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Trust Evolvement in Hybrid Team Collaboration: A Longitudinal Case Study

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Abstract Trust is referred to as a key facilitator in team collaboration as it is an important condition for information sharing. In this paper, we investigate factors associated with the establishment of trust in hybrid teams that collaborate virtually as well as face-to-face. Furthermore, we deliver an instrument to understand trust development in teams. We describe exploratory results of the instrument by running experiments with teams of collaborating students in China and Netherlands. Quantitative and qualitative analysis has been used to analyze these data. Finally, in the analysis of the experiments we describe initial patterns of trust development in groups from both individual and group perspectives, in two different cultural contexts.

Keywords Trust · Trust evaluation · Trust development · Teamwork · Virtual teams

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1 Introduction

Increasingly, knowledge workers have to work in teams that are global, inter-organizational, inter-cultural, and dispersed in several ways. Therefore, teams increasingly face the challenge of working (in part) virtually. With the development of technology, groups have started to form new ways of interaction. Electronic communication has been used to enable teams to collaborate virtually. Classical face-to-face collaboration has changed into the form of a virtual relationship using the web (Azadegan and Kolfschoten 2014). Virtual teams often face challenges related to a lack of presence and body language, and problems with respect and trust which can lead to unproductive processes and failed efforts (Cheng et al. 2013b).

Many scholars have identified the importance of trust in virtual teams (Jarvenpaa et al. 1998; Pinjani and Palvia 2013). According to the definition of trust of Mayer et al. (1995) and Tschannen-Moran and Hoy (2000), trust is one party's willingness to be vulnerable to another party based on the confidence that the latter party is benevolent, reliable, competent, honest, and open.

Trust plays a pivotal role in reducing complexity and cognitive load, which is very important in team collaboration (Kolfschoten and Brazier 2013). Furthermore, providing 'internal security' and internal balance between risk, utility, and payback factors is related to decision making ability within our daily lives (Abdul-Rahman and Hailes 2000). Trust, especially interpersonal trust, is an important concept in psychology and vital to personality development (Erikson 1963), and social life (Rotter 1980; Wang and Emurian 2005).

Trust and knowledge sharing play a central role in friendship development. According to Sharkie (2005), 'Trust is an important determinant of the predisposition or willingness of individuals to enter into conversations with others as a prerequisite for the sharing of knowledge for the benefit of the organization'. Consequently, trust represents both an outcome and a process: a degree of trust is necessary for individuals to open up and to confide in each other. Trust is enhanced when another's motives are understood, providing these motives are positively oriented. Building trust also plays an important role in supporting an individual's success in teams. Each individual's success is supported by the amount of effort the other team members apply to achieving the team's overall objective and trust building in teams improves team members' willingness to increase their efforts (Fairholm and Fairholm 2000). Thus, trust is a critical factor in the effectiveness of (virtual) teams. While trust has been studied in the context of teams, initial trust might be very different than trust during the project, and trust might change when the team is approaching a deadline or milestone (Cheng et al. 2013b; Rose and Schlichter 2013). Trust develops over time and can have different values for individuals in the team (Cheng et al. 2013a). To facilitate trust building in hybrid collaborating teams, we need to understand how trust develops in teams and when trust is most critical for the functioning of a team. Therefore, we designed a study to measure trust development over time.

To study trust development in teams, there is a need for a trust assessment instrument to draw on generic characteristics of trust as identified in the literature that help us to identify patterns of trust development over time. We developed an instrument that enables us to assess trust weekly, in the context of educational projects that also require

the students to deliver results on a weekly basis. The weekly assessment required us to create a short, focused instrument that can be used weekly without overly burdening the subjects. In this study we were interested in investigating trust development in hybrid teams. Throughout this paper we use the term hybrid teams in any situation where individuals collaborate both virtually as well as face-to-face. Hybrid teams do not have the problems of completely virtual teams, which are well documented in the literature (Sarker et al. 2011; Yusof and Zakaria 2012), but they are challenged by the virtual nature of their interaction, which is known to have an effect on trust building due to lack of body language (Cascio 2000; Greenberg et al. 2007). Furthermore, we feel trust development is likely to have a cultural component, which is why we chose to explore the findings from different contexts in different countries. To achieve this purpose, we designed an instrument to investigate the change in trust development in teams of students that takes place over a period of time by using quantitative and qualitative analysis. The last section of this paper is dedicated to a discussion on the analysis of patterns of trust development from individual and group perspectives.

