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RESEARCH NOTE

REVISITING GROUP-BASED TECHNOLOGY ADOPTION AS A DYNAMIC PROCESS: THE ROLE OF CHANGING ATTITUDE–RATIONALE CONFIGURATIONS[1]

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In this study, we set out to better understand the dynamics behind group-based technology adoption by investigating the underlying mechanisms of changes in collective adoption decisions over time. Using a longitudinal multi-case study of production teams in the British oil and gas industry, we outline how internally or externally triggered modifications to the constellation of adoption rationales and attitudes toward a focal technology between subgroups caused changes to adoption decisions within a team. The constellations further seemed to impact usage patterns including conflicts about ICT use and the stability of adoption. Based on these observations, we suggest that group-based adoption can be differentiated in qualitatively different technology adoption states (TAS), which emerge as the result of disparate attitude–rationale configurations across subgroups in a user collective. With this reconceptualization of collective adoption as technology adoption states, our study extends current group-based models by providing a new, qualitative lens to view the creation and stability of adoption patterns in complex user groups. With this, our study offers a process view on the (dis)continuance of information systems and provides a basis for practical guidelines on how to deal with problematic adoption situations when actors from multiple (sub)groups are involved.

Keywords: Technology adoption, collective adoption, diversity, distribution, group valence, process view, case study

[1]Suprateek Sarker was the accepting senior editor for this paper.

The appendices for this paper are located in the "Online Supplements" section of the *MIS Quarterly*'s website (http://www.misq.org).

Introduction

Technology use in groups is a collective action based on shared practices and interpretations among interdependent users (Burton-Jones and Gallivan 2007; Majchrzak et al. 2008). This collectiveness also extends to the adoption of new technologies (Sarker and Valacich 2010; Sarker et al. 2005). Initial attitudes toward new technologies can, for instance, be influenced through subjective norms or normative pressures by colleagues, supervisors, or subordinates (Burkhardt 1994; Sykes et al. 2009; Wang et al. 2013). This social and relational nature of technology adoption means that adoption decisions in groups cannot be predicted solely based on "aggregating the individual members' pre-interaction adoption preferences, or using the views of individual members as surrogates for the group" (Sarker and Valacich 2010, p. 783). Instead, the social process of reaching adoption decisions needs to be taken into account.

Frequently, user collectives are highly complex: Not only can they include members of different functions or disciplinary backgrounds (e.g., in R&D or emergency teams), they are also increasingly distributed across geographical locations. Members of dispersed subgroups "experience different exogenous events, physical settings, constraints and practices, resulting in their having different information, assumptions, preferences and constraints" (Cramton and Hinds 2005, p. 236). Dispersed subgroups thus form segregated territories, in which technologies can mean very different things. Hence, differences in demographics, social, and/or organizational contexts can affect experiences with and expectations for the use of technologies (Mark and Poltrock 2004; Sarker and Sahay 2003; Sarker and Valacich 2010; Venkatesh and Zang 2010), hindering the development of common interpretations and thus negatively affecting the development of agreement in a group. If diversity and distribution come together, adoption may become even more challenging, as distribution increases the likelihood of teams separating into subgroups (Cramton and Hinds 2005; Yilmaz and Peña 2014).

One of the few theoretical frameworks dealing with collective adoption is the TAG (technology adoption by broups) model (Sarker et al. 2005) and its later extension m-TAG (Sarker and Valacich 2010). The m-TAG model proposes that an

> adoption decision regarding a certain technology [is] made collectively by the group through a process of communication and negotiation (leading to some degree of consensus among members regarding the adoption decision) (Sarker et al. 2005, p. 45).

This alignment of attitudes and expectations among team members leads to a shared *group valence*, that is, a "positive or negative orientation of a group as a whole toward a technology" (Sarker et al. 2005, p. 45). Individual members, and especially those of high status, can play a role in swaying other members' opinions, yet the final decision depends on the collective orientation toward the focal technology. The m-TAG model is static in the sense that it considers the process toward one (initial) adoption decision. Yet, as past studies have demonstrated, adoption of new information systems often constitutes a process with episodic upsets and upheavals (Dennis and Garfield 2003; Lyytinen and Newman 2008), which can occur even long after implementation (Majchrzak et al. 2008; Tyre and Orlikowski 1994).

The possible instability of adoption decisions is thus well known. However, we still lack a clear understanding of *why* collective adoption decisions change over time, thus requiring an extension of existing group-based adoption models with a dynamic perspective. Moreover, although studies and models of collective adoption acknowledge the influence of social context in reaching agreement in groups (e.g., Burkhardt 1994; Jian 2007; Sykes et al. 2009), they lack an explicit focus on the impact of context differences on group-based adoption decisions. Our paper aims to fill these gaps by considering two key questions:

(1) *How do adoption decisions in groups change over time?*

(2) *How are group characteristics such as heterogeneity and distribution involved in the process of changing adoption decisions?*

We address these questions via a longitudinal investigation of collective adoption processes in complex teams.

