7-1-2013

Explaining The Changing Communication Paradigm Of Agile Information Systems Development: A Research Model, Measurement Development And Pretest

Markus Hummel
Goethe University, Frankfurt am Main, Hessen, Germany, hummel@wiwi.uni-frankfurt.de

Christoph Rosenkranz
Goethe University, Frankfurt Am Main, Hessen, Germany, rosenkranz@wiwi.uni-frankfurt.de

Roland Holten
Goethe University, Frankfurt Am Main, Hessen, Germany, holten@ise.uni-frankfurt.de

EXPLAINING THE CHANGING COMMUNICATION PARADIGM OF AGILE INFORMATION SYSTEMS DEVELOPMENT: A RESEARCH MODEL, MEASUREMENT DEVELOPMENT AND PRETEST

Hummel, Markus, Goethe University, Grüneburgplatz 1, 60323 Frankfurt am Main, Germany, hummel@wiwi.uni-frankfurt.de

Rosenkranz, Christoph, Goethe University, Grüneburgplatz 1, 60323 Frankfurt am Main, Germany, rosenkranz@wiwi.uni-frankfurt.de

Holten, Roland, Goethe University, Grüneburgplatz 1, 60323 Frankfurt am Main, Germany, holten@wiwi.uni-frankfurt.de

Abstract

Agile information systems development (ISD) methodologies are gaining more and more popularity because those approaches are considered as an effective way for managing rapidly changing requirements in turbulent environments. Despite growing research efforts, the fundamental processes that underpin agile ISD methodologies are still not well understood. Our contribution in this paper is twofold. First, we extend our knowledge on the theoretical underpinnings of agile ISD methodologies by developing a research model that is based on a solid theoretical foundation. Specifically, we propose that what we call 'social agile practices' have positive effects on the communication behavior of agile ISD teams in terms of communication informality and frequency. This, in turn, leads to higher mutual understanding and better relationships, resulting in higher ISD success. As a theoretical framework, we employ the Unified Model of ISD Success and extend it with context-specific insights from the Cognitive-affective Model of Organizational Communication and Media Naturalness Theory. Second, we develop measurement scales for the identified constructs. The proposed scales are then tested for construct validity in a pretest assessment that is based on an item-sort task. The results show very high values for the substantive validities of the constructs, indicating good construct validity.

Keywords: Agile Information Systems Development, Agile Software Development, Measurement Scale Development, Item Sort Pretest.

1 Introduction

During the last decades, *agile principles and practices* for information systems development (ISD) as well as new management concepts such as Extreme Programming (XP) (Beck, 1999) or Scrum (Schwaber and Beedle, 2002) have gained more and more popularity and increasing use in industry (e.g., Beck and Andres, 2004; Martin, 1991; Poppendieck and Poppendieck, 2003; Schwaber, 1995). *Agility* is understood as the continual readiness of an ISD methodology to rapidly create change, proactively or reactively embrace change, and learn from change while contributing to perceived customer value (Conboy, 2009). The resulting *agile ISD methodologies* appear to incorporate many lessons learned from research and practice on ISD (Cao et al., 2009; Cockburn and Highsmith, 2001; Highsmith and Cockburn, 2001; Vidgen and Wang, 2009), including the importance of human and social factors (Dybå and Dingsøyr, 2008). For example, instead of using formal mechanisms for project control, agile ISD methodologies rely on self-organizing and autonomous teams (Beck, 1999). Projects progress in small, iterative steps, allowing quick reactions to changing circumstances instead of planning the complete project upfront (Black et al., 2009; Erickson et al., 2005). This is complemented by principles such as having frequent iteration cycles, ensuring early delivery of working software, and keeping things generally simple (Beck et al., 2001). These principles are embodied in practices such as having frequent and short daily meetings, having customers on-site, or using mostly informal face-to-face communication instead of documents and models (Wang et al., 2012).