2 Types of Trust

The literature identifies four types of trust. The first is 'Dispositional trust'. Dispositional or 'basic' trust is specific to each individual. This type of trust is independent of any context (McKnight and Chervany 1996), acts as a central ingredient in the "healthy personality", and is linked to individual traits (Erikson 1963), relating to a person's general faith in human nature, that is, a cross-situational general tendency to trust other people (Rotter 1980). In virtual teams, this type of trust could be considered as the initial status of the trust in teams.

'Interpersonal' trust is developed from an inter-relationship between two or more persons. It is defined by Rotter (1967) as "an expectancy held by individuals or groups that the word, promise, verbal, or written statement of another can be relied on". Interpersonal Trust and social presence (Bente et al. 2004) are complementary to each other. This type of trust is a frequently researched area of trust in virtual teams. Wilson et al. (2006) have identified that interpersonal trust development in face-to-face teams is better than in purely virtual teams. Therefore, scholars have moved their research focus from virtual teams to hybrid teams where trust building is more likely (Bjørn and Ngwenyama 2009; Cheng et al. 2013b). This avoids the gap of the trivial conclusion that some initial face-to-face meetings are critical.

A third category known as 'Situational trust' implies a 'situational decision to trust' in which a person has formed an intention to trust every time a particular situation arises. Trust is associated with actions, mostly risk-taking behaviors. The form of the action depends on the situation and may concern something either tangible or intangible. Other key factors of situational trust have been listed as: benefit or gain (Lewicki and Bunker 1996; Tan and Thoen 2003), and the utility of information (Shapiro and Varian 1998). A situational decision to trust may occur when there is 'much to gain from trusting but little attendant risk' (Kee and Knox 1970). For this type of trust, in different situational settings of virtual collaborative teams, such as the face-to-face,

hybrid, and pure virtual setting, trust could be different (Fiol and O'Connor 2005; Griffith et al. 2003).

A further category of trust, variously termed 'System' or 'Structural' trust, has particular relevance to this relatively new environment. System trust predicts 'an impersonal institutional phenomenon, not founded on any property or state of the trustee, but rather on the perceived properties or reliance on the system or institution within which that trust exists' (Lewis and Weigert 1985; McKnight and Chervany 1996). System trust might relate to the banking system or a virtual community system and is therefore context dependent (Coetzee and Eloff 2005). For this type of trust, in the hybrid virtual team, researchers have also conducted trust research using different tools (Cheng and Macaulay 2014; Rose and Schlichter 2013).

The online environment, with its relative lack of 'media richness', holds a number of inherent risks that can negatively influence the building of trusting relationships (Daft et al. 1987). Interestingly, the recent dramatic growth in popularity of Internet-based social networking at platforms such as Facebook, MySpace, and Bebo presents a counterpoint to previous theories relating to people's capacity for online trust. The willingness of large numbers of people to share personal information with others online demonstrates either reduced public levels of apprehension with regard to system trust, or indeed the technical mastery of the tools and techniques for engendering trust. A significant feature of communications in social networking is its informality. This has been shown to have an effect on the development of trust within teams and thus the team's performance (Castelfranchi and Falcone 1998). Castelfranchi and Falcone (1998) also suggest a five-element strategy designed to address problems associated with trust in virtual societies and networked technologies comprising, human–computer (or systems) trust, interpersonal trust relationships and dispositional trust, together with risk and attitude, and potential gain. Whilst technology alone could provide connectivity between 'micro communities of knowledge' (Von Krogh et al. 2000), the balance for developing deep trust lies with social factors and the use of 'natural language' between participants (Nolan et al. 2007). Therefore, both social and technical connectivity is required for enabling knowledge exchange and high-level team performance (Kolb et al. 2008).

Dafoulas and Macaulay (2002) have stated that a high level of trust is required in order for virtual teams to perform effectively and avoid any delays and conflicts, which is much higher than in traditional co-located teams. According to Friedman et al. (2000), 'People trust people, not technology'. Building trust in virtual teams is complicated because time and geographical distance precludes most synchronous communication (Powell et al. 2006). Research on trust development over time on computer-mediated teams by Wilson et al. (2006) has also shown that it takes longer for trust to develop in computer-mediated virtual groups because it requires more time for members of those groups to exchange social information.