Methods

Study Design and Organizational Setting

For our study, we investigated the introduction of new information and communication technologies (ICTs) in teams working in the British offshore oil and gas industry, starting several months before their implementation and finishing up to two years into their usage. We used a longitudinal multi-case approach (Walsham 1995) focusing on the implementation and adoption process in three production teams. These production teams were distributed teams with two closely linked, but distinct, subgroups: one located on an offshore installation, the other in the onshore office. Offshore technicians and managers were responsible for platform operation and maintenance; engineers and managers in the onshore office dealt with the mid- to long-range planning and technical support. Both subgroups were jointly responsible for achieving set production targets, while ensuring the safety of equipment, personnel, and environment. Offshore staff, as mostly skilled personnel, had a strong hands-on focus toward the practical execution of tasks, while onshore staff, as mostly university-trained engineers, were concerned with sound planning and adherence to industry and legal standards. All teams were long-term, stable teams, in which the two subgroups worked across geographical distance, but in the same time zone and country.

Initially, production teams used only phone, mail, email, and audio-conferencing tools to communicate and collaborate between subgroups. This lack of contact created barriers to effective planning and the managing of unexpected events such as production or equipment failures. To improve the efficiency and effectiveness of onshore–offshore collaboration, senior managers decided on an ICT-upgrade, aiming "to enable onshore and offshore staff to work together more effectively using advanced software and dedicated communication links" (internal company document). The project aimed to enhance capabilities for communication as well as data exchange. The existing media remained, but were supplemented with facilities for continuous video-conferencing and real-time data streaming (see Appendix A, Figure A1, for an impression of the setup). External consultants were tasked with both the technical and social side of the implementation process such as the development of ICT solutions, the engagement of the teams, the evaluation of the technologies and process, as well as staff training and coaching. Six of the nine production teams at the company served as pilots to test ICT variations and their physical setup. After an 18-month pilot phase, the consultants developed a standardized ICT solution similar to the pilots, which was then applied to all nine production teams.

Data Collection and Analysis

In our study we focused on three teams: Two involved in the pilot phase, one in the main implementation (for details, see Appendix A, Table A1). The choice was partly based on practical considerations, as access to these three teams was the most consistent throughout the 2.5 years of our study and thus yielded the most comprehensive data. We further restricted our analyses on these three teams due to theoretical considerations, as they showed disparate patterns of adoption decisions over time. The three teams were located in the same organization, had identical team tasks and comparable team characteristics, and were confronted with the same technology change, which enabled us to compare the process across teams, while keeping internal and external variations as small as possible and avoiding the biases inherent in retrospective methods (Langley 2009). Our role was that of independent researchers: During the first two years of the study, the first author was located within the company as a nonparticipant observer, which meant that she could move freely in the organization, join meetings, engage in informal conversations, and access internal documents. In some situations, she was joined by the second author. A final visit for data collection took place six months after leaving the company. In these 2.5 years, we collected data from three sources: (1) 86 interviews with onshore and offshore team members, senior managers responsible for strategic decisions, consultants, and IT-support to capture (changes in) attitudes toward the new technologies and reasons for (changes in) their adoption, (2) observations to capture actual technology usage and its changes over time, and (3) 191 internal documents for background information on the project objectives, implementation process, and adoption issues (for details, see Appendix A, Table A2). Where possible, team members were interviewed again at a later stage, otherwise we interviewed their direct replacement. The interviews gathered insights on pre-implementation expectations, the implementation process, and, finally, usage of and experiences with the new technologies (see Appendix B for the interview guidelines). All interviews were audio-recorded and transcribed verbatim. The first author further conducted numerous informal conversations to obtain snapshots of recent developments and attitudes throughout the process, which were recorded as written field notes as soon as possible after the event. Direct observations in the onshore office and during visits to two offshore installations captured work processes and their changes before and after the implementation. Observations further included feedback meetings, in which teams voiced concerns about the technology or process, and weekly meetings of the consultants to discuss project progress and issues. The internal documents provided information on the technology change and issues encountered during the process. We used these documents as a window into the implementation strategy and a record of decisions as well as a second source on how the teams perceived the technology change and the challenges they encountered during the process.

