Success Factors of Agile Information Systems Development: A Qualitative Study

Markus Hummel
Goethe University Frankfurt
hummel@wiwi.uni-frankfurt.de

Alexander Epp
Goethe University Frankfurt
iepp@ymail.com

Abstract

We conduct a qualitative, interview-based study with 12 participants in order to shed further light on the success factors of agile ISD because quantitative studies reported on contradictory results. First, we identify four success factors from previous literature that form the conceptual basis of our investigation. Those factors are the team, customer, organization, and communication. We extend previous findings by opening up the black box of each of those factors. This is achieved by identifying sub-factors that enable agile ISD success. We find that autonomy is the most important team characteristic, whereas agile values and management support are crucial for the organizational level. For the customer role, customer involvement is judged to be most important, and for communication, the meeting practices are the most frequently mentioned sub-factor. In contrast to the other categories, we note that sub-factors for the organizational level were mentioned by fewer participants.

1. Introduction

Methods and approaches for agile information systems development (ISD) such as Scrum [1] are gaining more and more acceptance in practice [2]. The goal of those methods is to enable agility which is defined as "the continual readiness of an ISD method to rapidly or inherently create change, proactively or reactively embrace change, and learn from change while contributing to perceived customer value (economy, quality, and simplicity), through its collective components and relationships with its environment" [3, p. 340]. This definition highlights the importance of change, which is one of the fundamental differences in comparison to traditional, plan-based methods.

Despite considerable research efforts in the past, as highlighted by several literature reviews [2, 4, 5], research still lacks behind practice in explaining why agile ISD is successful [6]. Several studies on the success of agile ISD exist [e.g., 7], but partially contradictory findings [8, 9] underline the obvious necessity for further research. In contrast to previous studies on the success factors of agile ISD [e.g., 7], we are taking a qualitative approach for providing insights on four of the success factors. Those four factors are the team, customer, organization and communication.

Consequently, we ask the following research question: *How is the success of agile ISD affected by the team, customer, organization, and communication?* A qualitative approach helps to resolve previous contradictory findings by allowing the researcher to study a phenomenon in depth, including the context [10, 11]. On the basis of 12 interviews with experienced practitioners, we reveal several sub-factors that allow drawing conclusions on the mechanisms that enable the success of agile ISD. Our findings extend our knowledge on the fundamental underpinnings that constitute agile ISD success, thereby contributing towards the missing "theoretical glue" [3, p. 330].

The remainder of this paper is structured as follows. We first explain the theoretical background of agile ISD. Second, we provide an overview of related work on agile ISD and its success factors by comparing the findings of previous studies, which results in a conceptual model that is the basis for our coding scheme. Next, we present the research design, including details on the participants and the data analysis, followed by the results of the study. Subsequently, we discuss implications of the study and limitations of our approach. Lastly, we summarize our findings.

2. Theoretical background

2.1. Agile information systems development

A lot of different approaches are considered to be methods for agile information systems development

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(ISD) [12]. Prominent examples include Scrum [1], Extreme Programming (XP) [13], and most recently Lean Software Development (LSD) [14] which some consider to be the next evolutionary step in ISD [15]. All those methods share a common set of values and principles, as advocated by the Agile Manifesto [16]. Without relying on a detailed project plan upfront, agile ISD methods emphasize short iterations, frequent software delivery, self-organizing teams and informal communication [1, 13, 16, 17]. The most frequently employed agile ISD method in industry is by far Scrum [18]. Despite having a different focus, the roles and meeting practices of Scrum are mostly applicable to other agile methods such as XP and LSD [14, 19]. Scrum is a project management technique that promotes four meeting practices within the development process [1]:

- During the *daily scrum meetings*, all development team members meet up every day in order to discuss what they are doing right now, what they are doing next, and which problems they are facing. The length of the meeting should not exceed 15 minutes.
- During the *sprint planning* meetings, the development team, scrum master, and the customer representative discuss the sprint backlog which contains the functionality that will be included in the next sprint.
- During the *sprint review* meetings, the results of the last sprint are presented to the customer representative.
- The *sprint retrospective* meetings examine past sprints, and decide on process improvements for the next sprint.

