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Managerial interventions in multicultural virtual teams: A review and synthesis of the literature

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Title

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Title [English]

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Subtitle [English]

Abstract [English]

Teams distributed across cultural, geographic and temporal boundaries, also known as multi-cultural virtual teams (MVTs), have been prevalent in international organizations. To provide guidance for MVT managers and support accumulation of prior experience, we establish a management model based on the extended adaptive structuration theory (EAST) and verify the model with 55 empirical studies from leading publications in related fields. The findings contribute a comprehensive set of empirically verified managerial intervention in MVTs and suggest that managers can improve MVT outcomes through manipulating five sets of structural characteristics (i.e., organization, team, individual, technology and task) before and during the task process. Based on the findings, we generate a holistic view of managerial intervention, which explains the mechanisms of managerial intervention in MVTs.

Keywords (up to 8) [English]

Managerial intervention, Technology adaptation, Multi-cultural virtual team, Global virtual team, Extended adaptive structuration theory, Literature review

Title [German] (if possible)

Subtitle [German] (if possible)

Abstract [German] (if possible)

Keywords (up to 8) [German] (if possible)

Short teaser without bullet points [English]

Managers can improve MVT performance through conscious selection of ICT and defining use norms. Using technology can mitigate the negative aspects of cultural diversity, geographic and temporal separation. Using technology properly also simplifies and structures tasks. ICT for MVTs can be purposefully designed to fit into or modify certain team or task characteristics. Administrative managers and IT professionals should jointly develop ICT strategies to achieve high performance in MVTs.

1 Introduction

Virtual teams, defined as groups of people distributed across geographic and/or temporal boundaries and working toward a common goal through interdependent tasks (Maznevski and Chudoba 2000), have been studied for at least a decade. Lipnack and Stamps (1997)'s book *Virtual Teams: Reaching across space, time, and organizations with technology* opened up discussions and explorations on virtual teams. Since then, researchers in various disciplines, especially in management and information systems (IS), have worked jointly to define the scope of virtual team studies (e.g., Bell and Kozlowski 2002; Kirkman and Mathieu 2005), understand virtual team characteristics and team dynamics (e.g., Ahmad and Lutters 2011; Anawati and Craig 2006) and examine effective ways of utilizing virtual teams to achieve intended goals (e.g., Hertel et al. 2005; Lurey and Raisinghani 2001).

However, despite the extensive studies and consistently improved understanding of virtual teams, complaints about underperformance in virtual teams and difficulties in managing them, especially in those across cultural boundaries (i.e., multicultural virtual teams, also MVTs), persist. Carried out in industry, Economist Intelligence Unit's survey involving 407 participants from different industries showed that 56% of the respondents did not agree their virtual teams were well managed; the top two challenges for virtual team management were misunderstanding due to cultural differences and difficulty in leading teams remotely (Economist Intelligence Unit 2009). Similarly, RW^3 CultureWizard's survey with 600 employees of multinational corporations indicated that 40% of the respondents considered their virtual teams were underperforming (Solomon 2010). The reports from industry suggest difficulties in research on MVT management: either the research has not resolved relevant issues or the results from academic research has not been effectively communicated to or implemented in industry. We suspect that both types of difficulties exist.

We define the scope of relevant MVT studies for this paper as those describe, explain and/or predict how to facilitate MVT process or improve MVT outcomes (i.e., performance, member affect and team viability). On the one hand, it is suggested that research gaps are present in MVT management. As stated by various researchers, only a handful of studies examined managers' roles in virtual teams explicitly, among which scant studies were carried out with multicultural virtual teams (Gallenkamp et al. 2011; Zhang and Fjermestad 2006); Caulat (2010) suggested to study "virtual leadership" as a new and different discipline from traditional leadership due to the distinct characteristics in MVTs (i.e., cultural diversity, geographic and temporal separation). On the other hand, earlier research in MVTs or global virtual teams did examine some aspects of dealing with cultural diversity, geographic and temporal separation that had significant managerial implications for MVT managers. These implications should have served as levers to improve team performance and as a sound foundation for MVT management studies.

Seeing the mismatch between the suggested research gaps and existing literatures, we consider it is both important and relevant to find out which managerial intervention in MVTs has been suggested and verified in prior empirical studies. Since communication and collabora-

tion in virtual teams is largely supported by information and communication technology (ICT), managerial intervention is substantially technology-related, which makes MVT management an interesting topic for IS researchers.

To examine managerial intervention in MVTs in a systematic manner, we firstly establish a model integrating managerial intervention with team process; and then we examine empirical studies in MVTs and verify the model with empirical evidence. Following these steps, we are able to contribute a theoretical model of managerial intervention in MVTs, deliver a concrete set of effective managerial intervention for MVT managers and draw an agenda for IS researchers: how ICT has been adapted to improve MVT outcomes and how ICT can further support MVT management.

2 A model of managerial intervention in MVTs

To allow systematically accumulating and extending knowledge in managerial intervention in MVTs, we establish a theoretical model first to guide the review (see Fig.1) (Gregor 2006). For managers and IT professionals, the model provides a comprehensive view of what managers can do to improve MVT outcomes, especially through proper selection and use of ICT; for academic researchers, the model explains and predicts effectiveness of managerial intervention on MVT process and outcomes, serving as a theoretical ground for further research in MVT management.

The model is developed based on the extended adaptive structuration theory (EAST) (Naik and Kim 2010). EAST describes the interaction between the virtual environment and the knowledge producing process among virtual teams. It proposes five types of structures (task-technology fit, mission, organizational dimension, team dimension and individual dimension) and their direct effects on team social interaction, and consequently on team outcomes. Besides, it predicts a positive emotional process and decision process will lead to effective outcomes (Naik and Kim 2010). Developed to describe dynamics within general virtual teams, EAST does not explicate the active role of management before and during the team process.

Seeing the important and indispensible role of managers in uniting remote team members, allocating resources, formulating vision, plans and strategies and monitoring team process (Malhotra et al. 2007), we extend the EAST by explicitly including managerial intervention (i.e., managers' decisions and influences). Referring to every structural characteristic in the original EAST, we add a verb to each characteristic from a manager's view. For example, a characteristic at the organization dimension in the EAST model is organization culture; from managers' view, organization culture can be established or reinforced; we choose reinforce as the verb for managerial intervention, since in most cases, MVTs are set up within an organization context that has existed for a certain period. Following this way, we provide verbs (i.e., managerial intervention) to all structural characteristics and complete the model extension. Some words are slightly changed according to the retrieved literature to maintain consistency.

We term the extended model as EAST management model. According to the model, managers can exert intervention during two phases: structural characteristics formation and task process regulation. In the first phase, managers intervene in designing or adjusting structural

characteristics at organization, team, individual, technology and task dimensions; in the second phase, managers intervene in task process, which can be further divided into transition, action and interpersonal process (Marks et al. 2001). In the EAST model, social-emotional states (e.g., trust, cohesion, conflict) are emergent from task process, and the combination of social-emotional states and task process finally determine team outcomes. Neither social-emotional states nor team outcomes can be directly manipulated by managerial intervention; therefore, no managerial intervention is acting on them in the model. The interpretation of structural characteristics is better understood with empirical evidence. We present the interpretation of them in the appendix (See Appendix Tab.4).