These agile principles and practices have been mainly derived from past industry experiences (Lee and Xia, 2010). Proponents of agile ISD often claim that the adoption of agile principles and practices goes along with increasing ISD success (e.g., Cao et al., 2009; Erickson et al., 2005; Schatz and Abdelshafi, 2005). Although several literature reviews highlight the considerable past research efforts (e.g., Cohen et al., 2004; Dingsøyr et al., 2012; Dybå and Dingsøyr, 2008; Erickson et al., 2005), research still lags behind practice in understanding agile ISD for two important reasons: (1) there is scarce empirical evidence that agile practices and principles lead to increased ISD success (Iivari and Iivari, 2011; Lee and Xia, 2010) and (2) agile ISD methodologies lack "theoretical glue" (Conboy, 2009, p. 330). In consequence, this has led to calls for a more theory-based approach in research on agile ISD (Dingsøyr et al., 2012).

Our goal in this paper is to provide a first building block for a novel theoretical perspective on agile ISD. We intend to open up the ISD process conceptually and empirically, which research on ISD usually treats as a "black box" (Siau et al., 2010, p. 92). Specifically, we propose to focus on the communication mechanisms of agile ISD teams because we argue that the core of agile ISD methodologies impacts the way of collaboration and communication within the team. Consequently, we ask the following research question: *"What is the impact of agile practices on communication within ISD project teams?"* The main contribution of this paper is twofold. First, we integrate previous findings on agile ISD and communication and provide a research model representing the fundamental relationships between our main constructs. Second, we report on the development of valid measurement scales that we designed to measure our constructs. The proposed scales are then tested for construct validity in a pretest assessment that is based on an item-sort task.

The remainder of this paper is structured as follows. We first discuss the theoretical foundation of our research in Section 2. Following this, we outline the development of our research model in Section 3. Afterwards, we present and describe the measurement scale development for our main constructs in Section 4, including the pretest assessment. Next, we reflect on our results, highlight the implications and limitations, and give an outlook on further research in Section 5.

2 Related Work

A major focus of agile ISD methodologies is on principles and practices that are supposed to foster intensive communication, quick change, and reaction to continuously changing requirements involving

constant feedback (e.g., Melnik and Maurer, 2004; Pikkarainen et al., 2008; Sarker et al., 2009). The 'Agile Manifesto' explicitly highlights the importance of communication, for example, by stating that "the most efficient and effective method of conveying information to and within a development team is face-to-face conversation" (Beck et al., 2001). Some agile ISD methodologies rely "almost completely on oral communication with the customer" (Ramesh et al., 2010, p. 451). Business customers and developers should work together daily and project information should be shared through *informal communication* mechanisms such as face-to-face conversation rather than through documentation and models. Therefore, agile ISD can be described as a "cooperative game of invention and communication" (Cockburn, 2002, p. 28).

However, experiences from practice show that "over-communication" between participants and stakeholders can also be an inhibitor for ISD success (Vidgen and Wang, 2009). This can especially occur in extended environments, where many stakeholder groups and development teams are involved (Pikkarainen et al., 2008). Purely informal communication may not be effective when dealing with distributed teams, a large number of stakeholders, and vast amounts of information in very complex, IT-supported ecosystems (Cao et al., 2009). The emphasis of agile ISD methodologies on face-to-face conversations may also lead to challenges for team members with weak communication skills (Conboy et al., 2011), or for documenting knowledge for the subsequent maintenance and evolution of long-living IT systems (Black et al., 2009; Dybå and Dingsøyr, 2008).

While the importance and central role of communication in agile ISD is generally and frequently acknowledged (e.g., Korkala et al., 2006; Melnik and Maurer, 2004; Pikkarainen et al., 2008; Sarker et al., 2009; Sarker and Sarker, 2009; Wang et al., 2012), studies investigating communication and related phenomena are rare. For example, no studies have actually investigated and compared communication, social interactions, collaboration, or knowledge sharing in teams using different ISD methodologies. Is there really a difference in communication behaviour that is caused by agile principles and practices? Does a certain kind of communication behaviour explain or predict project performance or ISD success? Even though "the importance of communication has been shown paramount in agile development" (Korkala et al., 2006, p. 76), our current state of knowledge on and empirical evidence for the importance of communication in agile ISD is limited. We find this astounding when contrasted with the abundance of statements that refer to communication as being crucial for agile ISD projects.