The data was analyzed in several rounds. For the initial analysis, we condensed the vast amount of longitudinal data into a generalized timeline and individual timelines of events for each team using a temporal bracketing strategy (Langley 1999). We overlaid these timelines with the adoption decisions in each team based on field notes, company documentation, and documentation created by the consultant group. Phases were marked as adoption when the teams used the technologies on a (somewhat) regular basis (e.g., for formal meetings, problem-solving sessions, or personal conversations between subgroups). We marked phases as non-adoption if the teams either had the technologies switched off or one subgroup disabled their usage (e.g., by putting hard hats over the camera or by pointing it to mascots or room corners), so that no collaboration over the new technologies took place. The resulting timelines showed changes in adoption decisions in all three teams (see Figure C1 in Appendix C). To understand the reasons for these changes, we first coded all interviews and documents for either positive or negative evaluations of the new technologies to obtain a detailed picture of attitudes throughout adoption and non-adoption phases. In a second round, using open coding (Glaser and Strauss 1967), we marked the reasons participants gave for their decisions to adopt or not adopt the technologies. Coding examples can be found in Appendix D. Based on the two layers of coding, we obtained two different aspects underlying the adoption decisions: *attitudes* (i.e., the positive or negative evaluations of the new technologies) and *adoption rationales* (i.e., the reasons given for (non-)adoption of the technologies). As we analyzed the changing attitude–rationale constellations in each team, we found that onshore and offshore staff approached the project very differently and therefore separated the two subgroups in our timelines. Aggregation to the subgroup level seemed feasible as, with only a few exceptions, members' accounts within subgroups did align. Moreover, accounts of individuals often explicitly indicated a broader perspective beyond the individual (e.g., "*If something is going to enhance us, let's go for it,*" onshore engineer, Team 3). In Appendix E, we provide a summary of how our study was consistent with criteria for interpretive research (Golden-Biddle and Locke 1993).

Findings

In all three teams, episodes of adoption alternated with episodes of non-adoption, indicating that adoption decisions were not stable, but prone to fluctuations. In the following, we present within-case analyses for each team and then investigate commonalities and differences across teams to clarify the underlying process of the observed dynamics in teams' adoption decisions.

Within-Case Analyses of Teams' Technology Adoption over Time

Team 1: Uneasy Early Adoption, Team-Wide Withdrawal and Recovery

Team 1 was the first team to start as a pilot. At the outset of the implementation, the two subgroups differed both in terms of attitudes and rationales. In the onshore subgroup, an intensive information campaign with workshops, exhibitions, and personal consultations had created awareness and highly positive expectations based on the rationale that the new ICTs would reduce collaboration barriers and thus improve performance. In the offshore subgroup, attitudes were largely negative, as they saw the purpose of the new ICTs solely as supporting onshore engineers without providing benefits for themselves: "*[The video] is always on for [onshore], but it's not always on for us. If the nightshift switches that on, there won't be somebody there*" (offshore manager). Offshore staff also worried that the video link would lead to more interference from onshore engineers: "*If an alarm goes off in here, [onshore staff will think], 'Oh, I wonder what that is? Let's see what is going on in there.' And it would be like sitting in a goldfish bowl*" (control room technician). Also, disparities in the engagement phase and delays in the actual delivery of the technologies left the offshore subgroup feeling like "second class citizens." Planned offshore visits by the consultants were on several occasions canceled at short notice due to operational priorities. Moreover, due to rotating two-week shifts, only parts of the offshore personnel could be reached during any given visit. According to a member of the implementation group, offshore staff interpreted this different treatment as a conscious strategy and the ICTs accordingly as part of a "*management sponsored initiative to provide some form of additional surveillance.*" Many offshore technicians feared that onshore engineers would use the video link to "spy" on them and consequently turned the camera off or put boxes, coffee mugs, or hard hats in front of the lens, which effectively blocked onshore attempts to use the new technologies. The offshore group eventually gave in to the concerted pressures from onshore engineers, senior managers, and the implementation group to use the video link at least for formal meetings. A few offshore managers also used it for one-on-one conversations with onshore managers or engineers.

Not long after the implementation, the team moved from this partial adoption to non-adoption when the attitudes in the onshore subgroup also turned negative. This change was triggered by unmet expectations and the problematic start. Moreover, the resistance from the offshore subgroup meant that collaboration between the onshore and the offshore subgroups failed to improve. Frustrations were further triggered externally by the high degree of attention the group received by virtue of being the first pilot: "*If I had known that so much of our time would be expected to be given for what sometimes feels like a PR exercise for the consultants, I would have had serious reservations about being included*" (onshore engineer). As a consequence, attitudes in the onshore subgroup shifted to the negative, resulting in an alignment in negative attitudes for both subgroups, although due to different rationales. The result was that neither the video link nor the real-time data component was used, and the pilot came to be regarded as a failure by the team as well as the implementation group. This changed yet again, when 10 months after implementation Team 1 had to prepare for the annual overhaul of their offshore installation, which required frequent and intensive collaboration between the two subgroups over several weeks. During this period, the new technologies started to be used, as communicating via the video link made planning considerably faster and supported the detection of planning errors much earlier than before. These positive experiences dramatically changed attitudes toward the new technologies, leading to consistent use even by the offshore subgroup: "*The offshore managers are quite excited about having it on; you know, 'let's have it on and talk to the office'*" (offshore manager). The clear benefits in the form of improved team collaboration thus led to new positive attitudes on both sides based on the same rationales, and the new habit of keeping the video "always-on" remained intact for the rest of our observation period.