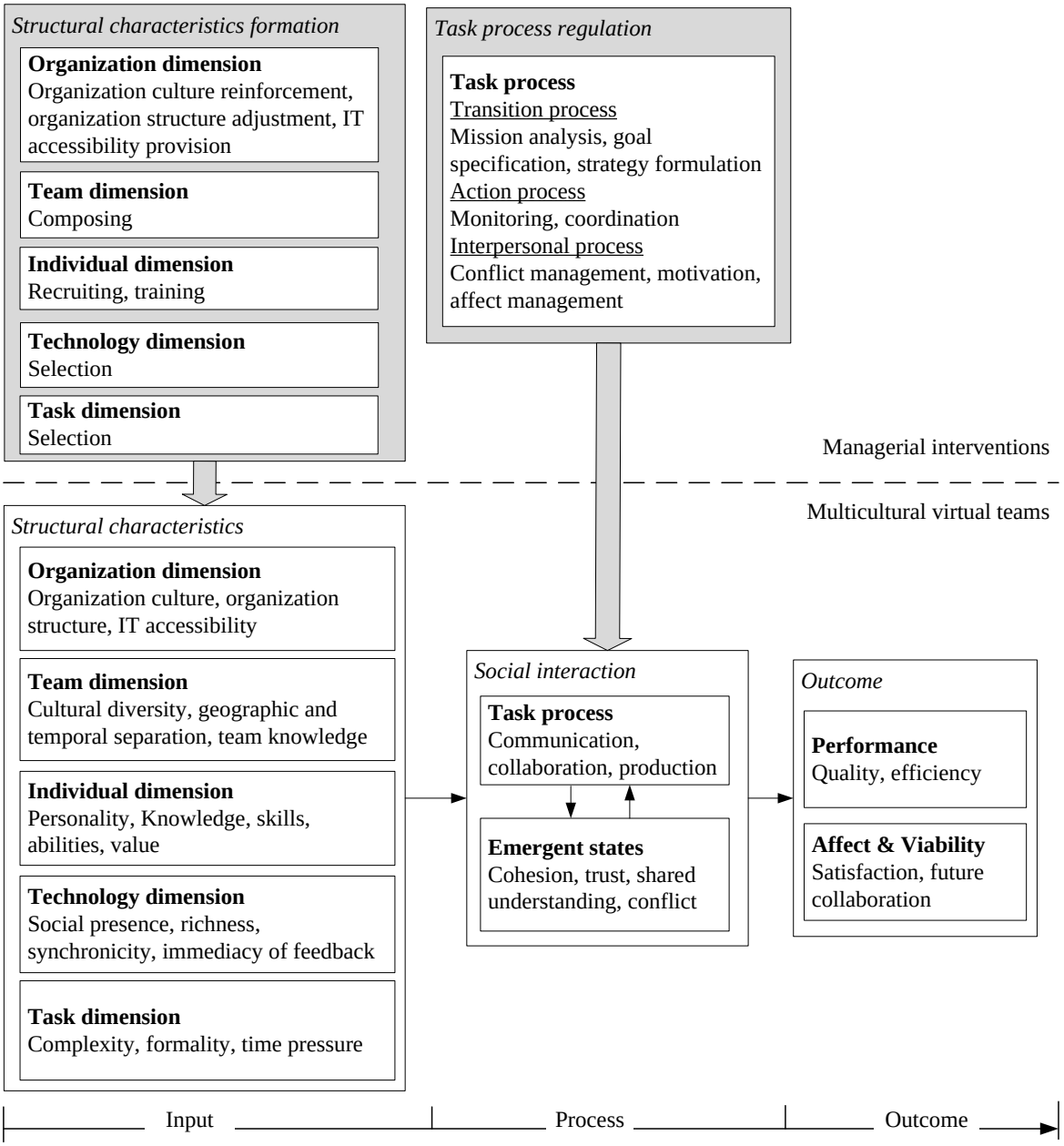

Fig.1 EAST management model in multicultural virtual teams

By explicitly introducing managerial intervention in the EAST model, we are capable to explain and predict effectiveness of managers' intervention in terms of their impacts on struc-

tural characteristics. Understanding the interaction between managerial intervention and structural characteristics, MVT managers can consciously improve MVT outcomes by adjusting structural characteristics or manipulating interactions between structures. In the following sections, we carry out a systematic review on empirical studies in MVTs to provide empirical evidence for the EAST management model. The empirical results can provide MVT managers sensible guidance on managing MVTs.

3 Methodology

According to Cooper (1985)'s definition, a literature review serves as a database containing primary or original published research on a specific topic, aiming at describing, summarizing, evaluating, clarifying, and/or synthesizing the underlying research. We adopted a systematic literature review process aiming at retrieving as many relevant primary studies as possible following an unbiased search strategy. However, two limitations of the scope of the review exist: due to researchers' language limitation, only publications in English are reviewed; to facilitate the assessment of the quality of the retrieved studies, only studies published in leading relevant journals and conferences were reviewed.

Following Kitchenham's (2004) procedures for systematic reviews, we firstly generated terms for search. We are interested in empirical studies that explicitly analyze cultural differences or effects of cultural diversity in multicultural virtual teams. Therefore, we used "culture" and "cultural" to search for cultural-related studies, "virtual", "dispersed" and "distributed" to describe virtuality, and "group" and "team" to search for studies in teams. These variations resulted in 12 combinations of terms used for literature retrieval.

Secondly, we selected the data retrieval sources from top IS and management journals, since leading journals are more contributive to a field (Webster and Watson 2002) and more likely be representative of the development of the field. Among the top 30 journals in the Association for Information System (AIS) MIS Journal Rankings (Saunders 2007), we went through the topic coverage and the latest table of content of each journal and selected journals with publishing interests in cross-cultural virtual team studies. The resulting list contains 14 IS journals and three management journals. Besides, according to a prior review of studies of multinational virtual teams (Connaughton and Shuffler 2007), we added three top journals in the communication and cross-cultural manage fields that published influential studies of multicultural virtual teams. To reflect the latest progress in the interested topic, we completed the list (see Appendix. Tab. 1) with three major conferences in the IS field (Urbach et al. 2009).

Thirdly, we retrieved literatures with the specific search terms in the data sources. Using electronic databases (EBSCO, ProQuest, AISeL, ScienceDirect, ACMDigital, SpringerLink), we searched in titles, abstract and author-provided keywords (if applicable) over the period of 1997- 2011. Some studies were firstly presented in a conference and later published in a journal and such conference papers were excluded from future analysis. With an initial searching, we retrieved 94 papers with the search terms. After reading the abstract and conclusions of these papers, we identified 55 papers reporting empirical studies in multicultural virtual teams, which formed the pool for detailed data extraction and analysis. Then we read each

paper carefully, identified the theories and methodologies and coded the managerial intervention according to the EAST management model.

The reviewed empirical studies employed a large variety of theories. For example, Lau & Murnighan's (1998) faultline theory was applied to explain the formation and effect of subgroups divided by geographical and cultural boundaries (Ahmad and Lutters 2011; Polzer et al. 2006), adaptive structuration theory (DeSanctis and Poole 1994) and time, interaction and performance (TIP) (McGrath 1991) were used for analyzing MVT dynamics (Massey et al. 2003; Maznevski and Chudoba 2000) , and social presence (Gunawardena 1995) and media richness and synchronicity (Dennis and Valacich 1999) were frequently adopted for media selection in MVTs (Lowry et al. 2010; Pauleen 2003). For a detailed review on theories used for virtual team research, please refer to Schiller & Mandviwalla (2007).

In terms of epistemology, we identified 39 studies holding a positivism view, 14 studies with an interpretivism view and 2 studies remaining unspecified. No study was identified as any other type of epistemology. Quantitative methods and qualitative methods were equally favorable in the empirical studies on MVTs, with 21, 28, 6 studies using quantitative, qualitative and hybrid methods respectively. The most employed methods were case studies or field studies (28 studies), experiments (12 studies) and surveys (10 studies); no one employed action research or design science research in the retrieved studies.

A wide range of information and communication technology is examined in the retrieved literature. According to Mittleman et al.'s (2008) taxonomy of groupware technologies, the studied technology covered every category of existing groupware: jointly authored pages (e.g., email, instant messaging, wiki, forum), streaming technology (e.g., telephone, teleconferencing, video conferencing), information access tool (e.g., shared file repositories, email filtering system) and aggregate systems (e.g., group calendar, workspace, group decision support systems, web conferencing). We summarize how the ICT was used and evaluated in the retrieved literature in the appendix (see Appendix Tab. 3). In the next section, we present the empirically verified managerial intervention in MVTs.

4 Literature review results: Effective managerial intervention in MVTs

We organize the identified managerial intervention according to its relationship to technology. We firstly examine the managerial intervention that directly acts on technology (e.g., technology selection, technology use), explain the interaction between technology and other structural characteristics and then briefly summarize the managerial intervention in that technology plays an indirect or inactive role. The complete list of managerial intervention is summarized in the appendix (see Appendix Tab. 4).

4.1 Managerial intervention directly related to technology

4.1.1 Technology selection

Technology selection occurs generally before a team activity is carries out. Managers must consciously and skillfully select appropriate ICT to overcome geographical, organizational, cultural and technological boundaries (Pauleen 2003; Pauleen and Yoong 2001). The selec-

tion of ICT for a MVT is affected by various factors, such as task, social and physical proximity among team members, accessibility to a certain ICT, individual preference and time zone differences among team members (Shachaf 2008). The most frequently examined contingent factors during the technology selection are task characteristics, cultural diversity, temporal and geographic separation, and technology accessibility and IT skills.

Align with task characteristics: task characteristics are emergent when people carry it out. Due to different work practice, knowledge and task-related experience, working time and holiday systems among MVTs members, the estimation of task complexity, formality and time pressure is very difficult and malleable (Cousins et al. 2007; Hanisch and Corbitt 2007; Huang and Trauth 2008).

Managers have to actively consider the team structure while assessing the task characteristics, and provide proper ICT to facilitate the task process (Goodhue and Thompson 1995). For example, if a task is of high complexity (i.e., the completion of a task requires distinct acts and information cues), richer communication tools (e.g., video conferencing) or tools with multiple cues (e.g., web conferences combining text presentations and voice chatting) can be adopted to enlarge the scope of transferable information, reduce ambiguity and improve problem solving quality (Hanisch and Corbitt 2007; Oshri et al. 2008; Shachaf 2008). When the time pressure of getting information for a task completion is high, synchronous communication tools (e.g., telephone, video conferencing) rather than asynchronous communication tools (e.g., emails) is preferred (Pauleen 2003). In most cases, MVTs need to carry out a great range of activities to complete a single task. Therefore, managers should provide a variety of communication media, so that team members have some latitude in matching technology use with certain task requirements during the task process (Maznevski and Chudoba 2000).

Align with temporal and geographic separation: MVTs consist of members from different countries, which often distributed across time zone and geographic boundaries. On the one hand, the temporal and geographic separation makes ICT use a must to support team process; teams have to rely on some kinds of ICT to enable the teamwork and develop interpersonal relationship. For example, to achieve work translucence teams use shared repositories (e.g., shared workspace) and information transfer tools (e.g., email) to share information; to develop interpersonal relationships and improve social presence, teams adopt team rooms and communication tools to create team identity and mutual understanding. On the other hand, the temporal and geographic separation of a team limits the feasible set of useful ICT. For example, when a team distributes across multiple time zones, synchronous communication becomes very unlikely or difficult to be scheduled, which keeps managers or team members from selecting or using synchronous technology (Wei and Crowston 2010).