3 Research Model

Based on the insights that we discussed in Section 2, we develop a research model that aims to open up the "black box" of the ISD process. We intend to investigate the impact of agile practices on informal and formal communication mechanisms within ISD project teams. In sum, we posit that higher degrees of communication informality lead to a higher degree of mutual understanding and better relationships in the ISD team, resulting in higher ISD success. Figure 1 summarizes the model, the main constructs, and the relationships, which are subsequently explained and derived in more detail.

The Unified Model of ISD Success (Siau et al., 2010) provides the common reasoning line of our theory development. The model is based on the classic input-process-output model (Hackman, 1987; McGrath, 1984) and provides a strong meta-framework that we use as a lens to develop our understanding of ISD. Other theories (e.g., socio-cognitive theories on communication) can be fitted into this framework in order to make contextually appropriate predictions about specific aspects of the ISD process.

First, we define input factors that are closely related to agile ISD projects as control variables. Agile ISD is reported to be mainly suited for small, co-located teams that develop non-critical software (e.g., Ågerfalk et al., 2009; Turk et al., 2005). We therefore include *team size*, *team distribution*, and *project domain* as control variables because variations in those factors may lead to differing results. Besides those specific controls for the agile ISD domain, previous studies on ISD in general and team performance indicate that the inclusion of the following input factors as controls will also affect the ISD

process and its outcomes to a large degree: *experience* (Siau et al., 2010; Turk et al., 2005), *corporate culture* (Misra et al., 2009), *developers' IT and business knowledge* (Hsu et al., 2012), *group cohesion* (Willer, 2009), and *project role* (Espinosa et al., 2007).

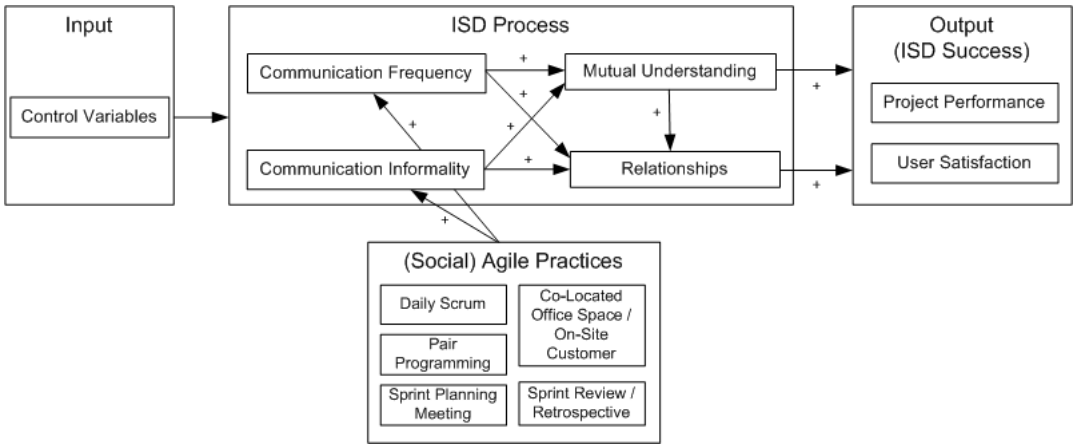

Figure 1: Research Model

Next, we specify the independent variable *(social) agile practices.* We are specifically interested in project teams that develop in an agile way. Since a universal definition of agility in the ISD domain does not exist (Conboy, 2009), we argue that the agility of an ISD methodology can be measured best by observing the degree of the use or implementation of agile practices. This is in accordance with related studies (Maruping et al., 2009; Wang et al., 2012). An increase in the use of agile practices leads to higher degrees of agility. Although prior literature has employed numerous agile practices for measuring agility (Maruping et al., 2009; So and Scholl, 2009; Wang et al., 2012), we argue that especially five practices that we call *social agile practices* have a strong influence on the social interactions and ways of communication in ISD project teams (cf. Table 1). Accordingly, as our focus is on explaining the influence of agile ISD on interactions and communication of team members, we suggest focusing on these five practices.