In addition to the described meeting practices, Scrum dictates the involvement of two specific roles in the development process [1]: The *scrum master* facilitates retrospectives, enforces process decisions after retrospectives, resolves misunderstandings, conflicts and problems in order to make sure that the team is able to concentrate on the actual work. The *product owner* is the customer or customer representative who is the interface of the business side to the development team. The main tasks of the product owners are providing feedback to the team and the prioritizing of the product backlog which contains all necessary functionality of the software product.

2.2. Related work

The focus of this study is on the factors that help to explain the success of agile ISD, as indicated by practitioner reports [20]. The search process of our literature review revealed seven scientific studies that focused explicitly on the identification and evaluation of success factors of agile ISD. The first study that provided empirical results on this topic was Chow and Cao [8] who conducted a questionnaire-based study of 109 agile projects. Stankovic et al. [9] replicated the study of Chow and Cao [8] in order to verify the success factors, but only one of the previously found success factors were confirmed in the context of Yugoslavia IT companies. The study of Misra et al. [7] was also based on a questionnaire that entailed 174 eligible responses of practitioners that are engaged in agile ISD. Stelzmann et al. [21] took a different approach and identified several success factors by studying companies working together in an agile workshop. Wan and Wang [22] and Wan et al. [23] investigate the success factors of a single organization by distributing a questionnaire. Lastly, Sheffield and Lemétayer [24] conducted interviews and distributed a questionnaire among agile communities.

We scanned each of those articles for success factors of agile ISD and aggregated the findings in order to draw conclusions on the empirical support for each success factor. Table 1 presents the results of this literature review. When comparing the identified success factors across the seven studies, a discrepancy is observable because of contrasting literature results. An agreed upon set of success factors is not observable. When relying solely on the most mentioned success factors in literature, Table 1 shows that the organizational culture, the involvement of the customer and team characteristics are crucial.

3. Conceptual model

Figure 1 presents the conceptual model which is the common reasoning line of our investigation and serves as the basis for data analysis. Table 2 defines the concepts in our conceptual model. We include the role of the organization, customer and team in our conceptual model because the previous discussion showed that those three factors are identified as important by previous research, but contrasting views still persist. We also include a forth variable in the model which is communication. A recent literature review highlights the necessity of more empirical studies on communication in agile ISD teams [5]. Contradictory results on the role of communication can be found in the literature because communication is identified as fundamental for agile ISD on the one hand [e.g., 17, 25, 26], but on the other hand, no significant or even a negative correlation between communication and success was found [7, 27]. We

Table 1. Comparison of success factors

Success factor	Count	Chow and Cao [8]	Misra et al. [7]	Wan and Wang [22]	Stelzmann et al. [21]	Sheffield and Lemétayer [24]	Wan et al. [23]	Stankovic et al. [9]
Team characteristics	5	X	X	X		X	X	
Customer involvement	4	X	X		X	X		
Organizational culture	4	X	X	X		X		
Project management process	3	X					X	X
Agile software engineering techniques	3	X			X		X	
Delivery strategy	3	X	X		X			
Customer communication	1				X			
Customer satisfaction	1		X					
Control	1		X					
Project nature & schedule	1							X
Requirements	1				X			

find it astounding that one of the key agile principles that emphasizes the use of direct face-to-face communication [16] is not supposed to be one of the success factors. By including communication as category in our model, we contribute towards resolving those contradictory findings.

In sum, we build on previous insights and enhance our understanding of agile ISD success by conducting an in-depth qualitative analysis of the four factors in our conceptual model.

4. Research design

Previous studies focused mainly on quantitative evaluation of agile ISD success factors which resulted in partially contradicting results. In order to contribute towards resolving this issue of those questionnaire-based data collection instruments, we decided to follow an exploratory, cross-sectional qualitative research design [10, 11] in order to provide deep and extensive insights on the four success factors of agile ISD in our conceptual model. This allows us to take the context of the interviewees into account and we are able to delve into detailed discussions when necessary.