Align with cultural diversity: cultural differences have been found in people's perception and use of technology. For example, people with different national cultural background perceive different degree of task-technology fit (Massey et al. 2001), respond to messages sent via communication media at different pace (Cousins et al. 2007), have different preference for processing communication cues and therefore different preference for communication media

(Niederman and Tan 2011). People also differ in their communication styles (Cousins et al. 2007; Shachaf 2008), language proficiency and abilities to handle multiple information threads (Sarker and Sahay 2004), which also reflect on technology-supported communication. Therefore, if MVTs are not properly managed and supported, misunderstanding, conflict and communication breakdowns may occur between culturally diverse members.

The selection of technology is influence by the team cultural composition. Although the cultural diversity in a team limits the range of potential effective media (Shachaf 2008), managers can take an active role in selecting technology characteristics to mitigate the unwanted effects of cultural diversity and support the positive effects of it (e.g., multiple perspective and knowledge sets). For example, texted-based and asynchronous communication media with rehearsability and reprocessability (e.g., email, instant messaging) can reduce misunderstanding in MVTs if some team members have relatively low proficiency at the chosen team language (Shachaf 2008; Wei and Crowston 2010). To allow for alternative cultural perspectives during technology selection, managers should discuss with remote team members (David et al. 2008; Pauleen 2003) and improve compromises on technology selection (Sarker and Sahay 2004).

Technology accessibility and IT skills: both technology accessibility at the organization or team level and individual skills can define the range of effective technology for MVTs. Several studies pointed out that different accessibility and quality of IT infrastructures at different sites adversely affected team communication quality and work efficiency (Kayworth and Leidner 2002; Sarker and Sarker 2009). The time lags and breakdowns due to instability of IT infrastructure can hinder both task-related and social-related communications and seriously influence the interpersonal relationships (Pauleen and Yoong 2001; Wei and Crowston 2010). Similarly, MVT members' diverse expertise and skills in communication and collaboration technologies also leads to difficulties in collaboration.(Kayworth and Leidner 2002; Sarker and Sahay 2004).

Therefore, it is an organization's responsibility to provide a great range of uniform or compatible IT infrastructures (Pauleen 2003; Sutanto et al. 2004) and technical skill trainings (Pauleen and Yoong 2001; Sarker and Sarker 2009) at different sites. In this way, when a MVT carries out its task, it has greater flexibility and opportunity to choose the optimal technology according to the ongoing task characteristics, temporal and geographic dispersion and cultural diversity.

4.1.2 Technology use

Managers not only need to select proper technologies for MVTs but also actively engage in formulizing guidelines and behavior norms to guide team members use technology in an effective way. The guidelines and norms are generally defined and communicated to all team members as part of the strategy formulation and planning activities during the transition process; they change team and task characteristics in the action process and interpersonal process. The extensive managerial intervention during task process can be largely divided into

two categories according to their functionality: use technology to bridge temporal and geographic separation, use technology to mitigate negative effects of cultural diversity.

To bridge temporal and geographic separation: MVTs distribute across temporal and geographic boundaries. This temporal separation makes team members less overlapping working time than collocated teams, which limits the amount, breadth and depth of information transfer among different sites. The geographic separation limits human connection due to lack of physical situatedness (Sarker and Sahay 2004), which may lead to ineffective communication, suspicion arising from the inability to verify remote members' actions (Sarker and Sahay 2004); if teams are partially collocated, geographic separation can promote the formation of subgroups, which negative influences team cohesion, trust, communication and collaboration at the team level (Panteli and Davison 2005; Polzer et al. 2006).

To overcome the temporal and geographic separation, managers can guide MVTs to use technology in improving virtual presence and for socialization (Ahmad and Lutters 2011; Cousins et al. 2007). To achieve a certain level of virtual presence, teams can set up regular and frequent ICT supported communication (Oshri et al. 2008), institutionalize norms for logging on asynchronous communication (e.g., team forums) and responding promptly (e.g., to emails), signaled temporary absence (e.g., during holidays, time conflicts with other obligations) with reminders and exchange visual cues to establish human connection (e.g., videoconferencing, posting pictures) (Huang and Trauth 2008; Sarker and Sahay 2004). Asynchronous ICT (e.g., team forums) can be used to overcome time zone differences and communicate around the clock (Sarker and Sahay 2004). A shared workspace or team room, especially one providing access only for team members, can greatly compensate for the absence of physical situatedness, create team identity, increase team cohesion and common ground (Sarker and Sahay 2004; Sarker and Sarker 2009; Shachaf 2008).

By using technology for socialization (e.g., exchanging non-work related information), distributed teams can create trust, perceived proximity and facilitate relationships (Malhotra et al. 2007; Mathieu 2010), reduce the saliency of subgroups (Ocker et al. 2009; Ocker and Webb 2009). Synchronous technology is found to be particular useful in alleviating geographic separation and maintain social ties in dispersed teams (Hinds and Mortensen 2005; Oshri et al. 2008), since the relative quick turn taking makes feedback and repair much easier, reduce misunderstanding and facilitate sharing of non-work related information (Hinds and Mortensen 2005). Other methods could be sending congratulatory messages to all team members or humorous emails to integrate emotional behaviors with task activities (Cousins et al. 2007) , using instant messaging to show the status of availability and engaging in informal conversations (Privman and Hiltz 2008) and employing groupware with consensus building capabilities to resolve intercultural conflicts (Kankanhalli et al. 2007).

To mitigate negative effects of cultural diversity: cultural diversity in MVTs may negatively influence team process, which leads to suboptimal team outcomes.

Firstly, it is highly likely that in a MVT members have different competency in the team language. This difference causes higher interaction cost for both native speakers and nonnative

speakers, which can result in reduced attraction and team cohesion (Shachaf 2008). Different competency in the team language can also result in miscommunication (Pauleen and Yoong 2001; Sarker and Sarker 2009; Shachaf 2008) and strongly influence effectiveness of participation in task-related as well as social-related communication (Wei and Crowston 2010): lack of language competency brings difficulties in understanding others and expressing own ideas; it also limits the exchange of social information, which in turn adversely affects communication (Wei and Crowston 2010).

Secondly, culturally diverse members communicate in different manners and have different conversation structures, which may cause misunderstanding and affect team cohesion (Cousins et al. 2007; Maznevski and Chudoba 2000). For example, Sarker and Sahay (2004) found in an ethnographic study that American students perceived Norwegian students as abrupt, blunt and reserved, whereas they were perceived by the Norwegian students as giving few constructive and critical responses. Shachaf (2008) summarized that people communicate differently in terms of the extent to which people reveal their intentions using explicit verbal communication (direct/indirect), the amount of information provided in communication (succinct/elaborate), assumption of similarity and equality between people (contextual / personal), and goal oriented or process oriented (instrumental/affective). These differences can negative influence communication and collaboration in MVTs.

Thirdly, MVT members differ in their values, which may hinder intercultural collaboration and team cohesion. For example, von Stetten et al. (2011) carried out an exploratory case study with six multinational IT projects and found that Indian's face maintenance, high power distance and low assertiveness made them tend to avoid conflict and criticism and express themselves in an indirect and concealing way, which negatively influenced trust and knowledge sharing with their German colleagues. The cultural value differences, not always observable, substantially change team members communication and working styles, which increase team conflicts (Hanisch and Corbitt 2007; Kankanhalli et al. 2007), lower trust (Jarvenpaa et al. 1998; Zolin et al. 2004) and team cohesion (Shachaf 2008).

Beyond merely acquainting team members with cultural knowledge through trainings and coaching, managers can effectively use ICT to mitigate the negative aspects of cultural diversity. Managers should ask team members jointly develop a meeting plan, explicating when to communication and which technology to be used (Massey et al. 2001). It seems that text based communication tools (e.g., email, instant messaging) media lacking of nonverbal and social cues are particularly favorable for MVTs to overcome the language barrier and reduce cross-cultural miscommunication (Shachaf 2008). Sometimes, a common message structure is developed and communicated with all team members (e.g., email style-formal, precise, direct, containing contextual information) can reduce the negative impact of different verbal communication styles.

When audio or video based synchronous communication tools are used for joint meetings, they are better combined with another visual or text-based media (e.g., teleconferencing with desktop sharing, video conferencing with printable whiteboards and IM); such combination

can overcome the language incompetency and create a common ground among dispersed team members (Ahmad and Lutters 2011; Hanisch and Corbitt 2007; Sarker and Sahay 2004; Shachaf 2008). Taking and sending written notes after teleconferencing with remote team members is also identified as an effective measure to eliminate cross-cultural misunderstanding (Shachaf 2008; Sutanto et al. 2004).

4.2 Managerial intervention not directly related to technology

Besides acting on technology selection and use, managers of MVTs can improve team effectiveness through changing organization, team, individual and task structural characteristics in favorable direction. In this section, we briefly summarize what managers can do on these structures.

Organization culture reinforcement: several studies found that a shared organization culture among all team members could mitigate the negative impact of cultural diversion, promote greater synergy and reduce conflicts among different sites (Huang and Trauth 2008; Huang and Trauth 2010; Kankanhalli et al. 2007; Privman and Hiltz 2008). Besides, an organization culture valuing diversity is particularly helpful to enable effective MVTs (Huang and Trauth 2008; Huang and Trauth 2010). Therefore, managers, especially top managers, should develop strategies to strengthen a universal organization culture that takes diversity as a valuable asset across all sites.