Practice	**Description**
Co-located office space / on-site customer	By providing a co-located office space and having an on-site customer, developers and a customer representative are located within close proximity; this enables efficient task delegation, joint problem solving, and direct as well as informal feedback (Cao et al., 2009; Dorairaj et al., 2012).
Daily scrums	Daily scrums are short, daily meetings in which each team member briefly talks about tasks that were recently completed and that still have to be done. Problems that the team members are facing are also discussed. Those meetings encourage the team members to talk about the current status of the project (Schwaber and Beedle, 2002).
Sprint planning meetings	During the sprint planning meetings, the developers and other stakeholders discuss which features will be implemented in the next iteration (Schwaber and Beedle, 2002).
Sprint review / retrospective	In sprint review / retrospective meetings, the results of the last iteration are presented and lessons learned are discussed among the team members (Schwaber and Beedle, 2002).
Pair programming	Pair programming involves close collaboration of the developers so that social interactions play a fundamental role (Sharp and Robinson, 2006).

Table 1: Social Agile Practices

In order to conceptually uncover the "black box" of the ISD process as regards the conceptualization of the social interactions and communication, we suggest to build on the Cognitive-affective Model of Organizational Communication (Te'eni, 2001). First, we focus on the employed medium that distinguishes agile ISD from plan-based methodologies. The medium is the physical carrier used for transmitting the message (Te'eni, 2001). We argue that we need to consider the degree of *communication informality* as the primary characteristic of the used medium in order to investigate the impact of agile

ISD methodologies on the communication mechanisms of ISD project teams. Higher communication informality is characterized by the employment of more natural communication media such as spontaneous face-to-face conversations and unstructured meetings that are characterized as personal and interactive (Katz and Kahn, 1978; Kock, 2004; Smith et al., 1994). As discussed in Section 2, the 'Agile Manifesto' as well as previous studies highlight that agile ISD methodologies downplay the role of formal communication and promote informal communication. Consequently, we argue that the use of agile practices increases the use of informal communication mechanisms and decreases the use of formal communication mechanisms in comparison to traditional, more plan-driven ISD methodologies. This is a one-way flow from agile practices to communication informality because communication activities are facilitated by social agile practices such as daily scrums and not the other way round (McHugh et al., 2011; Wang et al., 2012).

Besides the employed medium, we also suggest to explore the actual amount of communication. *Communication frequency* concerns the amount of interaction among team members, whether communication occurs in face-to-face conversations, by telephone, by written documentation, or via e-mail (Katz and Kahn, 1978; Shaw, 1981; Smith et al., 1994). Due to their supposed focus on facilitating frequent communication, we expect that the use of social agile practices increases communication among ISD project team members.

As conceptualized by the Cognitive-affective Model of Organizational Communication, we include the communication impact in the form of mutual understanding and relationships in our model (Te'eni, 2001). *Mutual understanding* relates to cognition and is defined as "the degree of cognitive overlap and commonality in beliefs, expectations, and perceptions about a given target" (Cohen and Gibson, 2003, p. 8). Recent insights from Media Naturalness Theory (Kock, 2009; Kock, 2005; Kock, 2004) posit that more as well as less transmitted information than provided by informal face-to-face conversations has negative implications on the cognitive effort that is needed for processing and understanding the transmitted message (Kock, 2004). This is in accordance with early work on ISD that indicates that mutual understanding is generated by efficient and frequent communication between the involved parties (Churchman and Schainblatt, 1965; Tan, 1994; Te'eni, 2001). We transfer this view to the agile ISD domain, recognizing the earlier identified role of communication informality. Specifically, we suggest that more natural, informal communication reduces the cognitive effort for creating mutual understanding, whereas the opposite applies for more formal communication. Similarly, we expect higher amounts of communication and social interaction among team members to facilitate the building of shared mental models, regardless of whether formal or informal communication mechanisms are used.

Good *relationships* among team members of ISD projects bear on affection and are indicated by the following three characteristics (Guinan et al., 1998): (1) team members share positive feelings for each other, (2) there is a sense of loyalty and responsibility, and (3) there is a common goal. Previous studies indicate that the frequent, informal communication activities resulting from the use of social agile practices have a positive impact on the relationships of team members (Guinan et al., 1998; McHugh et al., 2012; Te'eni, 2001). By frequently interacting face-to-face with other team members, a stronger bond between them is established in comparison to formal, written documentation. We suggest that increasing mutual understanding also directly increases the building of good relationships between team members because as team members discuss and build shared mental models, it is easier for them to reach consensus on goals and to establish an affectionate relationship with each other (Garrod and Pickering, 2009).