We conducted 12 semi-structured interviews with persons involved in agile ISD projects in order to shed further light on the success factors of agile ISD. The interviews lasted on average 45 minutes and were audio-recorded. The rationale behind the selection of interview partners was to ensure data triangulation and theoretical sampling in order to gain insights from different perspectives. Consequently, we selected interview partners that are employed in different project domains, different project roles and that have differing levels of experience. Table 3 provides an overview of our interview partners. Our interview partners have at least two years experience in agile ISD and mainly employ the agile ISD method Scrum.

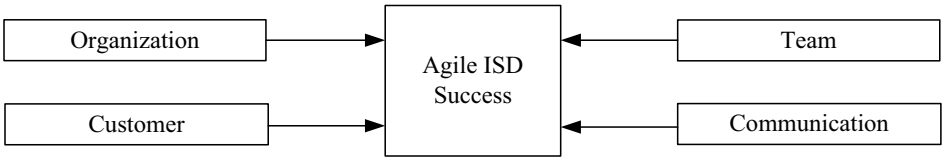

Figure 1. Conceptual model

Table 2. Definition and descriptions of concepts

Category	Description	Key References
Team	Properties and attributes of the team members that are required to get the job done.	Adolph et al. [29], Chow and Cao [8], Misra et al. [7].
Customer	The role of the customer entails that the customer or customer representative should be involved regularly throughout the development process. As defined in the XP practice on-site customer, customers should be co-located with the development team in order to enable quick interactions.	Beck [13], Korkala et al. [28], Schwaber and Beedle [1].
Organization	Every organization is characterized by its culture. The organizational culture is defined as "a symbolic system consisting of learned, shared, patterned sets of meanings guiding the actions of cultural members" [6, p. 511].	Geertz [30], Iivari and Iivari [6], Keesing and Strathern [31].
Communication	Communication is defined as "behavioral situations in which a source transmits a message to a receiver(s) with conscious intent to affect the latter's behavior" [32, p. 92].	Dennis et al. [33], Miller [32], Te'eni [34].
Agile ISD success	We define agile ISD success as system success (in terms of value, quality, functionality, and usage), project success (in terms of time and budget), as well as user satisfaction.	Lee and Xia [35], Siau et al. [36].

In terms of the interview guideline, we used a predefined checklist on the basis of previous literature on the four success factors organization [e.g., 6], customer [e.g., 28], team [e.g., 29] and communication [e.g., 17].

During the interviews, we also allowed room for deviations and open questions in order to capture novel, unexpected insights.

For data analysis, all interviews were transcribed and coded. Our initial coding scheme was composed of the four success factors that are represented in our conceptual model. On the basis of those factors, we extended and refined the coding scheme during the analysis procedure. Our final coding scheme consisted of the success factors and the respective sub-factors (see chapter 5.4., Table 4 for the full list). We used the software MaxQDA for the coding procedure.

5. Results

The following subsections present the results for each of the four previously identified success factors.

Table 3. Characteristics of interviewees

	Size of Organization	Domain of Projects	Role in Projects	Experience in Agile ISD	Used Agile ISD Methods
I1	420	IT	Team leader	2-3 years	Scrum, LSD
I2	103	Telecommunications	Scrum master	2 years	Scrum, LSD
I3	100	IT	Product owner	2-3 years	Scrum, XP
I4	13	IT	CEO	10 years	XP
I5	434000	Telecommunications	Developer	2-3 years	Scrum, RUP
I6	232000	Telecommunications	Department lead	2 years	Scrum, LSD
I7	152000	Auditing, consulting	Project manager	2 years	PRINCE2
I8	125000	IT, auditing, consulting	Developer, product owner, scrum master	3-4 years	Scrum, XP
I9	100	Auditing, consulting	Team leader, project manager	2-3 years	Scrum, XP
I10	100	Auditing, consulting	Team leader, project manager	2-3 years	Scrum, XP
I11	1	IT, auditing, consulting	Consultant	12 years	Scrum, XP
I12	7	IT	Department lead, scrum master	2 years	Scrum

5.1. Team

The most frequently mentioned team characteristic is autonomy. Agile ISD promotes self-organizing teams so that the development team itself decides on which tasks should be implemented next, and by whom.