Organization structure adjustment: cross-border teamwork in an organization sometimes encounters the problem of unbalanced power distribution. This phenomenon is salient particularly in offshoring projects, which impedes trust formation, knowledge sharing and collaboration and increase inter-site conflicts (David et al. 2008; Wei and Crowston 2010). Top managers should be aware of the adverse effects of unbalanced power distribution and establish a flat and integrated organization structure with uniform power distribution, which will promote trust establishment and positive relationships among distributed team members (David et al. 2008; Privman and Hiltz 2008).

Composing MVTs: managers can increase the possibility of high performance by composing an effective team. Team composition should be fit with task characteristics. For highly interdependent tasks, managers should consider to limit the team cultural diversity, since high cultural diversity is more likely to lead to conflicts (Kankanhalli et al. 2007). For highly complex tasks, managers encourage functional diversity to the extent that it brings a wide variety of perspectives, which promotes discussions on alternative solutions (Kankanhalli et al. 2007). Managers should avoid composing a dispersed team with a uniform culture at each site but different cultures across sites. Such combination can result in strong faultlines, which harm inter-site trust and increase conflicts (Polzer et al. 2006). Besides, managers should carefully tune the composition of members' cultural values in a MVT, since the cultural value composition influences both interpersonal trust and team performance (Lowry et al. 2010; Swigger et al. 2004). For example, prior studies indicated that teams with at least high harmony member were more likely to perform well, all members with low future-oriented value performed

poorly in time-critical tasks and teams with collectivistic members had higher interpersonal trust (Lowry et al. 2010; Swigger et al. 2004).

Non-technology related trainings: besides technical skill trainings, managers should organize common trainings on culture and collaboration across different sites to improve MVT members' knowledge, abilities and skills and develop a shared and professional work culture (Sarker and Sarker 2009). The most frequently mentioned trainings for MVTs are cultural awareness and cultural intelligence trainings (Anawati and Craig 2006; Evaristo 2003; Garrison et al. 2010; Krishna et al. 2004; Pauleen 2003; von Stetten et al. 2011), which enables team members to understand cultural differences, adjust expectations, demonstrate more adaptive behaviors, reduce misunderstanding and improve trust; however, such trainings should avoid overemphasizing differences through stereotypical descriptions of other cultures, which will harm the team cohesion (David et al. 2008). Effective cultural trainings should be provided before and during the team process, enabling continuous reflection on and share of ongoing experience (Huang and Trauth 2008; Krishna et al. 2004). Besides, language trainings (Oshri et al. 2008; Wei and Crowston 2010), conflict resolution trainings (Kankanhalli et al. 2007), self-facilitate trainings (Niederman and Tan 2011), trust and relationship building and communication skills trainings (Evaristo 2003; Gratton and Erickson 2007; Sarker et al. 2005) are also beneficial for MVTs.

Task selection: if possible, managers can skillfully align task characteristics with team characteristics (i.e., cultural diversity, team knowledge, geographic and temporal separation) to take better advantages of MVTs. Tasks can be selected and divided for distributed teams to enable seamless transition across time zones (Sarker and Sarker 2009). Task complexity and formalization should be aligned to team members' cultural values (e.g., uncertainty avoidance, power distance, short vs. long term orientation) to improve task performance (Evaristo 2003). To minimize cross-cultural issues, managers can purposefully choose culturally neutral projects for MVTs (e.g., developing middleware between the network and the applications) (Krishna et al. 2004). Researchers also suggest that tasks requiring knowledge sharing, structure and detailed teamwork and lean-communication benefit most from virtual collaboration (Krishna et al. 2004; Lowry et al. 2010; Privman and Hiltz 2008).

Managerial intervention in the transition process: in the transition process, managers should actively engage in mission analysis, goal specification and strategy formulation (Marks et al. 2001). Managers should help MVT members to develop and sustain a shared goal and vision across all sites (Jarvenpaa and Leidner 1998; von Stetten et al. 2011) and the goal should be discussed and clarified with all team members to eliminate any ambiguity (Jarvenpaa et al. 1998). For strategy formulation, managers should explicitly specify members' roles and responsibilities (Privman and Hiltz 2008; Sarker and Sahay 2004), maintain a low to moderate level of interdependence among distributed sites (Jarvenpaa et al. 1998; Sarker and Sahay 2004), divide tasks among different sites to enable a seamless transition between time zones (Sarker and Sarker 2009) and develop uniform project-related vocabularies and work practices (e.g., reporting and monitoring process, ICT use) (Chudoba et al. 2005; Krishna et al. 2004; Niederman and Tan 2011).

Managerial intervention in the action process: in action process, managers should monitor task-related process, internal and external systems, offer backup behaviors and coordinate the sequence and timing of interdependent actions (Marks et al. 2001). In MVTs, managers should particularly pay attention to the visibility of team members' contribution; managers should guide team members to document and formalize task process and ensure their performance is visible to remote members (Ocker et al. 2009; Sarker et al. 2005).

Due to the geographic and temporal separation, temporal coordination in MVTs is highly challenging. Managers should be vigilant of the potential delays due to time zone differences and diverse holidays at different sites, set up reasonable and relatively relaxed schedules for team tasks (Hanisch and Corbitt 2007; Niederman and Tan 2011). Managers should set up regular meetings with remote members to ensure synchronization between different sites; the meeting times should avoid religious holidays in other cultures (Anawati and Craig 2006), rotate among different sites to share the burden of overtime work (Pauleen and Yoong 2001; Sarker and Sarker 2009). When a team is distributed across multiple time zones, the team-work-related time should be explicitly stated and routinized (Sarker and Sahay 2004); to increase overlapping time, managers can encourage temporary extra working hours and frequent meetings (Privman and Hiltz 2008). Managers that assist in coordination MVT tasks provide assurances about team members' contribution, which leads to high team cohesion and team performance (Garrison et al. 2010).

Managerial intervention in the interpersonal process: in interpersonal process, managers carry out motivation and confidence building, conflict management and affect management (Marks et al. 2001). The cultural diversity and geographic and temporal separation of MVTs often implies greater conflicts (Paul et al. 2004a), lower trust and team cohesion across different sites (Zolin et al. 2004), which requires constructive managers' actions. Managers can facilitate the conflict resolution by addressing the problem as early as noticed (Jarvenpaa and Leidner 1998) and promoting collaborative conflict management style (i.e., solving the problem through collaboration) rather than ignore the problem (Kankanhalli et al. 2007; Paul and Ray 2011; Paul et al. 2004b).

To overcome cultural diversity among team members and develop task-related cohesion, managers can foster functional similarity (Garrison et al. 2010) and develop a shared team culture that values open communication and optimistic spirit (Huang and Trauth 2008; Ocker et al. 2009; Panteli and Davison 2005). Team cohesion can be further improved by fostering communication and collaboration between specific individuals across different sites, rather than collaboration between sub-teams (Ocker and Webb 2009; Polzer et al. 2006). Managers should also be aware of the different attitudes towards rewards in different cultures and align the reward structure with local cultures (Niederman and Tan 2011).

Managers also need to manage members' emotions (e.g., social cohesion, frustration and excitement) during the task process. The social cohesion in MVTs can be greatly improved by face-to-face meetings (Cousins et al. 2007; Oshri et al. 2008; Sarker and Sarker 2009) and exchange of social information (Garrison et al. 2010; Maznevski and Chudoba 2000). Using a

communication coordinator or cultural facilitator to coordinate intercultural communication is found to be an effective practice to overcome the negative impact of cultural diversity in teamwork (Hanisch and Corbitt 2007; Krishna et al. 2004). Managers can improve interpersonal trust by building rapport and trust at the beginning of a project (Ocker et al. 2009; Zolin et al. 2004), providing motivation for trust building (Lowry et al. 2010), encouraging proactive member actions (Jarvenpaa et al. 1998) and promoting empathetic task orientated communication (Jarvenpaa et al. 1998).

5 A holistic view of managerial intervention in MVTs

As presented in section 3, managerial intervention acts on every structural characteristic in the EAST management model; it formulates the characteristics during the team formation and continuously guides the interaction among different structures through the team process, which consequently affect emergent states and team outcomes. In this section, we summarize and explain the interactions between different structures and the impact of managerial intervention on them to gain a holistic view of the effect of managerial intervention in MVTs.

As shown in Fig.2, we classify the relationships between different structures according to the strength of dependency of one structure on another. For high dependency relationship, the independent structural characteristics (at the arrow end) often strongly influence or determine the dependent structural characteristics (at the arrowhead); for low dependency relationship, the independent structural characteristics sometimes slightly or moderately influence the dependent structural characteristics. We explain the dependency relationships in the figure as follows: at the individual dimension, managers can select or improve certain individual characteristics (e.g., balanced task-related skills and social skills, self-facilitate, cultural intelligent) by recruiting and training (Krishna et al. 2004; Pauleen and Yoong 2001). The individuals are future assembled into teams with a clever combination of cultural values, locations and time zones to take better advantages of MVT characteristics (Sutanto et al. 2004; Swigger et al. 2004). If tasks are defined before team formation, managers should also consider the task characteristics when composing the team (e.g., highly interdependent tasks, low cultural diversity)(Kankanhalli et al. 2007).