The development output of agile ISD is a successfully developed technology- or software-based IS. We define the dependent variable *ISD success* as high user satisfaction (Bhattacherjee, 2001) as well as high project performance in terms of time and budget (Wallace et al., 2004). Several experience reports (e.g., Erickson et al., 2005) as well as more rigorous studies (e.g., Cao et al., 2009) indicate a positive effect of agile ISD on ISD success, whereas other studies question this relationship (Lee and Xia, 2010). We intend to investigate this relationship in more detail by specifying that mutual understanding among team members and with the customer, which is caused by informal communication

promoted by social agile practices, increases ISD success. Earlier studies find that relationships are not significantly related to team performance (Guinan et al., 1998). We intend to reinvestigate this finding in the context of agile ISD projects because compelling arguments suggest that relationships are more important for agile ISD (e.g., Iivari and Iivari, 2011; Madsen and Matook, 2010; Misra et al., 2009; Molokken-Ostvold and Furulund, 2007). ISD projects can take several months or years, so there is a considerable need for good relationships between the team members in order to succeed with the project. If team members do not get along well, the collaborative agile ISD process is threatened.

Table 2 summarizes our key constructs.

Construct	**Definition and Description**	**Key References**
Social agile practices	Social agile practices are a subset of agile practices that are connected to interactions, collaboration, cooperation, and communication of team members (e.g., the practices co-located office space, on-site customer, and daily scrum).	Literature on agile ISD, e.g., Maruping et al (2009), So and Scholl (2009), Wang et al. (2012)
Communication informality	Communication informality is the degree to which ISD teams favour less formal communication channels and media (e.g., face-to-face conversations and other personal, interactive communication channels in contrast to highly structured meetings, written communication and other relatively non-interactive and impersonal communication channels).	Cognitive-affective Model of Organizational Communication (Te'eni, 2001), Media Naturalness Theory (Kock, 2005; Kock, 2004) and related literature, e.g., Katz and Kahn (1978), Smith et al. (1994)
Communication frequency	Communication frequency is the amount of social interaction among team members, regardless of the choice of communication channel and medium.	Cognitive-affective Model of Organizational Communication (Te'eni, 2001) and related literature, e.g., Katz and Kahn (1978), Ruekert and Walker Jr. (1987), Shaw (1981), Smith et al. (1994)
Mutual understanding	Mutual understanding is "the degree of cognitive overlap and commonality in beliefs, expectations, and perceptions about a given target." (Cohen and Gibson, 2003, p. 8)	Cognitive-affective Model of Organizational Communication, Media Naturalness Theory (Kock, 2005; Kock, 2004) and related literature, e.g., Biocca et al. (2001), Cohen and Gibson (2003), Ko et al. (2005), Tan (1994)
Relationships	Good relationships are characterized by (1) team members who share positive, friendly feelings toward each other, (2) a sense of loyalty and responsibility toward each other, and (3) the existence of a common goal.	Cognitive-affective Model of Organizational Communication (Te'eni, 2001) and related literature, e.g., Festinger (1950), Guinan et al. (1998), He et al. (2007)
ISD success	ISD success is defined as high user satisfaction, as well as high project performance in terms of time and budget.	Unified Model of ISD Success (Siau et al., 2010) and related literature, e.g., Bhattacherjee (2001), Iacovou et al. (2009), Wallace et al. (2004)

Table 2: Summary of Key Constructs

4 Measurement Scale Development

Only adequately measured variables can be used to identify significant relationships between those constructs (O'Leary-Kelly and Vokurka, 1998). To ensure content validity, we carefully designed our measurement scales by adopting items from existing questionnaires and by developing new ones based on established guidelines and our construct definitions (Moore and Benbasat, 1991). Our content validity assessment of prior literature revealed that all our constructs could be measured on the basis of existing scales except the construct "social agile practices". Scales for the individual agile practices exist (So and Scholl, 2009), but we first have to check whether the overall construct is to be measured with a formative or reflective scale. By following established guidelines (Jarvis et al., 2003; Petter et

al., 2007), we conclude that "social agile practices" should be measured as a formative construct because it is comprised of distinguishable practices, and not reflected by them. Based on this, we developed a new formative scale for "social agile practices" that pinpoints the separate practices in one item respectively (Petter et al., 2007). Furthermore, we adapted the already existing reflective measurement scales from the literatures on team performance and ISD for the constructs "communication informality", "mutual understanding", "relationships", and "ISD success". We reworded the existing scales in order to fit them to our research domain. Existing formative measures for the construct "communication frequency" can be used without adaption. Table 3 presents the items and the relevant literature we used for the item development. All items refer to the last project that the person was involved in.