Trust has been variously described as subjective and a phenomenon that evolves with time through new experiences and observations (Dimitrako 2003), as assuming different characteristics at varying phases of a relationship as well as in different types of relationship (McKnight and Chervany 1996). Overall, researchers have looked at understanding and analyzing trust in co-located as well as in dispersed teams. Beise et al. (2004) state that face-to-face meetings in virtual teams are needed to produce

commitment, accountability, and to increase urgency. Face-to-face interaction could also enhance the virtual team performance (Kirkman et al. 2004). Therefore, understanding hybrid teams and analysis of trust development also falls within the same line of research and needs to be investigated. Cheng and Macaulay (2014) investigated the individual trust factors and their second level factors in the hybrid collaboration settings by interviews; however, they did not turn to the longitudinal level of trust development. Researchers have paid much less attention to understanding trust development in hybrid teams, especially in the study of comparison of findings in different contexts in different countries. Our objective in this paper is to address this existing gap in the literature by introducing an instrument used for trust development analysis in hybrid teams.

3 General Trust Factors

Hoy and Tschannen-Moran (1999) conducted an extensive review of the literature on trust and identified five factors in trust. In this study, in order to investigate the trust development in hybrid virtual team, we have used Hoy and Tschannen-Moran's (2003) theoretical conceptualization of trust. They defined trust as 'an individual or group's willingness to make themselves vulnerable to another individual or group, relying on the confidence that the other party exhibits the following characteristics: benevolence, reliability, competence, honesty, and openness'. These five factors of trust accompany two other common denominators of trust: vulnerability and confidence (Reid 2008). We will address each of these seven factors below to establish a literature basis for our instrument to measure trust development over time.

3.1 Willingness to Risk Vulnerability

Being vulnerable (Boss 1978) implies that there is something of importance to be lost. Making oneself vulnerable is taking a risk. Trust is not taking risk per se, but rather a willingness to take risk. Also, it is reported that a necessary condition of trust is interdependence, wherein the interests of one party cannot be achieved without relying upon another (Rousseau et al. 1998). It is stated by Tschannen-Moran and Hoy (2000) that if there is no interdependence, there is no need for trust. The degree of interdependence that brings with it vulnerability may also alter the form trust takes (Wilson et al. 2006). Risk is also considered as the perceived probability of loss, as interpreted by the decision maker (Coleman 1990; Williamson 1993). Trust is then considered as a willingness to be vulnerable under conditions of risk and interdependence (Rousseau et al. 1998).

3.2 Confidence

The relationship between confidence and trust is amorphous in the literature. For example, Deutsch (1958) considered the reasons why one would trust another person to produce some beneficial event. The 'individual must have confidence that the other

individual has the ability and intention to produce it'. Luhmann (1988) proposed a distinction that helps to differentiate trust from confidence. He asserts that both concepts refer to expectations, which may lead to disappointment. Luhmann argues trust differs from confidence in that it requires a previous engagement on one's part, recognizing and accepting that risk exists.

3.3 Benevolence

The concept of benevolence is defined as the confidence that one's well-being, or something one cares about, will be protected and not be harmed by the trusted party or group (Cummings and Bromily 1996; Dafoulas and Macaulay 2002; Mishra 1996; Webber 2002). Trust acts as an assurance that the other person will not exploit one's vulnerability or take excessive advantage if the opportunity presented itself (Cummings and Bromily 1996). This sense of benevolence between individual and groups is crucial to the interdependence and vulnerability that are vital for trusting relationships (Reid 2008).

3.4 Reliability

At the basic level, trust has to do with predictability, which means it requires consistency of behavior and knowing what to expect from others (Butler and Cantrell 1984; Hosmer 1995). Reliability or dependability combines a sense of predictability with benevolence and there is a sense of confidence that the need will be met (Wilson et al. 2006). The concept of reliability means that there is a sense of confidence that one's basic needs will be met in a positive way. If trust is to exist, individuals must behave in a consistent and predictable manner in the interests of other members of the team (Mishra 1996).