Managers can manipulate the organization culture and organization structure to mitigate some negative effects of team characteristics (e.g., cultural diversity, power distribution) (David et al. 2008; Huang and Trauth 2008) and these effects primarily occur during the team process. Managers should also assure a wide range of necessary ICT is accessible across different sites, which defines the scope of technology characteristics (Pauleen 2003; Sutanto et al. 2004). At the task dimension, managers do not always have the latitude in selecting proper tasks for MVTs (e.g., tasks are defined by customers), but if it is applicable, managers should select tasks according to the team characteristics to facilitate the task division, temporal coordination and knowledge transfer (Evaristo 2003; Sarker and Sarker 2009).

Technology characteristics (e.g., social presence, richness, synchronicity) are not inherent properties of ICT, but emergent properties when the ICT interact with MVTs and organizational context (Orlikowski 2008). For example, if managers define technology use norms

(e.g., ensuring frequent interactions, combining with another channel) properly and the organizational context supports them, even a lean medium can be rich (Shachaf 2008). However, managers do need to select ICT artifacts characteristics (e.g., software, hardware parameters) that can support certain emergent technology characteristics (Orlikowski 2008); the selection should actively take both team characteristics and task characteristics into account (Majchrzak et al. 2005b; Wei and Crowston 2010). Based on the selected artifact characteristics, managers should define technology use norms and align the emergent technology characteristics with team and task characteristics in a way that technology can mitigate the negative aspects of certain team characteristics (e.g., cultural diversity, geographic and temporal separation), improve emergent states and facilitate task process (Ahmad and Lutters 2011; Ocker et al. 2009; Sarker and Sahay 2004). The alignment, or technology adaptation, continues throughout the complete team process; this is especially true in a virtual team process where most team communication and collaboration activities are technology supported (Thomas and Bostrom 2010b).

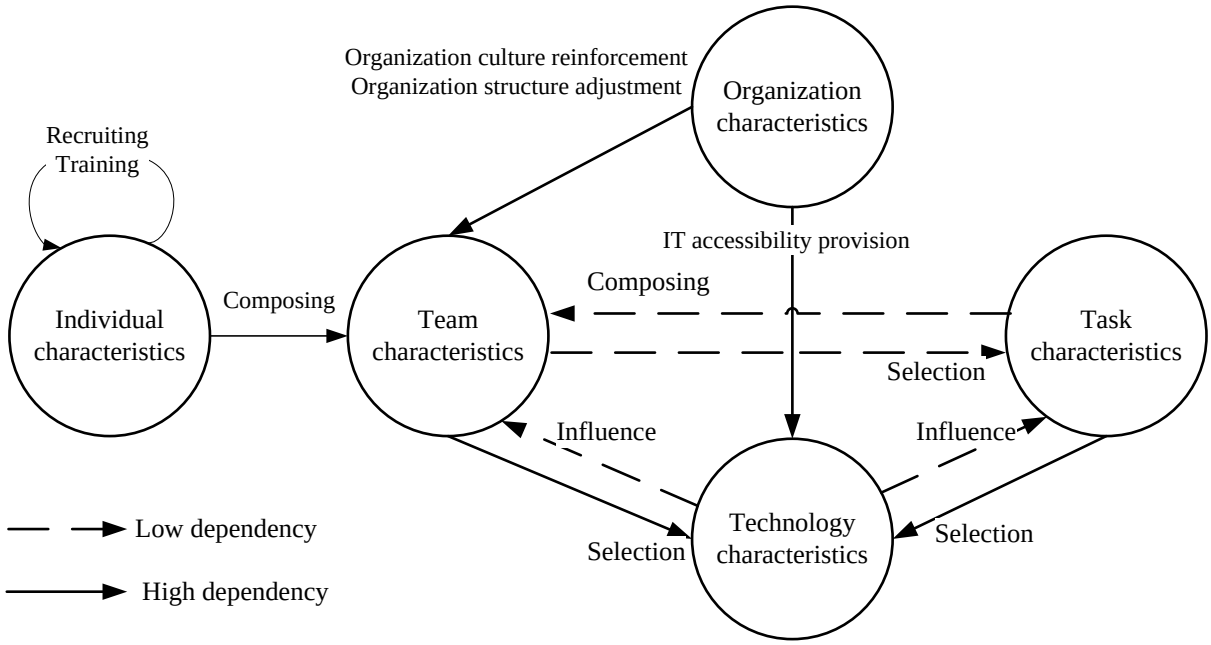

Fig.2 A holistic view of managerial intervention in MVTs based on the EAST management model

The holistic view of managerial intervention in MVTs explains the mechanisms of using managerial intervention to structure team input and facilitate team process, and consequently improve team outcomes. Managers can follow the relational links between different structures and consciously and purposefully adjust certain structural characteristics in a desirable direction to achieve high team performance.

6 Summary and Outlook

What should managers do to improve MVT effectiveness? How is ICT involved in the MVT management? To answer these questions, we carried out a systematic literature review on 55 empirical studies and extracted empirically verified managerial intervention based on the

EAST management model. We find that managers can improve team effectiveness by creating or adjusting structural characteristics at organization, team, individual, technology and task dimension, and continuously align these structural characteristics during the task process. By mapping the relationships between different structural characteristics, we establish a holistic view of managerial intervention in MVTs: the five structures in MVTs are interdependent and mutually influential; managers can achieve high team performance by manipulating structural characteristics (e.g., technology selection, organization culture reinforcement) to mitigate the negative impacts of other structural characteristics (e.g., cultural diversity, geographic and temporal separation). The findings strongly suggest that ICT can be used as a powerful lever in improving MVT performance through proper selection and setting use norms.

Theoretical contribution: this study has two theoretical contributions: firstly, we extended the EAST model with managerial intervention, which explains and predicts effectiveness of managerial intervention on improving MVT outcomes. Secondly, we developed a holistic view of managerial intervention in MVTs. The holistic view presents the interconnection among different structures and explains the mechanisms of managerial intervention.

Practical implications: the study also has clear practical implications for both management and IT professionals. For MVT managers, we contribute a set of effective managerial intervention at different dimensions (see a complete list in the Appendix Tab.4). Managers who want to understand the functioning mechanisms of the intervention can further benefit from the holistic view of managerial intervention. By following the guidelines suggested in the study, managers can consciously and purposefully exert influences at organization, individual, team, task and technology dimensions and facilitate team process to achieve high team performance.

For IT professionals, the study highlights the important and dynamic role of ICT in improving MVT performance and suggests great potential for future design and improvement of ICT. As indicated in retrieved literatures, ICT in multicultural virtual teams should be designed to enable mitigation of certain negative impacts at the team dimension (e.g., cultural diversity, geographic and temporal separation). Some solutions have been proposed in the retrieved studies. The vigilance of ICT should be increased to monitor and report distributed team process on a regular basis (Ocker et al. 2009), in this way managers can timely adjust team plan an d identify conflicts or task difficulties. Commonly used ICT in a team should incorporate some cultural knowledge to promote cultural awareness (e.g., a group calendar displaying local holidays of all sites) (Huang and Trauth 2008). Collaborative technology should support group awareness (i.e., know what others are doing) and group memory (i.e., the knowledge of a group is shard in common) to create shared cognition among distributed members, lead to better coordination and avoid duplicate work (Lowry et al. 2010). ICT should be designed to encourage the sharing of contextual information (e.g., clarifying authors' identifications, enabling easy examination of historical messages, enabling multiple perspectives and partial and tentative messages) to compensate the distributed and cultural diverse nature of MVTs and gain collaboration skills (Majchrzak et al. 2005a).

Beyond the suggestions in literatures, we encourage IT professionals to be more comfortable and confident to design or implement ICT aiming at changing team, task and organization characteristics. For example, social media that support collaborative contribution and facilitate the exchange of information communication (e.g., SNS, Wiki) should be helpful to mitigate the negative aspects of geographic distribution and cultural diversity, strengthen the social ties in MVTs and develop a shared team culture. Design features that augment or exhibit a common organizational culture that values diversity, a shared team identity, functional similarity and shared goals should be implemented in ICT for multicultural virtual teams. ICT can support managers' decisions through collecting individual characteristics (e.g., KSA, cultural values, and prior team histories) and making them available to the managers; in certain circumstances, such information might be beneficial if shared with all team members without invasion of privacy to increase the awareness of others' cultural values and facilitate the cultural adaption of behaviors and expectations.

Outlook: as indicated in the literature synthesis, communication and collaboration across different sites hardly exist without using information and communication technology and the ICT can be managed to modify team and task characteristics in favorable directions. We believe what is examined in this paper is only part of the complete set of feasible intervention. Future studies can build upon the proposed EAST management model and explore in the full range of feasible managerial intervention. According to the findings, it is promising if MVT managers and IT professionals can jointly develop a strategy of ICT adoption and use based on given structural characteristics (organization, team, task); however, we are not aware of such studies in the retrieved literature. Future studies are expected in analyzing the creation of synergy between general managers and IT professionals in managing MVTs. Finally, tailored design of ICT to fit in or change specific team or task characteristics should be an emergent topic in design research in the IS field.

References

Ahmad, R., and Lutters, W.G. 2011. "Examining Ict-Mediated Cultural Factors for Subgroup Impact on Virtual Team Dynamics," in: *AMCIS 2011 Proceedings*. Paper 229.