"Autonomy is very very important and we emphasize this here [in our company]." (I3)

Team members have to be able to decide themselves which tasks should be implemented next.

"Of course there is the product owner who is telling you what to do, but the difference is that I evaluate myself [...] how much and when I am doing it." (I2)

Autonomy and self-organization is not always perceived as positive. In larger teams, decision making processes may become cumbersome.

"Being autonomous and self-organized makes it more difficult [...] if you have 30 people and 30 opinions."(I2)

Also, our data shows that there is the danger that the freedom is misused. You need personal discipline in order to comply with the few rules that agile ISD methods such as Scrum are opposing.

"This is what many people underestimate. It is discipline. [...] You have to follow the few rules that are prescribed by Scrum in a strict way, with a lot of discipline, otherwise, the project will get out of control." (I8)

For example, discipline is crucial for the Scrum meeting practices in order to allow a focused and efficient discussion within the short time frame of the meeting.

"If you do not have discipline in the meetings, it is an endless discussion." (I8)

Motivation is another team characteristic that is crucial according to our interviewees. Only motivated individuals enable efficient teamwork in an agile project.

"With the agile approach, as expressed by the Agile Manifesto, you try to better use this self-responsibility and the individual motivation and put it in the foreground. For people that do have this motivation, it is great. If they do not have this motivation, there may be difficulties."(I11)

Motivation is also built up by allowing the teams to develop in an autonomous way.

"Self-organizing is an extremely important success factor which leads to intrinsic motivation. [...] You only know in which direction the product is heading, but how you do it [is your decision], just do it and let me know when you are done. This is a different motivation as if someone is telling you what to do." (I2)

Team members have to be willing to learn continuously. Learning from mistakes is encouraged by the retrospective practices of Scrum or LSD.

"You have to be willing to learn. This means that I internalize new knowledge and that I am able to transfer it to different domains." (I12)

According to our interviewees, involved persons are encouraged to reflect constantly about the current state of the system.

"Nobody told me when developing in a traditional way that I should think about whether I do things right. It was implicit that I do things right. Scrum wants you to think about it explicitly." (I8)

Persons involved in agile ISD need to be team-minded in a sense that cooperative work among team members is of crucial importance. Employees who are not communicative and rather work alone have a hard time developing in an agile way.

"If you're a not a team-minded person, you will not be happy with Scrum. Similarly, the company who employs Scrum will not be happy with you if you are not team-minded." (I2)

5.2. Organization

Agile ISD needs a different organizational culture than traditional, plan-based methods. The organizational culture in an agile context has to support the key principles and values of agile ISD, especially the shift of power from management towards the team.

"For me, maybe even the most important point is a special culture within the company and the teams." (I4)

"There is this pressure by working agile that the values and leadership understanding has to change." (I6)

It is important that all involved parties understood what it means to develop in an agile way. If those values are not understood, there will constant irritations.

"The values have to be understood by the employer such as the product owner, but also for the scrum master and the team." (I12)

The interviews indicate that this shift of power from management to the development teams may be perceived as a threat to management because responsibilities of management are transferred to the team.

"There may be this loss of power because teams are self-organized and work autonomously. What do I do then if I am a manager?" (I12)

According to our interviewees, managers' responsibilities shift towards creating a supporting environment for teams developing in an agile way.

Management is responsible for pointing the teams into the right direction, but team members decide themselves what to do next and how do to it.

"The manager has to take care that the conditions for employees allow them to make the right decisions and that there is a culture that allows making mistakes." (I12)

Management is also crucial for the adoption process of agile methods. Our interviewees state that only management support allows executing the necessary changes in the organizational culture for the shift from traditional, plan-based methods to agile methods.

"You need a clear statement of management saying we want to adopt agile approaches. There were first initiatives bottom up. Those always failed because the environment was hostile for agile." (I6)

Moreover, the organizational levels need to be more flat when developing in an agile way. I2 believes that ideally, there should be no hierarchies at all. Flat hierarchies help the teams to become autonomous and develop self-organizing.