3.5 Competence

In order to trust an individual, one must feel that the individual or group has the capacity, skills, and resources to act in a reliable and benevolent manner (Mishra 1996). Competence is the ability to perform as expected and according to the standards of the current assignment. It is the extent to which a trusted party has knowledge and skills. The absence of competence in one party often results in the failed expectations of the other party (Tschannen-Moran 2004). If one party is considered incompetent then the other individual in the relationship is not likely to invest their efforts in building trust.

3.6 Honesty

Honesty, from an individual's perspective, is related to a person's character, integrity, and authenticity (Wilson et al. 2006). Honesty is believed to be a fundamental facet of trust that takes an individual's character and integrity into account (Tschannen-Moran 2004). Honesty encompasses the ideals of truthfulness, authenticity, and commitment

(Hoy and Tschannen-Moran 1999). Many researchers see honesty as a pivotal aspect of trust. Without honesty, the foundation of reliability, predictability, and benevolence have no fertile interpersonal ground in which to grow (Cummings and Bromily 1996).

3.7 Openness

Openness is considered as the extent to which relevant information is not withheld and it is a process by which people make themselves vulnerable to others by sharing their personal information (Butler and Cantrell 1984; Mishra 1996). Openness is the degree to which a team's culture is open so that information can flow freely as needed. When individuals are involved in open communication, they do so with the confidence that each actor is on the same wavelength and that all participants are risking the same high stakes. The leveling of the playing field reduces the sense of vulnerability, fear of injury, and the risk of exploitation. It is also stated by researchers that individuals who are unwilling to extend trust through openness will end up living in isolated prisons of their own making (Kramer 1996).

4 Measurement Instrument

4.1 Instrument Design

To explore and understand trust development in hybrid virtual teams, we evaluated each of these seven factors both from a self-perspective (I was trustworthy), and from a group perspective (the group was trustworthy) on a weekly basis. We asked the group if, in general, things changed with respect to the trust in the group, and the activities they performed that week. The results were used to analyze patterns of trust development/evolution.

In the study, we asked student groups to rate different aspects of trust on a weekly basis during a longitudinal project. Each week we asked students to rate trust on the seven factors discussed above, and to indicate whether it changed compared to the previous week. Furthermore, we asked about causes for the change in trust using open questions, overall activities, and media used by the team for that week. Here, we asked participants to report the joint activities that they performed that week and the frequency of communication and interactions, such as formal meetings, informal meetings, hallway chats, email, skype, IM, chat, phone call, etc. We also asked them to specify and elaborate on their answers.

Finally, we asked for the name, age, nationality, and group number of each participant, to be able to compare trust within and across teams, and promised confidentiality of the results to stimulate open answering of the questions. The questions have also been tested (Cheng et al. 2013b). The complete instrument is given in "Appendix 1".

4.2 Pilot Study

To test the instrument we did a pilot study at Delft University of Technology in the Netherlands. In this stage, we gathered only results from 3 weeks in three groups,

and the results were quite incomplete, therefore not sufficient for the full analysis. Nevertheless, we received no negative feedback on the instrument and no difficulties in interpretation or filling out the form. However, weekly commitment to fill in the questions seemed to be quite a burden for the participants, and some incentive was therefore required to gain complete results. A second pilot test of the instrument was performed in a longitudinal project-based course at the University of International Business and Economics in China for 9 weeks in eight groups. Over this longer period and different country context, we also received no negative feedback and no difficulties in interpretation or filling out the form. Students were happy to fill in the survey every time. However, after this test, in order to make the analysis more accurate, we decided to create three questions to evaluate one item rather than one question per item as previously. Therefore, we decided to use 21 questions for the individual perspective and 21 further questions for the group perspective. We also decided to change our data collection method from a word document survey to a MS Excel based format to make it easier to fill out the questionnaire. Based on the tests, we were able to see some initial patterns in trust development. In particular, we saw a change in trust after the first week, and towards the end of the project. Encouraged by the findings, we did two larger case studies both for 9 weeks (see Sect. 5 for details on the case studies).

4.3 Measurement Validation

To validate the instrument, we used the same datasets as for the results. The data collected were subjected to a purification process in order to evaluate the reliability and validity of the construct measurement. Thus, we conducted exploratory factor analysis (EFA), an inter-items consistency test, and confirmatory factor analysis (CFA) respectively, according to methodological guides in IS research (Gefen et al. 2000; Straub et al. 2004).