Team 2: Promising Start and Late Failure

Team 2 was the last of the pilot teams to implement the new technology. At the outset, attitudes toward the new systems were largely positive in both subgroups, although for different reasons. As in Team 1, the attitude of onshore engineers was positive based on the expectation of easier and more efficient collaboration. The rationale for positive attitudes amongst managers in the offshore subgroup revolved primarily around hopes for the improvement of relationships: "*Some of the technicians have never met some of the people onshore. That [video] will definitely help to improve the working relationship.*" Offshore technicians were more critical, voicing the same fears as their colleagues in Team 1 (i.e., disruption of their work and invasion of their privacy). Onshore engineers and offshore managers were thus aligned in their positive attitudes, although for different reasons, while in the offshore subgroup, attitudes and rationales were misaligned.

To avoid the problems of low adoption in Team 1, senior managers decided "*to create demand from offshore before giving them the technology*" (senior manager). Therefore, the video use in Team 2 was not enforced to avoid the impression of a "*management-driven surveillance tool*," which had caused such negative reactions in Team 1. Instead, offshore technicians were brought into the office to visit their onshore colleagues and see the new technologies "from the other side." This created a chance to talk about expectations between the subgroups and to create closer personal links, which worked very well:

> *In the beginning there was a bit of suspicion, because it was like the Big Brother fear, if you like. But because it hasn't been forced upon the technicians, and because it is evident that we are getting a benefit from it, and because there are examples where we improved things like the communication, the reaction to problems on the plant…now it's quite well perceived"* (offshore manager).

These experiences triggered a change in attitudes in the offshore subgroup: Both subgroups now felt very positive about the new technologies, largely for the same reasons (i.e., improved coordination and better inter-group relationships). As a result, the camera was on nearly all the time, replacing emails, phone calls, and audio-conferencing, and even became a means of informal communications, just as offshore managers had hoped. This high level of adoption persisted throughout the pilot phase until shortly after the move to the standardized solution.

The situation changed dramatically after the move because of a radical alteration in group composition: New offshore managers were appointed, who were very critical and partly even hostile toward the new technologies. This also stopped offshore technicians from continuing to use the video link. As a result, the video link remained always on in the onshore office, while the offshore side switched it off, except sporadically when onshore staff requested formal meetings. As a consequence, onshore engineers reverted back to sending emails instead of communicating directly via video link, as "*control room technicians ask for emails anyway to show to their team leaders that this request came from onshore*" (onshore engineer). During this period, the attitudes of the two subgroups were diametrically opposed, leading to a situation in which adoption became blocked for the onshore subgroup and where conflicts about technology use prevailed. In the final stage, the onshore subgroup also became alienated, this time triggered by an external event: The implementation group decided to monitor compliance with their always-on policy using automated logging of usage statistics. This was widely perceived as *policing* and as such resented. As a result, the team switched the video on in the morning and switched it off as soon as the timer showed that the prescribed eight hours had elapsed. Also, "*the camera is always on, but they're pointing it to the window or the top of the roof*" (informal conversation with onshore manager in Team 3). The new policy thus resulted in negative attitudes, albeit for different reasons, and hence withdrawal in the onshore subgroup as well. This situation continued until the end of our observation period.

Team 3: From Collective Rejection to Collective Embrace

Team 3 did not participate in the pilots, but moved directly into the standardized solution. The initial reactions ranged from cautious to critical in both subgroups, as team members did not see the benefit for their particular situation. The oil field that Team 3 operated was already near the end of its productive life and team performance close to 100%, rendering the proposed benefits moot for this team: *"The costs of installation, maintaining it—we'll never see the benefit of it. Not the benefits that have been claimed"* (offshore manager). Both subgroups agreed in their negative attitudes toward the new technologies and their rationales for these critical views.