"A success factor of agile software development the way I see it and how it is practiced in my company is flat hierarchies. Ideally no hierarchies." (I2)

"If you have a lot of hierarchies, it is difficult for teams to be autonomous and self-organized, especially to be autonomous. Because there is always someone who is in charge." (I2)

5.3. Customer

The involvement of the customer in the review meetings is deemed to be crucial, according to our interviewees. Those meetings allow the customer to provide concrete feedback that makes sure that the final product corresponds to the needs of the customer.

"Sometimes there were comments [of the customer in the sprint review meetings]: 'Yes, this is nice! This is good!' Or 'you should do small changes at this feature', and once he was saying: 'I imagined this in a completely different way. It is good that we talked about this in time'." (I10)

The feedback of the customer may entail that requirements are changing when trying out first versions of the software so that previously build functionality has to be adapted or even deleted. Typically, at the beginning of the project, the customers are not sure about the detailed requirements of the software product. Trying out new versions of the software at the end of iterations allows the customer to become clearer about what she/he actually wants.

"It is a success factor that I use the opportunities that the Scrum framework offers by incorporating change and positive customer feedback." (I6)

"As a customer, you have to be aware what you are getting into when using an agile approach, he has to be closer to the team and regular feedback is necessary." (I8)

Customer focus and customer proximity is needed throughout an agile project.

"You cannot do an agile project when the customer is excluded." (I9)

The degree of the customer involvement depends on the individual customer. Some customers do not want to be involved frequently or do not have the time. In order to avoid that the project is drifting in the wrong direction, a regular involvement at least once a month is necessary according to our interviewees.

"In my experience, you need this alignment with the customer regularly. Depending on the customer, this may be once a week, once a month, partially even in longer cycles. But then it is getting dangerous." (I4)

If the customer is involved too much, there may be the possibility that the customer is running idle because the team may have to implement functionality that may not be visible to the customer.

"Sometimes the team implements features quickly that do not concern the customer directly." (I4)

Our interviewees also see other dangers when involving the customer closely. For example, it is important that the requirements change between iterations and not within the iterations because the team cannot concentrate on the tasks at hand. New requirements and user stories should only be discussed at the beginning of an iteration.

"If the product owner takes advantage of the situation by saying that agile means to me that I can add new requirements whenever I want, then it won't work out." (I11)

Only requirements that are relevant for the customer should be implemented, nothing more. I3 emphasizes that the customer is responsible for prioritizing the user stories that should be implemented next in order to make sure that time and money is invested in the features that have the highest priority. The customer has to decide at the end of the later sprints whether it makes sense to continue the development of the product, or if the current version of the software is acceptable. If the customer is satisfied with the current state of the product, it may not be necessary to implement 100% of the requirements –80% may be enough.

"Agile development […] allows to decide a lot sooner [than traditional development], before money and resources are invested." (I6)

It is important that the customer trusts the development team. In order to build up trust, frequent software delivery at the end of iterations is crucial according to our interviewees. Furthermore, transparency is needed to build trust. The customer should be able to see the current status of the project at all times.

"Trust [of the customer] is definitely another success factor in this respect. Not just the understanding of values, but also trust in those persons who implement the values." (I12)

"Customers use Kanban-boards to see the current status of the project […] so there is 100% transparency for the customer." (I2)

It is also important to develop mutual understanding between the customer and the development team. Mutual understanding is not only needed for a common understanding of the requirements, but also for defining terms such as success, agility, and the role of the customer.

"It is a crucial success factor that client and contractor develop mutual understanding on the cooperation in an agile project." (I11)

"[…] Customers have heard of the buzzwords agility and Scrum and they have certain imagination about it and are surprised by the reality. We make sure that we develop a mutual understanding early." (I8)

5.4. Communication

Our interviewees confirm that communication is critical for any agile ISD project. I2 thinks that it is not possible to employ agile ISD successfully when not talking to each other and everyone doing their own thing. This includes communication with the product owner, as emphasized by I6, as well as among the development team.