Construct	**Item**	**References**
Social agile practices (formative)	We followed the agile practice "Daily Stand-Up Meetings" by meeting up every day.	Newly developed
	We followed the agile practice "Co-Located Office Space" by locating team members close-by.	
	We followed the agile practice "Iteration Planning Meetings" by meeting up at the beginning of an iteration for deciding which requirements will be implemented within the iteration.	
	We followed the agile practice "Pair Programming" by doing our software development using pairs of developers.	
	We followed the agile practice "Sprint Review / Retrospective Meetings" by meeting up at the end of an iteration for discussing the results of the last iteration and lessons learned.	
Communication informality (reflective)	Team meetings tended to be very informal in nature.	Adapted from Smith et al. (1994)
	Meetings between members of the development team were very informal.	
	Communication between team members was always face-to-face.	
	The development team employed rather informal than formal communication channels.	
Communication frequency (formative)	Please estimate the frequency of formal face-to-face meetings between you and other team members.	Adapted from Smith et al. (1994)
	Please estimate the frequency of informal face-to-face meetings between you and other team members.	
	Please estimate the frequency of formal written communication between you and other team members.	
	Please estimate the frequency of informal written communication; personal notes, etc., between you and other team members.	
	Please estimate the frequency of telephone conversations between you and other team members.	
Mutual understanding (reflective)	My opinions were clear to other team members.	Adapted from Biocca et al. (2001)
	The opinions of other team members were clear to me.	
	My thoughts were clear to other team members.	
	The other team members' thoughts were clear to me.	
	Other team members understood what I meant.	
	I understood what other team members meant.	
Relationships (reflective)	I had friendly relations with the other team members.	Adapted from Guinan et al. (1998)
	The other team members often got on my nerves.	
	There was a lot of unpleasantness among people in the development team.	
	I was often disappointed with other team members.	
ISD success (reflective)	Our last project was completed within budget.	Based on Wallace et al. (2004) and on Bhattacherjee (2001)
	Our last project was completed within schedule.	
	I think that the customers are pleased with the software that we developed.	
	I think that the customers are satisfied with the software that we developed.	
	I think that the customers feel delighted about the software that we developed.	
	I think that the customers are frustrated with the software that we developed.	

Table 3: Overview of Items after the Content Validity Assessment

Since we partially developed new items and transferred as well as reworded existing items of related domains into the agile ISD context, the item compatibility and appropriateness for our research domain has to be checked first in order to establish construct validity. Unidimensionality, reliability, and validity are needed to ensure construct validity for our four reflective constructs (O'Leary-Kelly and Vokurka, 1998). We assessed those three components by conducting an item-sort task (Anderson and Gerbing, 1991; Moore and Benbasat, 1991). We also included the newly designed formative scale for the novel construct "social agile practices" in the sorting in order to determine whether the items we developed actually contribute towards the intended construct (Note: the construct "communication frequency" is formative and the items were not reworded, so we did not include it in the sorting in order to keep the pretest parsimonious and to reduce the effort for the participants to an acceptable level.). We used this item-sort task to establish substantive validities, which is a major contributor towards generating construct validity and is suitable for pretest settings that typically include small sample sizes (Anderson and Gerbing, 1991), making sure that the items load on the intended constructs and not on others.

In order to guarantee construct validity of the candidate items and to identify poorly worded or ambiguous items, we recruited twenty-one experts on software development for conducting the sorting task. The panel consisted of academic staff conducting research within the ISD domain as well as experienced practitioners from industry. For each item, the participant had to decide which construct resembles the item best. The items were sorted randomly. Definitions of the constructs were provided and one researcher was also present during the sorting procedure in order to explain the definitions and clarify any misunderstandings. We encouraged the participants to report poor wording and misleading phrases.