Both subgroups, however, changed their attitudes through actual use and by attending joint technology training sessions. Unlike the other teams, the main driver for adoption came from offshore personnel, who turned the video link into a "*drop-in facility for technicians to talk to onshore engineers*" (internal document, implementation group). As a consequence, Team 3 became the most comprehensive in its use of the new technologies, consistently at or near 100% according to usage reports. The team itself attributed this to internal factors, namely the preexisting close relationships between subgroups within the team. As one onshore engineer explained: "*In fault of a better term, [the team] is family.*" Accordingly, offshore staff felt very comfortable contacting their colleagues onshore. The implementation group attributed the difference to the more consistent knowledge of how to use the technology, as "*[this team] sent more people to the training than any of the other teams together.*" Another explanation may be the change toward more realistic expectations about possible benefits. Given the context of a mature oilfield and near 100% production efficiency, Team 3 considered the promise of big gains in productivity as unrealistic. However, they were satisfied with the smaller gains for improved communication. Similar to Team 1, these positive experiences led to favorable evaluations and the wish to continue the current use of the technologies, driven by the same rationales within both subgroups. Team 3 did not experience any changes in its attitude or usage until the end of our observation period and also experienced no observable conflicts about the if, who, how, or when of the usage.

Cross-Case Analysis: Explaining Changes in Collective Adoption Decisions

As the within-case analyses illustrate, all three teams experienced changes in their adoption decisions from adoption to non-adoption or vice versa. Comparing adoption decisions across teams, we found that collective technology adoption happened in two situations: either when both subgroups were aligned in their positive attitudes toward the new technologies (e.g., the second phase in Team 3) or when the positive subgroup could overcome the other's negative attitude by enforcing compliance (e.g., in the early adoption phase in Team 1). Similarly, non-adoption emerged either when both subgroups had negative attitudes toward the new technologies (e.g., last phase in Team 2) or when the subgroup with negative attitudes could successfully block the other with more positive attitudes from using the technologies in question (e.g., Team 2 after the change of offshore management). Adoption decisions were further influenced by the rationales for why a subgroup accepted or rejected the technologies. For example, while the early phase in Team 1 was characterized by non-adoption, this phase contained in fact two different constellations of attitudes and adoption rationales: in the first instance, non-adoption was due to negative attitudes only in the offshore subgroup due to fears of intrusion and work disruptions; in the second instance, the onshore and offshore subgroups developed agreement in their negative attitudes—for offshore due to fears of invasion and disruptions, for onshore due to lack of benefits and frustration with the process. These two constellations were characterized by disparate consequences, namely conflicts versus no conflicts about the if, why, and how of technology use. This suggests that the overt symptom of non-adoption in distributed settings can be due to disparate constellations of attitudes and rationales across subgroups with very different consequences for (approaches to) technology use.

Situations with *alignment in affect and rationale* seemed relatively free of conflict (e.g., adoption after the overhaul process in Team 1, adoption in the pilot phase in Team 2, or initial non-adoption in Team 3). Situations with alignment in attitudes but *misalignment in rationales* led to some conflicts about how, when, or why to use the new capabilities, while situations with *misalignments in attitudes* raised the more fundamental question of use or nonuse and seemed considerably more fraught with tensions. Hence, the various attitude–rationale configurations formed qualitatively different states, each with their own consequences for collective usage and the stability of adoption decisions. We introduce the term *technology adoption states* (TAS) to indicate the diverse nature of adoption emerging from these attitude–rationale constellations.

Throughout our study, we observed six different technology adoption states. The first two were states in which subgroups shared their positive or negative attitudes toward the new technologies for the same reasons. We refer to these states as *congruent adoption* and *congruent non-adoption*, respectively, as collective (non-)adoption was based on congruence in the attitudes and rationales between subgroups. TAS-types three and four were situations in which subgroups were aligned in their positive or negative attitudes, but for different rationales. We refer to these as *disparate adoption* and *disparate non-adoption*. TAS-types five and six occurred if teams experienced misalignments in attitudes. In these situations, teams needed to find a solution to resolve the tensions inherent in the misalignment leading to *blocked adoption* or *compliant adoption*. Blocking was expressed as either complete withdrawal by one subgroup (i.e., offshore technicians' refusal to switch the camera on during the later usage phase in Team 2) or more indirect resistance behaviors such as turning the camera away or obstructing the view. *Blocked adoption* thus describes a state in which the use of technologies in a team is prevented by the refusal of one subgroup to use it or allow its use by the other subgroup. Naturally, blocking by one subgroup is only possible if the other subgroup lacks power to influence the behaviors of the former subgroup (i.e., the one opposed to the adoption). The last adoption state, *compliant adoption*, emerged when one subgroup with positive attitudes used their relative power to pressure the other subgroup into using the technologies despite lacking acceptance in the other (e.g., when the offshore subgroup in Team 1 was pressured by their onshore colleagues, the implementation group, and upper management to use the video during the early pilot phase).[2]