First, exploratory factor analysis was conducted on 21 items of seven trust factors, based on the Netherlands and China's samples respectively. A principal component analysis with a varimax rotation was employed, and an eigenvalue of 1 as the cut-off point was selected. However, the EFA only identified six factors with an eigenvalue exceeding 1.0 in both samples, but also found that three items of reliability did not load properly on its assumed trust factor or had high cross loadings with the items of confidence (for the China sample) or competence (for the Netherlands sample). The EFA results indicated that we could not effectively discriminate the reliability measures with the confidence or competence in two samples. Therefore, to ensure discriminant validity, we dropped the reliability from the initial set of trust factors (Straub et al. 2004). Furthermore, due to the low levels of factor loadings (not greater than 0.4), the first items belonging to risk [see "Appendix 1", questions (1a) and (2a)] were dropped from further analysis.

Second, we tested the reliability of the six remaining trust factors the using internal consistency coefficient. The results showed that Cronbach's alphas for all constructs were greater than 0.7 (from 0.78 to 0.92), demonstrating adequate internal consistency (Straub et al. 2004). Therefore, the average score of each trust factor was calculated and used in further analysis.

Finally, we carried out confirmatory factor analysis using LISREL software to further establish whether the measurement items would load on risk, confidence, benevolence, competence, honesty, and openness, as distinct factors. The good fit statistics of CFA in the two samples showed the model of six factors fit the data reasonably well: χ^2/df. lower than 2.5, root mean square error of approximation (RMSEA) lower than 0.08, and comparative fit index (CFI) greater than 0.9, which strongly suggests that the measurements demonstrate discriminant validity (Gefen et al. 2000). In addition, all items loaded significantly on their expected trust factors (with the loadings being greater than 0.7), providing support for convergent validity.

All in all, the obtained results conclude that the measurements of trust factors have adequate reliability, convergent and discriminant validity. Thus, when we conducted the subsequent quantitative analysis, such as the changing pattern of trust factors, we were able to obtain more reliable and accurate empirical results.

5 Case Study

5.1 Case Study in China

For the China case study we selected an information system related course. The undergraduate students were aged from 19 to 20 years, including males and females. They were divided randomly into different groups to do the team project for 9 weeks. Each group consisted of about 4–5 students. In total, we had 46 participants in 10 groups.

During the whole semester, the students were asked to collaborate to evaluate an e-business website and to explore its current problems, to come up with key problems for the future improvement of the website. The students were asked to collaborate in groups to finish the group tasks in 9 weeks.

The groups were instructed to work collaboratively using collaboration techniques and methods from Collaboration Engineering (Briggs et al. 2003). These methods are called thinkLets. ThinkLets are defined as named, packaged facilitation techniques that create predictable, repeatable patterns of collaboration among people working towards a goal (Kolfschoten et al. 2006). ThinkLets can be used to create patterns of collaboration such as divergence (brainstorming), clarifying, reduction (selection or elimination), organizing, evaluation, and consensus building (Briggs et al. 2003, 2006). Each technique is scripted to describe a tool to be used in a certain configuration and with specific process guidance. The groups can use these techniques by themselves after a short training period, as they are intended to be highly transferable (Briggs et al. 2003, 2006). The students have been taught to use the thinkLets in lectures by slides introducing thinkLets and also sample videos of using collaborative meeting software with which they practiced in advance. ThinkLets can be found in the thinkLet book (Briggs and de Vreede 2001). The thinkLets helped them to effectively work together in brainstorming problems for the website, categorizing these into different usability factors and voting on their relative importance. Then they went through a similar cycle of brainstorming, categorizing, and voting to identify solutions.

During the project, the teams used different software to support their collaboration, such as Tecent QQ Group, which is widely used Chinese group-chatting software,

Renren, and Weibo, which are Social Networking tools used in China. They also used Kanbox which is online storage software for them to share outcomes and files. They also used mobile phones and email to communicate with each other. In addition, they had some offline meetings throughout the collaboration period, to work more efficiently. The students filled out the survey each week until the ninth week when their project finished. Each group then submitted their group assignment with the project outcomes. After evaluation, all the students passed the assignment and received sufficient grades for their project. Each student also filled out the open question in the survey with qualitative explanation each week. We have successfully collected the data for each group over 9 weeks.