Anawati, D., and Craig, A. 2006. "Behavioral Adaptation within Cross-Cultural Virtual Teams," *IEEE Transactions on Professional Communication* (49:1), pp. 44-56.

Bell, B.S., and Kozlowski, S.W.J. 2002. "A Typology of Virtual Teams," *Group & Organization Management* (27:1), p. 14.

Caulat, G. 2010. "Virtual Leadership: On Becoming a Real Leader," in: *Institute for Work Based Learning*. Middlesex University.

Chudoba, K.M., Wynn, E., Lu, M., and Watson Manheim, M.B. 2005. "How Virtual Are We? Measuring Virtuality and Understanding Its Impact in a Global Organization," *Information Systems Journal* (15:4), pp. 279-306.

Connaughton, S., and Shuffler, M. 2007. "Multinational and Multicultural Distributed Teams: A Review and Future Agenda," *Small Group Research* (38:3), p. 387.

Cooper, H.M. 1985. "A Taxonomy of Literature Reviews," in: *69th Annual Meeting of the American Educational Research Associatio*. Chicago, IL, USA.

Cousins, K.C., Robey, D., and Zigurs, I. 2007. "Managing Strategic Contradictions in Hybrid Teams," *European Journal of Information Systems* (16:4), pp. 460-478.

Cramton, C.D. 2001. "The Mutual Knowledge Problem and Its Consequences for Dispersed Collaboration," *Organization Science* (12:3), pp. 346-371.
David, G.C., Chand, D., Newell, S., and Resende-Santos, J. 2008. "Integrated Collaboration across Distributed Sites: The Perils of Process and the Promise of Practice," *Journal of Information Technology* (23:1), pp. 44-54.
Dennis, A.R., and Valacich, J.S. 1999. "Rethinking Media Richness: Towards a Theory of Media Synchronicity," *HICSS '99 Proceedings*, p. 10.
DeSanctis, G., and Poole, M.S. 1994. "Capturing the Complexity in Advanced Technology Use: Adaptive Structuration Theory," *Organization Science* (5:2), pp. 121-147.
Du, R., Ai, S., Abbott, P., and Zheng, Y. 2011. "Contextual Factors, Knowledge Processes and Performance in Global Sourcing of It Services: An Investigation in China," *Journal of Global Information Management* (19:2), pp. 1-26.
Economist Intelligence Unit. 2009. "Managing Virtual Teams: Taking a More Strategic Approach," in: *The Economist*. The Economist Intelligence Unit Limited.
Elron, E., and Vigoda-Gadot, E. 2006. "Influence and Political Processes in Cyberspace," *International Journal of Cross Cultural Management* (6:3), p. 295.
Evaristo, R. 2003. "The Management of Distributed Projects across Cultures," *Journal of Global Information Management* (11:4), pp. 58-70.
Gallenkamp, J.V., Korsgaard, M.A., Assmann, J.J., Welpe, I.M., and Picot, A.O. 2011. "Talk, Trust, Succeed–the Impact of Communication in Virtual Groups on Trust in Leaders and on Performance (Working Paper)." from http://ssrn.com/abstract=1737783
Garrison, G., Wakefield, R.L., Xu, X., and Kim, S.H. 2010. "Globally Distributed Teams: The Effect of Diversity on Trust, Cohesion and Individual Performance," *Database for Advances in Information Systems* (41:3), pp. 27-48.
Goodhue, D.L., and Thompson, R.L. 1995. "Task-Technology Fit and Individual Performance," *MIS Quarterly* (19:2), pp. 213-236.
Gratton, L., and Erickson, T. 2007. "Eight Ways to Build Collaborative Teams," *Harvard Business Review* (85:11), p. 100.
Gregor, S. 2006. "The Nature of Theory in Information Systems," *MIS Quarterly* (30:3), p. 611.
Gunawardena, C.N. 1995. "Social Presence Theory and Implications for Interaction and Collaborative Learning in Computer Conferences," *International Journal of Educational Telecommunications* (1:2/3), pp. 147-166.
Hanisch, J., and Corbitt, B. 2007. "Impediments to Requirements Engineering During Global Software Development," *European Journal of Information Systems* (16:6), pp. 793-805.
Hertel, G., Geister, S., and Konradt, U. 2005. "Managing Virtual Teams: A Review of Current Empirical Research," *Human Resource Management Review* (15:1), pp. 69-95.
Hinds, P.J., and Mortensen, M. 2005. "Understanding Conflict in Geographically Distributed Teams: The Moderating Effects of Shared Identity, Shared Context, and Spontaneous Communication," *Organization Science* (16:3), p. 290.
Huang, H., and Trauth, E.M. 2008. "Cultural Influences on Temporal Separation and Coordination in Globally Distributed Software Development," in: *ICIS 2008 Proceedings*. Paper 134.
Huang, H., and Trauth, E.M. 2010. "Identity and Cross-Cultural Management in Globally Distributed Information Technology Work," *ICIS 2010 Proceedings*: Paper 148.
Jarvenpaa, S.L., Knoll, K., and Leidner, D.E. 1998. "Is Anybody out There? Antecedents of Trust in Global Virtual Teams," *Journal of Management Information Systems* (14:4), pp. 29-64.

Jarvenpaa, S.L., and Leidner, D.E. 1998. "Communication and Trust in Global Virtual Teams," *Journal of Computer Mediated Communication* (3:4), pp. 0-0.
Kankanhalli, A., Tan, B., and Wei, K. 2007. "Conflict and Performance in Global Virtual Teams," *Journal of Management Information Systems* (23:3), pp. 237-274.
Kayworth, T.R., and Leidner, D.E. 2002. "Leadership Effectiveness in Global Virtual Teams," *Journal of Management Information Systems* (18:3), pp. 7-40.
Kirkman, B.L., and Mathieu, J.E. 2005. "The Dimensions and Antecedents of Team Virtuality," *Journal of Management* (31:5), p. 700.
Kitchenham, B. 2004. "Procedures for Performing Systematic Reviews," Keele University, Keele, UK.
Krishna, S., Sahay, S., and Walsham, G. 2004. "Managing Cross-Cultural Issues in Global Software Outsourcing," *Communications of the ACM* (47:4), pp. 62-66.
Lau, D.C., and Murnighan, J.K. 1998. "Demographic Diversity and Faultlines: The Compositional Dynamics of Organizational Groups," *The Academy of Management Review* (23:2), pp. 325-340.
Lee, O. 2002. "Cultural Differences in E-Mail Use of Virtual Teams: A Critical Social Theory Perspective," *CyberPsychology & Behavior* (5:3), pp. 227-232.
Lipnack, J., and Stamps, J. 1997. *Virtual Teams: Reaching across Space, Time, and Organizations with Technology*. John Wiley & Sons Inc.
Lowry, P.B., Zhang, D., Zhou, L., and Fu, X. 2010. "Effects of Culture, Social Presence, and Group Composition on Trust in Technology Supported Decision Making Groups," *Information Systems Journal* (20:3), pp. 297-315.
Lurey, J.S., and Raisinghani, M.S. 2001. "An Empirical Study of Best Practices in Virtual Teams," *Information & Management* (38:8), pp. 523-544.
Majchrzak, A., Malhotra, A., and John, R. 2005a. "Perceived Individual Collaboration Know-How Development through Information Technology–Enabled Contextualization: Evidence from Distributed Teams," *Information Systems Research* (16:1), pp. 9-27.
Majchrzak, A., Malhotra, A., and John, R. 2005b. "Perceived Individual Collaboration Know-How Development through It-Enabled Contextualization: Evidence from Distributed Teams," *Information Systems Research* (16:1), pp. 9–27.
Malhotra, A., Majchrzak, A., and Rosen, B. 2007. "Leading Virtual Teams," *The Academy of Management Perspectives* (21:1), pp. 60-69.
Marks, M.A., Mathieu, J.E., and Zaccaro, S.J. 2001. "A Temporally Based Framework and Taxonomy of Team Processes," *The Academy of Management Review* (26:3), pp. 356-376.
Massey, A., Montoya-Weiss, M., Hung, C., and Ramesh, V. 2001. "Cultural Perceptions of Task-Technology Fit," *Communications of the ACM* (44:12), pp. 83-84.
Massey, A.P., Montoya-Weiss, M.M., and Hung, Y.T. 2003. "Because Time Matters: Temporal Coordination in Global Virtual Project Teams," *Journal of Management Information Systems* (19:4), pp. 129-155.
Mathieu, C. 2010. "The Management of Distance in Remote-Work Environments: A Deleuzian Approach," *AMCIS 2010*: Paper 471.
Maznevski, M.L., and Chudoba, K.M. 2000. "Bridging Space over Time: Global Virtual Team Dynamics and Effectiveness," *Organization Science* (11:5), pp. 473-492.
McGrath, J.E. 1991. "Time, Interaction, and Performance (Tip)," *Small Group Research* (22:2), p. 147.
Mittleman, D., Briggs, R., Murphy, J., and Davis, A. 2008. "Toward a Taxonomy of Groupware Technologies," in *Groupware Design Implementation and Use*. Berlin, Heidelberg: Springer, pp. 305-317.