Triggers for Changes in Technology Adoption States

Reviewing changes in TAS, we found that such shifts were triggered either by external or internal team events that affected the interpretation of the new technologies and with this the attitudes and rationales for adopting or (dis)continuing the use of the new systems. *External triggers* were, for instance, the behaviors and decisions of the implementation group and team managers such as the different treatment of subgroups in the engagement and implementation process in Team 1 or the decision to monitor video use. We further found two types of *internal triggers*, namely changes in team composition such as the offshore management in Team 2 and engagement in specific tasks such as the overhaul process in Team 1 that triggered unexpected positive experiences. Interestingly, events that could cause one team to react with a change in its adoption state had no perceptible effect on another (e.g., the decision to police the amount of video use, which was detrimental in Team 2, but seemed to have no effect for Teams 1 and 3). These observations suggest that, in situations of attitude–rationale misalignments, trigger events can have a considerable impact, whereas adoption states characterized by alignment of attitudes and rationales seem much more stable and less susceptible to internal or external team events. Still, sufficiently dramatic events could cause breakdowns even in very stable congruent adoption states (e.g., Team 2). Whether an event caused a change in collective adoption seemed to depend on how severe the event was and on possible buffering conditions in the team (e.g., quality of relationships between subgroups or extent and stability of attitude–rationale alignments).

Theoretical Contributions and Practical Implications

The aim of this paper was to extend our understanding of why adoption decisions in groups change over time, and how group characteristics such as heterogeneity and distribution are involved in this process. Our findings indicate that collective adoption dynamics have their basis in time-bound constellations of attitudes and rationales across subgroups, which are altered due to internal or external triggering events in the team. These malleable attitude–rationale configurations were linked to specific usage patterns in the interconnected subgroups. Based on these observations, we introduced the concept of *technology adoption states* (TAS) to describe the basis of collective adoption decisions and to provide a framework to explain the mechanisms behind their dynamics over time. We summarize this process in Figure 1.

Our study extends existing models of group-based adoption by linking the form of (initial) adoption with the likelihood of shifts in adoption decisions at later times. Adoption has traditionally been operationalized as a binary choice (see Jeyaraj et al. 2006) or as strength of adoption (Sarker and Valacich 2010). Yet, our observations suggest that it may be rather the specific nature of collective adoption that impacts stability or changes of adoption decisions. We thus argue that group-based adoption models require a stronger focus on the qualitative features of (initial) adoptions and their role for post-adoption behaviors. Our concept of qualitatively different, malleable technology adoption states also offers a framework to describe and predict how groups dynamically move between phases of adoption and non-adoption and why they experience shifts in usage patterns. It thus provides a link between initial adoption and post-adoption behaviors based on renegotiable attitude–rationale configurations.

Our study also helps to sharpen the concept of group valence that underlies group-based adoption according to the m-TAG model (Sarker and Valacich 2010; Sarker et al. 2005). In considering *attitude* and *rationale* as underlying aspects of a group's orientation toward a focal technology, we suggest that valence as the "positive or negative orientation of a group as a whole toward a technology" (Sarker et al. 2005, p. 45) is

[2] Although not observed in our study, it is possible to imagine that compliant adoption states could also occur when the other subgroups lack strong attitudes toward the new technology. Hence, compliant adoption may not always be due to insurmountable external pressures, but could also be a consequence of a neutral stance that makes resistance (i.e., blocking) unlikely.

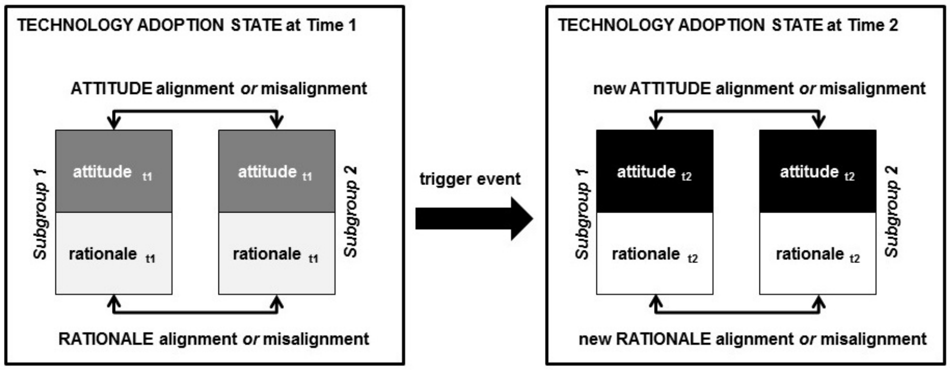

Figure 1. Changes in Technology Adoption States (TAS) as Attitude–Rationale Reconfigurations

created as a combination of these two aspects and emerges as a result of the constellation of their (mis)alignments across members. The different usage patterns in, for instance, disparate and congruent adoption states indicate that both attitude and rationale are needed to determine the exact nature of group valence. In this, we consider attitude and rationale not as independent dimensions (as attitudes toward a technology are likely to be influenced by the reasons behind the positive or negative evaluation of it), but rather as two aspects that together create overall group valence and the specific type of adoption state.