"Reasonable communication is extremely important. It helps a lot to arrive at a good solution." (I3)

"It doesn't help me if I have the best programmer in the world who is not capable to talk one normal sentence. […] I'd rather have someone who doesn't program that well but who can talk reasonable." (I3)

Agile practitioners prefer face-to-face communication. If face-to-face communication is not possible, videoconferencing should be used because it resembles face-to-face the most. More structured and formal communication media such as instant messaging and e-mail are not used to the same extent.

"First priority is face-to-face, then video, then audio, then textchat, and e-mail." (I3)

Communication among team members suffers if the whole project plan is created upfront and detailed requirements specifications are distributed because there is no necessity to talk to each other. This entails that developers feel that they do not have to act as a team, but rather as a collection of individuals working for themselves. There is also the danger that the overarching goal is not present for the team members.

"If you plan too much upfront, communication is disrupted because people just sit down and write the code down. […] There was no matching with the bigger goal and the rest of the team. This is dangerous." (I4)

Too much communication may be a problem because not all team members are willing to engage constantly in face-to-face communication.

"Too much communication or getting on the nerves of employees is not good. Not enough communication is really bad. You have to develop a feeling about the communication needs of the employees." (I7)

The interviewees indicate that direct communication is mostly taking place within a co-located office space.

"If you sit together, you communicate daily in an informal way, you can go over, knock on the door and say 'I have a problem, I don't get this'." (I7)

Communication is also triggered by Scrum meeting practices that create a regular structure for team interactions.

"Scrum creates a structure, a clear communication structure and procedure. This is definitely a success factor." (I12)

Especially the daily scrums encourage team members to talk every day about the current status of the project. Those meetings are important to get to know what the other colleagues are doing, which may lead to an increased velocity of the ISD process:

"Scrum tries to promote those daily sprint meetings […] including mutual communication, so that everyone is informed and is able to get involved and contribute towards the success of the project." (I9)

It is essential that all team members take part in the daily meetings which is considered very helpful by our interviewees because those meetings provide a "frame for communication":

"Everyone is allowed to engage in the discussion. […] I see this very positive. The meeting is a frame for communication which makes it hard to communicate in a bad way. Except when people hide something." (I10)

"The daily stand-ups promote communication as well in the end, similar as the review and retro too." (I3)

Communication is also stated to be important for the retrospective meetings. Retrospectives enable an open discussion about what went wrong in the last iteration, but also about what worked out fine. A stated outcome is trust among the development team.

"By talking openly with each other every two weeks about what went good and what can we improve, an extreme trust is built up, which develops and is not present from the beginning." (I3)

Direct communication is also taking place in the sprint review meetings, in which the results of the last iteration are discussed with the customer.

"The customer is involved in the sprint review meetings and he is able to say 'I like this, more of this or I don't like this – less of this." (I3)

5.5. Summary of findings

Table 4 presents the sub-factors of the previously identified success factors that are crucial for enabling success. In sum, we identified five team sub-factors, three organizational sub-factors, three sub-factors on the customer role, and two sub-factors concerning communication. The number in brackets indicates how many of our interview partners mentioned the sub-factors in the sense that they are important for agile ISD success. In contrast to the other categories, sub-factors for the organizational level were mentioned by fewer participants.

One has to keep in mind that our data also shows that the identified factors are no blueprint for success. For example, too much direct communication may hinder the progress of the team. Similarly, feedback and changing requirements of the customer within iterations is also counterproductive.

6. Discussion

We conducted a qualitative, interview-based study with 12 participants in order to shed further light on the success factors of agile ISD. To our knowledge, we provided first qualitative empirical evidence with a focus on agile ISD success factors. We concentrated on four potential factors as identified by previous quantitative literature, namely the team, customer, organization and communication. We find evidence of those success factors in our qualitative data, thereby contributing towards resolving the contradictions that are observable in the literature. Our results support the findings of Chow and Cao [8] and Misra et al. [7] in terms of the success factors team characteristics, customer involvement, and organizational culture, which was questioned by Stankovic et al. [9]. In relation to a recent quantitative study [37], our data also indicates that executive support is critical, but we find contrasting results in terms of the co-located office space practice because our data indicates that co-location is important for agile ISD success. This is questioned by the results of Maccherone [37] who reports on a lower productivity of co-located teams. Furthermore, our results support the notion that communication is indeed an success factor of agile ISD, which was questioned by other studies [7, 27].