5.2 Case Study in the Netherlands

In the Netherlands we did a case study with students from an interdisciplinary minor on project management. The students were both male and female, and had an average age of 22 years. A small majority of the students were Dutch, others were international students, but mostly had attended the University for 2 years as the project was in their third year of study. The students worked in groups of 3–5 from different bachelor major programs in engineering. The students had a program with weekly assignments and feedback meetings to develop an approach for project management in a specific domain. The students were free to choose their means of collaboration and communication during the project, but the pressure to perform and collaborate was high due to weekly feedback meetings, and frequent grades for (sub) assignments. Most groups had not worked together previously, as they were from different studies. However, some students knew each other socially. The students worked on the project for 7 weeks, after which they handed in a mid-term assignment. The project lasted another period of 7–8 weeks, after which no data were collected. The students received an e-mail with a link to the online assessment instrument every week to remind them to fill out the survey. The students received a 10 euro gift card for participation. Despite these measures, the data were not complete, as some students missed a survey and some students stopped filling in the survey.

6 Survey Results and Analysis

We successfully gathered longitudinal quantitative and qualitative data from the two case studies. In this section, we will analyze the quantitative data results first.

6.1 General Analysis

For two samples, we separately computed the average score for the six trust factors used in the following analysis. We conducted a series of Analysis of Variances (ANOVAs) to study whether the score of six trust factors would change over all the stages (from beginning to end) and with the responders' answers for individual and group questions. Based on the statistical results (see Table 1), the responders' scores of trust factors

Table 1 General analysis using two-way ANOVAs

Statistical significance	Risk		Confidence		Benevolence		Competence		Honesty		Openness	
	CN	NL	CN	NL	CN	NL	CN	NL	CN	NL	CN	NL
Over time	Y	Y	Y	Y	Y	N	N	Y	N	Y	Y	N
Individual versus group	N	N	N	N	Y	N	N	N	N	N	N	N

Y, statistical significance; N, no statistical significance

for individual and group showed almost no significant differences. Only benevolence in the China sample showed a significant difference. However, for China and the Netherlands samples four trust factors have significant changes over all the stages but not the other two trust factors. Full ANOVA results can be found in "Appendix 2".

6.2 The Changing Pattern of Trust Development Over Time

To discover the changing pattern of trust development, we plotted the average score of each trust factor for two samples over all the stages (see Fig. 1). For the changing pattern of the Netherlands' sample, we found that it decreases first, increases in the second stage, then it shows some fluctuation, while towards the end some trust factors may decrease sharply again. For the changing pattern of the China sample, we found that it may increase continually over the initial two stages and then it shows some fluctuation.

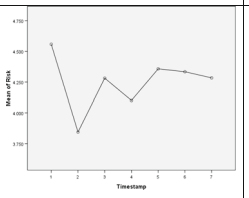
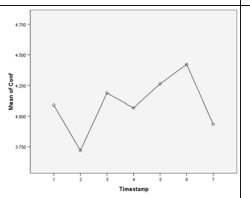
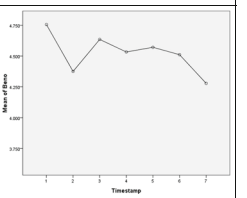
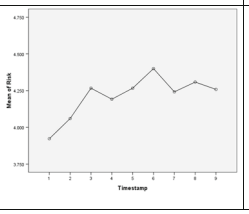
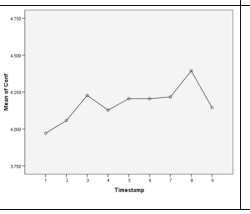
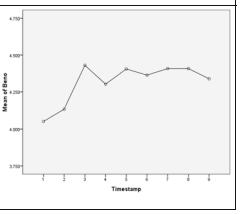
To further validate the changing pattern as shown in Fig. 1, we conducted the difference of means test (*t* test) for the trust factors between two consecutive stages. For the Netherlands and China sample, Tables 2 and 3 respectively, show the change of each trust factor over the stages and corresponding significance level. For the China samples, the scores of trust factors increase continually and significantly from the first to the third stage. However, we do not provide the test results from the first to second stage and second to third stage in Table 3 for brevity, as these are not statistically significant.