Our study further extends literature on group-based adoption by demonstrating how resistance and withdrawal may be the result of oppositional dynamics among heterogeneous user groups. Previous research has shown that disparate interpretations of technological artifacts can lead to conflicts in usage or resistance behaviors by subgroups in an organization (e.g., Jian 2007; Lapointe and Rivard 2005; Mark and Poltrock 2004; Sarker and Sahay 2003). In introducing the concept of technology adoption states, our study illustrates how disparate interpretations of the same technologies translate into collective adoption dynamics by affecting resistance and withdrawal behaviors in subparts of a collective over time. In considering subgroup dynamics, our study also puts a new emphasis on the multilevel nature of collective technology adoption. One observation was, for instance, that in teams in which usefulness was defined locally (i.e., focused primarily on one's own subgroup), adoption and non-adoption seemed less stable than when the focus was on benefits for the whole group. Also, while in our narratives we focused primarily on shifts and conflicts of attitude–rationale configurations between subgroups, at times conflicts also emerged within subgroups or between the teams' interpretations with those of senior managers and the organization. The lens of attitude–rationale configurations can help to sharpen our view on such dynamics across different foci as a natural part of collective technology adoptions by considering consequences of (mis)alignments across individual, subgroup, team, or organization levels.

In terms of practical implications, understanding collective adoption as malleable technology adoption states offers managers and organizations a new conceptual lens to analyze adoption or non-adoption decisions in complex group settings as well as a framework for how to deal with problematic situations. In the case of *congruent non-adoption*, for instance, managers should identify the shared negative beliefs to address them across all subgroups, while with groups in *disparate non-adoption* states, managers or organizations need to identify subgroup-specific concerns and reconcile them individually. The higher likelihood of fragmentation in attitudes and rationales in heterogeneous user collectives also makes evident that organizations need to shift their emphasis from a focus on achieving initial adoption to an emphasis on retaining adoption over time. Hence, in our view, organizations need to acquire a new mind-set, which treats technology changes in collectives not as a one-time deployment, but as a process that requires management on a continuous basis. This also includes considerations of how decisions affect the balance of attitude–rationale configurations even long after implementation.

Limitations and Future Research

As any study, ours also comes with a number of limitations. First, our setting confounded heterogeneity and distribution, which makes it difficult to tease apart the exact contributions of distance and diversity on collective adoption dynamics. Future investigations should thus consider the individual as well as combined impacts of distribution and (various types of) heterogeneity. This is especially relevant as subgroups with conflicting interests are not restricted to distributed teams. Collocated groups with diversity in terms of gender, nationalities, or disciplines are common in organizations and may be expected to experience similar fragmentations during technology adoptions (e.g., Lapointe and Rivard 2005). Also, future studies should consider greater dispersion (more than two subgroups) and additional aspects of distribution (e.g., across time zones; O'Leary and Cummings 2007). The more different environments and organizations are involved, the more likely it is that disturbing events will affect at least one of the subgroups and that attitudes and rationales may differ across contexts.

Second, our study investigated ongoing teams with well-established routines and long-standing relationships between subgroups. This maturity seemed to have positive effects in terms of high team familiarity and intra-team trust, but also led to tensions, when the new systems threatened such established relationships and routines. New groups do not have to replace deeply ingrained work processes or renegotiate long-standing relationships. On the other hand, technology adoptions will have to take place at a time when they may still lack a clear task focus, clear norms, and a strong common identity (Sarker and Sahay 2003). Moreover, a group's time horizon (ongoing versus project-based) impacts its emphasis on either social relationships or task completion (Saunders and Ahuja 2006). Stage in the life cycle and differences in time focus may thus form important boundary conditions to understand the formation of TAS and thus collective adoption dynamics, which clearly deserve further attention.

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References

Burkhardt, M. 1994. "Social Interaction Effects Following a Technological Change: A Longitudinal Investigation," *Academy of Management Journal* (37:4), pp. 869-898.

Burton-Jones, A., and Gallivan, M. 2007. "Toward a Deeper Understanding of System Usage in Organizations: A Multilevel Perspective," *MIS Quarterly* (31:4), pp. 657-679.