For theory, our qualitative data also complements previous quantitative assessments with in-depth and profound insights of our qualitative research design. We extend our knowledge on the success factors of agile ISD by breaking up each factor into several sub-factors that contribute towards the positive relationship with agile ISD success (see Table 4 for a list of the sub-factors). Each sub-factor has the potential to be one of the fundamental components that lead to agile ISD success. The identified sub-factors help to explain why a correlation with success is observable, thereby contributing towards the missing "theoretical glue" [3, p. 330]. Although those sub-factors were investigated in traditional ISD domains [e.g., mutual understanding in 38], we provide novel insights into the importance and applicability of those factors in the agile ISD domain.

We encourage future research to investigate each of the four success factors and their sub-factors in detail in order to further contribute towards uncovering the under-researched concept of agile ISD success. Also, more in-depth qualitative or quantitative investigations of other potential success factors of agile ISD may also help in this regard. The identified sub-factors and their relations to agile ISD success may be used as blueprints for hypothesizing about the impacts on agile ISD success when employing confirmatory research designs.

Table 4. Summary of findings

Team	Organization	Customer	Communication
1. Autonomy (12) 2. Willingness to Learn (10) 3. Team-Mindedness (4) 4. Discipline (3) 5. Motivation (3)	1. Management Support (6) 1. Agile values (6) 2. Flat organizational levels (3)	1. Customer focus & proximity (10) 2. Regular & timely feedback (7) 2. Mutual understanding and trust with the development team (7)	1. Meeting practices (e.g. daily scrums) (8) 2. Co-located office space (5)

Hypotheses may be derived directly from Table 4, for example, one may hypothesize that management support is positively correlated with agile ISD success. Lastly, future research is needed that investigates the relationships among those sub-factors because we expect that the sub-factors are closely related. For example, there may be a correlation between the meeting practices and mutual understanding with the customer.

In terms of practice, our findings show that managers should take special care in selecting team members for agile projects. Only persons that have the necessary skill set (e.g., in terms of motivation, responsibility, and autonomy) are able to contribute towards successful agile ISD. Similarly, the organizational culture has to support agile values and principles by flat organizational levels. Also, self-organizing teams should be supported by management. A customer or customer representative should be situated closely so that frequent feedback may be provided. Lastly, management should take care in supporting the direct communication paradigm of agile ISD. In order to achieve the full benefits of agile ISD, direct face-to-face communication should be preferred and indirect communication media such as e-mail or formal documentation should be reduced as much as possible, as advocated by the Agile Manifesto [16]. Practitioners should also take special care in an appropriate implementation of the identified sub-factors, for example, a productive frequency of direct face-to-face communication is needed.

Our study is not without limitations. Due to the small sample size of this qualitative study, the illustrated findings are hardly generalizable. We cannot yet postulate that the identified factors have a definite impact on agile ISD success. Confirmatory studies are needed to validate our findings. Furthermore, we do not claim that our list of sub-factors is complete because we may have missed dimensions of the success factors due to our research design or data analysis procedure. Lastly, each of our interview partners is working for a different organization, so we were only able to capture single data points within each organization which may not be representative for the whole organization. Similarly, our interviewees mainly use Scrum and we cannot automatically generalize our findings to all agile ISD methods.

7. Conclusion

On the basis of a cross-sectional, qualitative study based on 12 interviews, we investigated how the four factors team, customer, organization, and communication influence agile ISD success. We opened up the black box of each of those success factors and found several sub-factors that enable a positive correlation with agile ISD success. Thus, we provide qualitative insights into the fundamentals of agile ISD, and hope to inspire deeper qualitative and quantitative research in the future.

8. References

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