g. Agarwal and Prasad 1998; Tornatzky and Klein 1982), our results indicate that relative advantage, compatibility, and complexity seem to be relevant determinants for the acceptance of a software process innovation. The expanded theory depicted in Figure 3 complements existing approaches in information systems research, which have so far mainly applied or adapted the DOI Theory to explain the developer acceptance of software process innovations (Hardgrave et al. 2003; Mustonen-Ollila and
Lyytinen 2003). Up to now, the customer perspective instead has primarily been investigated with respect to the factors that determine the acceptance of finished software products (Bradford and Florin 2003; Moore and Benbasat 1991; Rajagopal 2002). As the success of agile methodologies considerably depends on the willingness of customers to actively support the development process, however, it becomes necessary to also examine the customer acceptance of software process innovations. To this end, the theory provided in Figure 3 offers a conceptual basis that can be used to examine the customer acceptance of agile methodologies in confirmatory studies.

With the provided theory, we do not only inform research on the diffusion of software process innovations however. The theory also informs research on agile methodologies and their techniques. While the results of our exploratory study only represent an initial understanding of the subject, they already imply that some of the promises of agile methodologies may not hold true anymore when analyzing benefits and drawbacks from a customer perspective. Judging the success potential of agile methodologies solely from the developers’ point of view may hence produce shortsighted results. From the customer perspective, especially the required discipline and the process complexity need to be reduced to better ensure the sustainability of agile development projects in which customers have to steadily participate. Our results moreover suggest that the effects that individual measures and techniques of agile methodologies have during the development process are not fully understood yet. In comparison to the claims in literature, the studied customers found several measures and techniques of Scrum, such as the continuous inspection of software, to have an effect apparently not intended by creators of the Scrum methodology. Additional research is hence required to better understand the effect of agile development measures and techniques in practice. Finally, our results suggest that researchers should also take a broader perspective when analyzing the economic benefits of agile methodologies. Obviously, customers do not perceive efficiency gains to be the only economic benefit. While we have uncovered additional aspects of potential relevance in our study, more research is required to unveil what determines the economic value of agile projects from a customer perspective.

For practice, the presented acceptance factors and perceptions give information about the potential opportunities and threats that accompany the introduction of Scrum from a customer perspective. Our findings suggest that Scrum brings relative advantages for customers with respect to the economic value of ISD projects as well as the adequacy and availability of the project outcomes. The findings furthermore indicate that customers are able to more effectively steer and control ISD projects as Scrum better fulfills their needs for transparency and communication with the development team. While these factors bring opportunities for customers, our findings suggest that complexity increases with the introduction of Scrum although the creators of the methodology promise the opposite. Especially, customers will need to show a continuous engagement on site in order to benefit from the opportunities that the new methodology brings. The required discipline was viewed to be challenging by customers, however. It can therefore compromise the willingness of customers to engage in Scrum projects in the long run. Furthermore, there seems to be a lacking methodological support that makes it difficult for customers to plan ahead of the development. The perceived complexity of Scrum might hence pose a threat to the sustainability of agile development projects that companies ought to carefully observe and manage.

We have taken several precautions to ensure the reliability of our findings. In particular, we used both methodological and data triangulation to cross-verify our results with data from different sources that was gathered with more than one method. To increase the reliability of the qualitative results, we decided to interview owners of different Scrum roles and to check their statements for consistency. Moreover, we chose to cross-verify the interview results by collecting quantitative data from all Product Owners of the company. Among the surveyed Product Owners, several were still involved into traditional projects. In doing so, we could for instance minimize the risk that examined Product Owners were only involved into agile development at the time of our study, which could otherwise have caused sample bias. Nevertheless, there exist limitations in the light of which our results have to be interpreted. First, the external validity of our results is limited because we studied only the ISD projects of one company in which Scrum, a specific agile methodology, was used. Although many Scrum practices, including the concept of on-site customers, are typical for agile methodologies, others might not be essential elements of an agile methodology. This limitation accordingly ought to be taken into account when interpreting our results in the light of agile methodologies as a generic concept. Second, the external validity of our findings might be criticized because of the size of the analyzed sample. The identification of acceptance factors is built upon a comparatively small number of expert interviews. However, as we obtained highly convergent data which
quickly led to theoretical saturation, we deem the results to be useful (Given 2008). Furthermore, we
decided to collect quantitative data to cross-verify the qualitative results, thereby deliberately making use
of the entire sample of customers we had access to. In comparison with purely survey-based studies, the
sample size might still be considered limited, which admittedly reduces the expressive power of the results.
When adopting an exploratory, qualitative approach to investigate a new field, researchers are typically
not yet looking for generalization from a sample to a population, though. They are rather looking for
plausibility and logical reasoning through the development of concepts and theory, which are to be
verified in other settings later on (Given 2008; Walsham 1995). This is the type of contribution we wished
to achieve by carefully selecting a representative case to study. In such an interpretive qualitative setting,
quantitative data is primarily used to cross-verify certain observations for plausibility (Given 2008).
Therefore, even analyzing smaller samples can provide fruitful contributions. As the statistical tests yiel-
ded highly significant results, we deem the results to be helpful. Yet, we decided to conduct t-tests as they
are comparably robust with respect to the sample size.

Conclusions

Up to now, research has rarely examined how customers perceive agile development. In this paper, we
have presented the results of an exploratory study in which we investigated how on-site customers
perceive agile methodologies using Scrum as our example. We wanted to know which factors determine
the customer acceptance of Scrum and if they are perceived as benefits or drawbacks in comparison to
traditional methodologies such as the waterfall model. Using the Diffusion of Innovations Theory as a lens
for analysis, we discovered several acceptance factors and examined their perception in depth. Based on
these findings, we refined the generic DOI constructs in order to provide a theory dedicated to explain the
customer acceptance of agile methodologies.

The identified factors are intended to provide a conceptual basis to support additional efforts in which the
role of the customer in agile development is examined more closely. Future research ought to confirm our
results in different contexts and try to identify additional acceptance factors, which might have remained
uncovered during our study. To find out if the identified drawbacks may indeed pose barriers to the
acceptance of agile methodologies or if they are dominated by the perceived benefits in practice, future
research should also investigate how the different factors impact the acceptance in comparison to each
other. While we have provided a framework of acceptance factors and evaluated their perception, we have
not yet examined how they interrelate. As the results of our ANCOVA have shown that the perception of
acceptance factors is likely to change the longer agile methodologies are used, additional research should
furthermore investigate the longitudinal dimension of customer acceptance more closely. Apart from such
efforts, future research should also develop methods and tools to better assist customers in achieving their
tasks during agile development projects. From a customer perspective, there especially seems to be a need
to better support the planning process, which complements the development process. Therefore, more
investigation is needed into what causes the perceived complexity, how it can be managed more efficiently,
and how customers should organize their work in agile processes. Up to now, agile methodologies have
primarily been designed to better accommodate developers and to help them better achieve their tasks.
The results of our study also indicate a need to better accommodate the customer in agile methodologies,
however.

When introducing agile methodologies, the “highest priority is to satisfy the customer” (Beck et al. 2001).
Likewise, examining the customer perspective should become a research priority in order to unveil the
true potential of agile methodologies. With the acceptance factors and the perceptions presented in this
paper, we intend to provide a starting point for such endeavors.

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