Naik, N., and Kim, D.J. 2010. "An Extended Adaptive Structuration Theory for the Determinants and Consequences of Virtual Team Success," in: *ICIS 2010 Proceedings*. Paper 232.
Niederman, F., and Tan, F.B. 2011. "Managing Global It Teams: Considering Cultural Dynamics," *Communications of the ACM* (54:4), pp. 24-27.
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.
Ocker, R., Zhang, Y., Hiltz, S.R., and Ronson, M.B. 2009. "Determinants of Partially Distributed Team Performance: A Path Analysis of Socio-Emotional and Behavioral Factors," in: *AMCIS 2009 Proceedings*. Paper 707.
Ocker, R.J., and Webb, H. 2009. "Communication Structures in Partially Distributed Teams: The Importance of Inclusiveness," in: *AMCIS 2009 Proceedings*. Paper 423.
Orlikowski, W.J. 2008. "Using Technology and Constituting Structures: A Practice Lens for Studying Technology in Organizations," in *Resources, Co-Evolution and Artifacts*. pp. 255-305.
Oshri, I., Kotlarsky, J., and Willcocks, L. 2008. "Missing Links: Building Critical Social Ties for Global Collaborative Teamwork," *Communications of the ACM* (51:4), pp. 76-81.
Panteli, N., and Davison, R.M. 2005. "The Role of Subgroups in the Communication Patterns of Global Virtual Teams," *Professional Communication, IEEE Transactions on* (48:2), pp. 191-200.
Paul, S., and Ray, S. 2011. "Cultural Diversity, Perceived Work Atmosphere, and Intragroup Conflict in Global Virtual Teams: Findings from a Laboratory Experiment," in: *AMCIS 2011 Proceedings*. Paper 167.
Paul, S., Samarah, I.M., Seetharaman, P., and Mykytyn Jr, P.P. 2004a. "An Empirical Investigation of Collaborative Conflict Management Style in Group Support System-Based Global Virtual Teams," *Journal of Management Information Systems* (21:3), pp. 185-222.
Paul, S., Seetharaman, P., Samarah, I., and Mykytyn, P.P. 2004b. "Impact of Heterogeneity and Collaborative Conflict Management Style on the Performance of Synchronous Global Virtual Teams," *Information & Management* (41:3), pp. 303-321.
Pauleen, D.J. 2003. "Lessons Learned Crossing Boundaries in an Ict-Supported Distributed Team," *Journal of Global Information Management* (11:4), pp. 1-19.
Pauleen, D.J., and Yoong, P. 2001. "Relationship Building and the Use of Ict in Boundary-Crossing Virtual Teams: A Facilitator's Perspective," *Journal of Information Technology* (16:4), pp. 205-220.
Picot, A., Assmann, J.J., Korsgaard, M.A., Welpe, I.M., Gallenkamp, J.V., and Wigand, R.T. 2009. "A Multi-Level View of the Antecedents and Consequences of Trust in Virtual Leaders," in: *AMCIS 2009 Proceedings*. Paper 271.
Polzer, J.T., Crisp, C.B., Jarvenpaa, S.L., and Kim, J.W. 2006. "Extending the Faultline Model to Geographically Dispersed Teams: How Colocated Subgroups Can Impair Group Functioning," *The Academy of Management Journal* (49:4), pp. 679-692.
Privman, R., and Hiltz, S.R. 2008. "Whose (Partially Distributed) Team Are You On? Interviews About" Us Vs. Them" in Corporate Settings," *AMCIS 2008 Proceedings*: Paper 231.
Qureshi, S., and Zigurs, I. 2001. "Paradoxes and Prerogatives in Global Virtual Communication," *Communications of the ACM* (44:12), pp. 85-88.
Sarker, S. 2005. "Knowledge Transfer and Collaboration in Distributed Us Thai Teams," *Journal of Computer Mediated Communication* (10:4), pp. 00-00.

Sarker, S., and Sahay, S. 2004. "Implications of Space and Time for Distributed Work: An Interpretive Study of Us-Norwegian Systems Development Teams," *European Journal of Information Systems* (13:1), pp. 3-20.
Sarker, S., and Sarker, S. 2009. "Exploring Agility in Distributed Information Systems Development Teams: An Interpretive Study in an Offshoring Context," *Information Systems Research* (20:3), pp. 440-461,479-480.
Sarker, S., Sarker, S., Nicholson, D.B., and Joshi, K.D. 2005. "Knowledge Transfer in Virtual Systems Development Teams: An Exploratory Study of Four Key Enablers," *IEEE Transactions on Professional Communication* (48:2), pp. 201-218.
Saunders, C. 2007. "Mis Journal Rankings." from http://ais.affiniscape.com/displaycommon.cfm?an=1&subarticlenbr=432
Schiller, S.Z., and Mandviwalla, M. 2007. "Virtual Team Research," *Small Group Research* (38:1), p. 12.
Shachaf, P. 2008. "Cultural Diversity and Information and Communication Technology Impacts on Global Virtual Teams: An Exploratory Study," *Information & Management* (45:2), pp. 131-142.
Solomon, C. 2010. "The Challenges of Working in Virtual Teams ", RW^3 LLC, New York.
Sutanto, J., Phang, C.W., Kankanhalli, A., and Tan, B.C.Y. 2004. "Towards a Process Model of Media Usage in Global Virtual Teams," in: *ECIS 2004 Proceedings*. Paper 167.
Swigger, K., Alpaslan, F., Brazile, R., and Monticino, M. 2004. "Effects of Culture on Computer-Supported International Collaborations," *International Journal of Human-Computer Studies* (60:3), pp. 365-380.
Thomas, D., and Bostrom, R. 2010a. "Team Leader Strategies for Enabling Collaboration Technology Adaptation: Team Technology Knowledge to Improve Globally Distributed Systems Development Work," *European Journal of Information Systems* (19:2), pp. 223-237.
Thomas, D., and Bostrom, R. 2010b. "Vital Signs for Virtual Teams: An Empirically Developed Trigger Model for Technology Adaptation Interventions," *MIS Quarterly* (34:1), pp. 115-142.
Urbach, N., Smolnik, S., and Riempp, G. 2009. "The State of Research on Information Systems Success," *Business & Information Systems Engineering* (1:4), pp. 315-325.
von Stetten, A., Beimborn, D., Weitzel, T., and Reiss, Z. 2011. "Managing the Impact of Differences in National Culture on Social Capital in Multinational It Project Teams–a German Perspective," in: *ECIS 2011 Proceedings*. Paper 73.
Webster, J., and Watson, R.T. 2002. "Analyzing the Past to Prepare for the Future: Writing a Literature Review," *MIS Quarterly* (26:2), p. 3.
Wei, K., and Crowston, K. 2010. "The Impact of National Culture on Knowledge Sharing in Global Virtual Collaboration: A Practice Lens," in: *ICIS 2010 Proceedings*. Paper 137.
Winkler, J., Dibbern, J., and Heinzl, A. 2007. "Der Einfluss Kultureller Unterschiede Beim It-Offshoring," *Wirtschaftsinformatik* (49:2), pp. 95-103.
Zhang, D., Lowry, P.B., Zhou, L., and Fu, X. 2007. "The Impact of Individualism—Collectivism, Social Presence, and Group Diversity on Group Decision Making under Majority Influence," *Journal of Management Information Systems* (23:4), pp. 53-80.
Zhang, S., and Fjermestad, J. 2006. "Bridging the Gap between Traditional Leadership Theories and Virtual Team Leadership," *International Journal of Technology, Policy and Management* (6:3), pp. 274-291.
Zolin, R., Hinds, P.J., Fruchter, R., and Levitt, R.E. 2004. "Interpersonal Trust in Cross-Functional, Geographically Distributed Work: A Longitudinal Study," *Information and Organization* (14:1), pp. 1-26.

Appendix

Tab. 1 Sources of literatures

Field	Journal / Conference Title (abbr.)
IS journal (14)	BISE, CACM, DATABASE, EJIS, I&M, I&O, IEEETProf-Commun, IJHCS, ISJ, ISR, JGIM, JIT, JMIS, MISQ
IS conference (3)	AMCIS, ECIS, ICIS
Management journal (4)	AMJ, HBR, IJCCM , OS
Communication journal (2)	CyberPsych, JCMC,

Tab.2 The distribution of papers across publications

Field	Publication	#	Articles
IS	BISE/WI	1	Winkler, Dibbern, & Heinzl (2007)
IS	CACM	5	Oshri, Kotlarsky, & Willcocks (2008); Massey, Montoya-Weiss, Hung, & Ramesh (2001); Qureshi & Zigurs (2001); Krishna, Sahay, & Walsham (2004); Niederman & Tan (2011)
IS	DATA-BASE	1	Garrison, Wakefield, Xu, & Kim (2010)
IS	EJIS	4	Suprateek Sarker & Sahay (2004); Hanisch & Corbitt (2007); Cousins, Robey, & Zigurs (2007); Thomas & Bostrom (2010a)
IS	I& M	2	Souren Paul, Seetharaman, Samarah, & Mykytyn (2004b); Shachaf (2008)
IS	I&O	1	Zolin, Hinds, Fruchter, & Levitt (2004)
IS	IEEET-ProfCom-mun	3	Anawati & Craig (2006); Saonee Sarker, Sarker, Nicholson, & Joshi (2005); Panteli & Davison (2005)
IS	IJHCS	1	Swigger, Alpaslan, Brazile, & Monticino (2004)
IS	ISJ	2	Lowry, Zhang, Zhou, & Fu (2010); Chudoba, Wynn, Lu, & Watson Manheim (2005)