Two indices were used in order to evaluate substantive validity of the measures, namely the proportion of substantive agreement, PSA, and the substantive validity coefficient, CSV (Anderson and Gerbing, 1991). The PSA index indicates the proportion of participants that assign the item to the intended construct. In order to determine the extent to which an item is also tapping into a different construct, the CSV index has to be evaluated, which represents the extent to which respondents assign an item to its posited construct more than to any other construct (Anderson and Gerbing, 1991). The PSA index ranges from 0.0 to 1.0 and the CSV index from -1.0 to 1.0. Higher values indicate greater substantive validity, and the recommended threshold for CSV is greater than 0.5 (cf. Anderson and Gerbing, 1991 for a more detailed discussion). Table 4 presents the final results of the item-sort task.

Construct	**Number of Items**	**P_{SA}**	**C_{SV}**
Social agile practices	5	1.00	1.00
Communication informality	4	1.00	1.00
Mutual understanding	6	1.00	1.00
Relationships	4	0.98	0.95
ISD success	6	1.00	1.00

Table 4: Results of the Item-Sort Task as regards Substantive Validity

Both P_{SA} and C_{SV} indices indicate high substantive validity because four of the five constructs achieve the highest possible value of the scale. Only the "relationships" construct shows lower values because some participants linked these items to the "mutual understanding" construct. Nevertheless, the C_{SV} index of the "relationships" construct is well above the 0.5 threshold. Since all the values indicate high values of substantive validity, we did not drop or reword any items.

5 Conclusion

Currently, the exact nature of the relationship between agile practices and communication is poorly understood within the ISD domain. Factors that drive or inhibit communication within the ISD process remain largely unexplained. Even though many researchers stress the importance of effective communication in the ISD process, "few provide empirical evidence or concrete suggestions" (Bostrom,

1989, p. 280). In this paper, we developed a research model that opens up the "black box" of the ISD process as regards the impact of agile ISD methodologies and that sheds light on the communication processes of agile ISD teams. The model, its constructs, and its hypotheses have been thoroughly derived by integrating components of theories from different approaches and areas of research as well as findings from previous studies on agile ISD.

Our theoretical reasoning builds on the Unified Model of ISD Success. As control variables, we identified several input factors that are highly likely to contribute to differing outcomes of the ISD process. We hypothesized that the ISD process is affected by five social agile practices that focus on communication, collaboration, and social interaction. The ISD process itself is opened up by investigating the impact of agile practices on communication behaviour within project teams. Since agile ISD is supposed to be fundamentally about communication, we expect that those social practices will have a significant impact on communication informality and communication frequency, which in turn lead to higher mutual understanding and better relationships. As a consequence, we expect positive implications for the success of the ISD project in terms of higher user satisfaction and higher project performance.

Before testing the model, we carried out a construct validation process in order to ensure that we are able to measure the constructs that we actually intend to investigate. First, we assessed content validity in order to generate appropriate items for the constructs by adopting existing scales and developing a new one for the formative construct "social agile practices". As a next step, we contributed towards establishing construct validity by assessing the substantive validity of the measures. Substantive validity was achieved by conducting an item-sort task with expert participants. The results show very high values for the substantive validities of the constructs, which is a strong indication for good construct validity, and that the identified items apparently measure the constructs appropriately.

As regards limitations, we have to point out that the results of our pretest assessment are only indications of the reliability and validity of our constructs. Without a pilot test and the testing of the overall questionnaire, we can only derive initial indications of construct validity. Moreover, we have to be careful as regards other influencing variables. Therefore, before conducting a pilot test, we will first conduct a thorough literature review for screening and checking the available literature on agile ISD and communication for other constructs and appropriate measurement items that we might have missed and that may be incorporated into our questionnaire. Our research model provides the appropriate reference framework for analysing the literature. This might lead to additional constructs or new measurement scales. If we discover additional constructs and measurements, we will repeat our pretest assessment for any new items. Consequently, we intend to fully establish construct validity by conducting the pilot test of the fully developed and pretested questionnaire in order to further assess the validity of our items, which will result in a first reliability assessment. We will also carry out the third stage of the construct validation process, namely hypothesis testing, by using the final version of the to-be-developed questionnaire within large-scale surveys and case studies.

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