6.3 Key Findings of Quantitative Analysis

According to the results of the quantitative analysis, we can generate the following key findings:

- In this study, according to the statistical results, we find that the individual and group results are almost the same in both cases, indicating that there was no significant conflict in group behavior (e.g. I was reliable, but they were not).
- The trust development trend in the Chinese sample and the Dutch sample are opposite in the beginning. It is easy to see from Fig. 1 that the development trend of trust factors in the Chinese groups all increase in the the initial stage, while the Netherlands' groups all decrease after the first week then increase again in the third week.

(a)

Trust Factors	Risk	Confidence	Benevolence
Netherlands			
China			

(b)

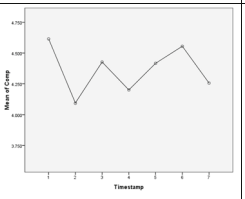
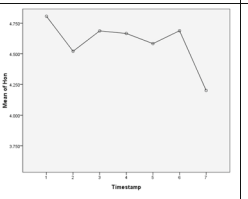
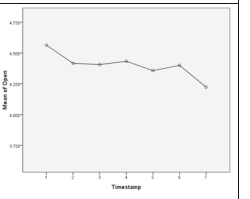
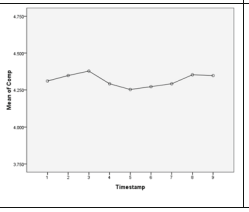
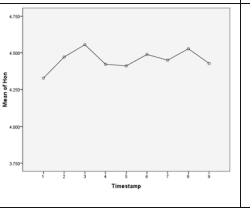
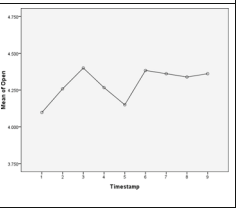
	Competence	Honesty	Openness
Netherlands			
China			

Fig. 1 Changing pattern of trust development over time

- For both samples, the trust factors fluctuate in the middle stage towards the end, but in the end, most of the factors decrease.
- The Chinese sample and the Dutch sample both have two trust factors that do not change significantly over all stages and these are also different. For the Chinese sample, 'competence' and 'honesty' factors do not change significantly across all stages. For the Netherlands' sample, it has 'benevolence' and 'openness' factors do not change significantly over stages.

6.4 Qualitative Results

To support the quantitative data received and analyzed from the questionnaire, we also included a number of questions to be answered qualitatively by the participants, which were further analyzed.

Table 2 *t* Test for the trust factors in the Netherlands' sample

Trust factors	Stage					
	1 → 2	2 → 3	3 → 4	4 → 5	5 → 6	6 → 7
Risk	−0.71**	0.43*	-0.18^{ns}	0.25^{ns}	-0.02^{ns}	-0.05^{ns}
Confidence	−0.37*	0.47*	-0.12^{ns}	0.19^{ns}	0.16^{ns}	−0.49*
Benevolence	−0.38**	0.26^{+}	-0.10^{ns}	0.03^{ns}	-0.06^{ns}	-0.23^{ns}
Competence	−0.52**	0.33*	-0.22^{ns}	0.21^{ns}	0.14^{ns}	-0.30^{ns}
Honesty	−0.29*	0.16^{ns}	-0.02^{ns}	-0.08^{ns}	0.10^{ns}	−0.48**
Openness	-0.14^{ns}	-0.01^{ns}	0.03^{ns}	-0.08^{ns}	0.04^{ns}	-0.18^{ns}

ns not significant
Significance level: $^{+}\ p < 0.1$; $^{*}\ p < 0.05$; $^{**}\ p < 0.01$

Table 3 *t* Test for the trust factors in the China sample

Trust factors	Stage						
	1 → 3	3 → 4	4 → 5	5 → 6	6 → 7	7 → 8	8 → 9
Risk	0.34**	−0.07	0.07	0.13	−0.15	0.06	−0.05
Confidence	0.26*	−0.10	0.07	0.00	0.01	0.17	−0.25*
Benevolence	0.37**	−0.12	0.10	−0.04	0.04	0.00	−0.06
Competence	0.06	−0.08	−0.04	0.02	0.02	0.06	−0.00
Honesty	0.23*	−0.13	−0.01	0.07	−0.03	0.07	−0.10
Openness	0.30*	−0.13	−0.11	0.23^{+}	−0.02	−0.02	0.02

ns not significant
Significance level: $^{+}\ p < 0.1$; $^{*}\ p < 0.05$; $^{**}\ p < 0.01$

For the initial trust pattern in the Chinese group, which first increases, we looked at comments about the first weeks (Table 4).