Field	Publication	#	Articles
IS	ISR	2	Saonee Sarker & Sarker (2009); Majchrzak, Malhotra, & John (2005b)
IS	JGIM	3	Du, Ai, Abbott, & Zheng (2011); Pauleen (2003); Evaristo (2003)
IS	JIT	2	David, Chand, Newell, & Resende-Santos (2008); Pauleen & Yoong (2001)
IS	JMIS	6	D. Zhang, Lowry, Zhou, & Fu (2007); Kankanhalli, Tan, & Wei (2007); S. Paul, Samarah, Seetharaman, & Mykytyn Jr (2004a); Kayworth & Leidner (2002); Jarvenpaa Knoll, & Leidner (1998); A. P. Massey, Montoya-Weiss, & Hung (2003)
IS	MISQ	1	O'Leary & Cummings (2007)
Conf.	AMCIS	7	Picot et al. (2009); Privman & Hiltz (2008); Mathieu (2010); Ocker, Zhang, Hiltz, & Ronson (2009); R. J. Ocker & Webb (2009); Paul & Ray (2011); Ahmad & Lutters (2011)
Conf.	ECIS	2	von Stetten, Beimborn, Weitzel, & Reiss (2011); Sutanto, Phang, Kankanhalli, & Tan (2004)
Conf.	ICIS	3	Huang & Trauth (2010); Wei & Crowston (2010); Huang & Trauth (2008)
Mag.	AMJ	1	Polzer, Crisp, Jarvenpaa, & Kim (2006)
Mag.	HBR	1	Gratton & Erickson (2007)
Mag.	IJCCM	1	Elron & Vigoda-Gadot (2006)
Mag.	OS	3	Maznevski & Chudoba (2000); Hinds & Mortensen (2005); Cramton (2001)
Comm.	CyberPsych	1	Lee (2002)
Comm.	JCMC	2	Jarvenpaa & Leidner (1998); S. Sarker (2005)
	Total:	55	

Tab.3 Major ICT examined in the retrieved literatures

Category	ICT	Features and functions
Jointly authored pages	Email	- Integrate emotional behaviors with task activities - Useful for sending documents - Eliminate nonverbal differences - Overcome time zone difference - Tend to be formal - Loss of shared context, misinterpretation, poor or no response and misunderstanding - Cannot convey social and nonverbal cues - Not suitable for communication requiring further conversation and immediate responses
	IM	- Eliminate nonverbal differences - Show the status of availability - Exchange informal conversations to foster relationships - Can be easily combined with other communication tools - Synchronicity requires time synchronicity and language proficiency - Informal nature amplifies cultural differences - Lack of social cues - Only used among the most immediate, inner circle
	Wiki	- For communication and information sharing - Not appropriate when a document has too many versions
	Forum	- Overcome time zone differences
Streaming technology	Telephone	- Deal with matters under some urgency - Useful for checking on progress and keeping up momentum - Support the integration of emotional behaviors with task performance - To discuss issues informally before a formal communication
	Teleconferencing	- Local teams can sit together and help each other to overcome the language barrier - Can be combined with written summaries - Can be complemented with another channel (e.g., desktop sharing, IM) - Convenient

Category	ICT	Features and functions
		- Language encoding is more difficult than text-based communication - May hinder collaboration if a dominant speaker comes up - Distractive with too many participants - Tend to be too formal, or informal or using a wrong tone
	Video conferencing	- Faster and improving understanding compared with email - Can mitigate teleconference deficiencies - Enable concurrent and collaborative work - High social presence - Strengthen social ties - Lack of eye contact - Require high language competency
Information access tool	Shared file repositories	- Overcome time zone differences
	Email filtering system	- Alleviate information overload
Aggregate systems	Group calendar	- Alleviate information overload
	Workspace	- Overcome geographic separation - Strengthen social ties - Create team identity - Increase teams' common ground - Increase team cohesion - Increase social presence
	Group decision support systems	- Support collective action - When giving consensus building capabilities, support integrative conflict resolution
	Web conferencing	- ideal for communicating management decisions and for sharing documents

Tab.4 Lists of managerial intervention in MVTs

Managerial intervention	Interpretation	Effect
Organization culture reinforcement	- Create a shared organization culture that values diversity	- Mitigate negative effects of cultural diversity - Reduce conflicts, increase synergy
Organization structure adjustment	- Establish a flat organization structure with uniform power distribution	- Avoid faultlines - Develop a flexible, agile and committed workforce
IT accessibility provision	- Provide access to a wide range of uniform or compatible ICT across different sites	- Provide latitudes for MVTs to adapt ICT to team and task characteristics
Team composing	- For highly interdependent tasks, compose a low cultural diverse team - For highly complex tasks, encourage functional diversity - Avoid strengthening faultlines by crossing both geographic and cultural boundaries - Skillfully adjust the composition of cultural values (e.g., future-orientation, harmony, collectivism vs. individualism)	- Reduce conflicts - Promotes different perspectives, better decision making quality - Increase interpersonal trust and team performance
Training	- Offer common trainings for all sites - Language training, cultural awareness and cultural intelligence training - Conflict resolution training - Self-governing training - Collaborative skills training (e.g., communication, relationship building) - ICT select and use training	- Create a common ground - Be culturally intelligent, reduce misunderstanding, improve trust - Strengthen social ties - Reduce conflict - Facilitate communication and collaboration

Managerial intervention	Interpretation	Effect
		- Improve ICT use
Technology selection	- Provide a variety of ICT across different sites - For highly complex tasks, provide richer ICT; for urgent tasks, provide synchronous ICT - Use shared repositories and information transfer tools - Adopt team rooms and communication tools - For low language proficiency members, provide text-based asynchronous ICT - Improve compromises on technology selection	- Reduce ambiguity, improve team performance - Enable latitude in task-technology fit - Achieve work translucence - Develop interpersonal relationship - Improve social presence - Reduce misunderstanding - Reduce conflicts
Technology use	- Set regular and frequent ICT supported communication - Institutionalize norms for logging on and responding promptly - Signal temporary absence - Use asynchronous ICT to overcome time zone differences - Use a shared workspace or team room - Exchange social information through ICT - Use synchronous communication from time to time - Integrate emotional behaviors with task activities - Use IM to show the status of availability - Use GSS to resolve intercultural conflicts - Develop a common structure for emails - Combine videoconferencing with another visual or text-based media	- Improve social presence - Foster interpersonal relationships - Take advantages of time zone differences - Create team identity and common ground - Increase team cohesion and trust - Reduce faultlines - Reduce conflict - Reduce cultural differences in communication styles
Task selec-	- Enable seamless transition across time zones - Align task complexity and formality to team members' cultural values (e.g.,	- Take advantages of time zone differences - Improve task performance

Managerial intervention	Interpretation	Effect
tion	uncertainty avoidance, short vs. long term orientation) - Enable knowledge transfers across different sites - Choose culturally neutral projects	- Gain domain expertise and move up the value chain - Minimize cross-cultural issues
Mission analysis	- Clarify the mission with all team members - Clarify the time frame with all team members	- Improve compromises on team missions - Enable adjustments on team-building investment
Goal specification	- Developing shared goals, ensure a sense of complementary objectives among all team members - Clarify goals to a great extent, eliminate ambiguity	- Overcome cultural differences - Improve trust
Strategy formulation	- Specify roles and responsibilities explicitly - Maintain a moderate to low interdependency between different sites - Divide work to enable seamless transition between time zones - Uniform work practices - Establish a shared project-related vocabulary - Provide instructions (detailed vs. general) according to members' cultural values (high hierarchy vs. low hierarchy)	- Reduce conflicts - Smooth coordination - Improve trust - Take advantages of time zone differences - Improve team performance - Establish a common ground
Monitoring	- Improve visibility of members' contribution - Ensure continued participation, full and complete exchange of information - Maintain the shared project-related vocabulary	- Enable knowledge transfer - Improve satisfaction on team performance - Maintain a common ground
Coordination	- Set up intelligent and relaxed time frames for tasks - Schedule regular meetings and rotate meeting times across different sites - Consider all local holidays when set up schedules and meetings	- Maintain sustainable working relationships - Improve transparency and accountability - Increase team cohesion

Managerial intervention	Interpretation	Effect
	- Take notes during meetings and share time afterwards - Specify the team clock - Increase overlapping time through allowing flexible working time - Regulate response time to messages or emails	- Reduce misunderstanding - Improve trust - Improve team performance
Conflict management	- Using collaborative conflict management styles (solving the problem through collaboration) - Address perceived conflicts as early as noticed - Protect team members' privacy when resolving conflicts	- Improve satisfaction with the decision-making process and perception of the decision quality - Improve perceived participation - Reduce conflicts - Improve team performance
Motivation	- Fostering functional similarity - Foster individual communication between different sites - Develop a shared and compromise team culture that encourages open discussion, express concerns and is optimistic - Foster team identity - Provide localized motivations for members in different cultures	- Mitigate negative effects of cultural diversity - Avoid faultlines - Reduce conflicts - Improve performance - Increase members' initiative and motivation
Affect management	- Arrange face-to-face meeting for socialization and team building - Rotate face-to-face meeting locations - Encourage the exchange of social information and informal communication - Use a communication or cultural coordinator - Build trust at the beginning of a project - Use trust-enhancing mechanisms among different sites - Encourage empathetic task oriented communication	- Improve cultural awareness - Create interpersonal ties - Facilitate team process - Improve team performance - Reduce misinterpretations - Improve awareness of others' progress - Improve trust