Cramton, C. D., and Hinds, P. J. 2005. "Subgroup Dynamics in Internationally Distributed Teams: Ethnocentrism or Cross-National Learning?," *Research in Organizational Behavior* (26:4), pp. 231-263.

Dennis, A. R., and Garfield, M. J. 2003. "The Adoption and Use of GSS in Project Teams: Toward More Participative Processes and Outcomes," *MIS Quarterly* (27:2), pp. 289-323.

Glaser, B. G., and Strauss, A. 1967. *Discovery of Grounded Theory: Strategies for Qualitative Research*, Mill Valley, MA: Sociology Press.

Golden-Biddle, K., and Locke, K. 1993. "Appealing Work: An Investigation of How Ethnographic Texts Convince," *Organization Science* (4:4), pp. 595-616.

Jeyaraj, A., Rottman, J. R., and Lacity, M. C. 2006. "A Review of the Predictors, Linkages, and Biases in IT Innovation Adoption Research," *Journal of Information Technology* (21:1), pp. 1-23.

Jian, G. 2007. "'Omega is a Four-Letter Word': Toward a Tension-Centered Model of Resistance to Information and Communication Technologies," *Communication Monographs* (47:4), pp. 517-540.

Langley, A. 1999. "Strategies for Theorizing from Process Data," *Academy of Management Review* (24:4), pp. 691-710.

Langley, A. 2009. "Studying Process in and Around Organizations," in *The Sage Handbook of Organizational Research Methods*, D. Buchanan and A. Bryman (eds.), London: Sage Publishing, pp. 409-429.

Lapointe, L., and Rivard, S. 2005. "A Multilevel Model of Resistance to Information Technology Implementation," *MIS Quarterly* (29:3), pp. 461-491.

Lyytinen, K., and Newman, M. 2008. "Explaining Information Systems Change: A Punctuated Socio-Technical Change Model," *European Journal of Information Systems* (17:6), pp. 589-613.

Majchrzak, A., Rice, R., Malhotra, A., King, N., and Ba, S. 2008. "Technology Adaptation: The Case of a Computer-Supported Inter-Organizational Virtual Team," *MIS Quarterly* (24:4), pp. 569-600.

Mark, G., and Poltrock, S. 2004. "Groupware Adoption in a Distributed Organization: Transporting and Transforming Technology through Social Worlds," *Information and Organization* (14:4), pp. 297-327.

O'Leary, M. B., and Cummings, J. N. 2007. "The Spatial, Temporal, and Configurational Characteristics of Geographic Dispersion in Teams," *MIS Quarterly* (31:3), pp. 433-452.

Sarker, S., and Sahay, S. 2003. "Understanding Virtual Team Development: An Interpretive Study," *Journal of the Association for Information Systems* (4), pp. 1-38.

Sarker, S., and Valacich, J. S. 2010. "An Alternative to Methodological Individualism: A Non-Reductionist Approach to Studying Technology Adoption by Groups," *MIS Quarterly* (34:4), pp. 779-808.

Sarker, S., Valacich, J. S., and Sarker, S. 2005. "Technology Adoption by Groups: A Valence Perspective," *Journal of the Association for Information Systems* (6:2), pp. 37-71.

Saunders, C., and Ahuja, M. 2006. "Are All Distributed Teams the Same? Differentiating Between Temporary and Ongoing Distributed Teams," *Small Group Research* (37:6), pp. 662-700.

Sykes, T. A., Venkatesh, V., and Gosain, S. 2009. "Model of Acceptance with Peer Support: A Social Network Perspective to Understand Employees' System Use," *MIS Quarterly* (33:2), pp. 371-393.

Tyre, M. J., and Orlikowski, W. J. 1994. "Windows of Opportunity: Temporal Patterns of Technological Adaptation in Organizations," *Organization Science* (5:1), pp. 98-11.
Venkatesh, V., and Zang, X. 2010. "Unified Theory of Acceptance and Use of Technology: U.S. vs. China," *Journal of Global Information Technology Management* (13:1), pp. 5-27.
Walsham, G. 1995. "The Emergence of Interpretativsm in IS Research," *Information System Research* (6:4), pp. 376-394.
Wang, Y., Meister, D. B., and Gray, P. H. 2013. "Social Influence and Knowledge Management Systems Use: Evidence from Panel Data," *MIS Quarterly* (37:1), pp. 299-313.
Yilmaz, G., and Peña, J. 2014. "The Influence of Social Categories and Interpersonal Behaviors on Future Intentions and Attitudes to Form Subgroups in Virtual Teams," *Communication Research* (41:3), pp. 333-352.

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