From these comments, we can see that participants needed to get to know each other to develop initial trust, and that initial interaction in the brainstorming and activity in the group helped them to establish more trust. The teams in this sample were randomly assembled. Therefore, they needed to get to know each other first.

For the Netherlands groups, in which their trust factors first decreased, we have found the following comments in the first 2 weeks (Table 5).

These comments show that several students had difficulty in following up on agreements made in the team to deliver or to meet. The pressure in the group to perform in the second week already might have shown the team members who was more and less reliable in various aspects of performance. These teams were formed by the students themselves in the first joint kick-off days of the project, in which the whole class got to know each other in highly interactive workshops and excursions. This could explain why the students initially had some trust in the team they built, but then were confronted with actually working together, explaining the drop in trust. In the second week, teams already had initial feedback from the teacher on their work in a formal meeting and so they had some real performance pressure.

Table 4 Factors and comments for Chinese group, increasing first

Comments examples for Chinese sample Weeks 1–2
Week 1: Maybe I can't very trust my team because we just construct the team, and I find every member has their own ideas or something to do in the team so that we haven't reach a very satisfactory level
Week 2: Everyone seems to be more active than last week and I feel it's a good starting
Week 2: This is the second time that we get together to work as a team, and we r more familiar with each other
Week 1: Before the group discussion, we didn't know each other's ideas, so the trust level was low
Week 2: With the increased frequency of discussion, we have a higher trust between each other
Week 2: Because of long time cooperation, the trust in our team increases
Week 2: Our team members are active to our task about brainstorming. So our discussion is efficient and fierce
Week 2: Everyone seems to be more active than last week and I feel it's a good starting. We have established more trust because everyone joins in the talking and everyone has their ideas

Table 5 Factors and comments for the Netherlands' group, decreasing first

Comments examples for the Netherlands' sample Weeks 1–2
Week 1: After a week of work it became clear that it worked out quite well
Week 2: People didn't show up to group-meetings, or had to leave early without telling us in advance
Week 1: We got to know each other better and this improved the trust in the team
Week 3: The way they work is very different from the way I like to work. This created tension between us
Week 2: I couldn't do what was required of me and someone else had to do the task instead

Overall, we can see that the way the team is composed affects trust, as well as the context in which they get to 'familiarize' themselves. In the Dutch teams, this process was performed under high performance pressure, while in the Chinese teams, there was less initial familiarization, and they got to know each other 'on the job' but not under high performance pressure.

For the second finding, the trust decreasing trend at the end of the project, we have also analyzed the qualitative explanations. Here, while the trend is decreasing for both, the two cases have different explanations for this phenomenon.

China
Comments in the final weeks of the project
Week 5: Maybe we are busy at finding a job or other things, we think it's too tired to finish the task
Week 7: Maybe everyone is busy, the discussion in this week is not that smooth. And maybe we have something else to do during the online discussion, so the response is not prompt
Week 7: Since this period of time is the most important time for a college student, we do not pay enough attention to the work
Week 8: We seemed to have problem to have meeting together. Even though we agree on a proper time and it is through the Internet. But we can make it in the end
Week 8: Someone did not show up in the discussion

Netherlands
Week 7: But one member of the group keeps letting us down, delivering late and with a poor quality
Week 7: There were no tasks being done this week
Week 7: The ill team member didn't really make effort to help the rest of the group with completing our tasks

In the Chinese groups, the team members are alleged to have focused their attention on higher level goals, such as finding a job. In the Dutch teams, the remarks develop into more overall judgments of people's performance, rather than explanations for this week's trust. It seems that there is more understanding for the Chinese group members who do not deliver, participate or meet appointments, than in the Netherlands, where these group members are considered poor performers, even when sick.

For the third finding, there was a similarity in the individual and group results. This is interesting, as the comments do seem to point to individual untrustworthy behavior. However, apparently both in the Dutch and in the Chinese teams, no one indicated a significant difference between their own trustworthiness and the trustworthiness of the group. Perhaps this would be different if the trustworthiness of each group member was evaluated individually.

For the fourth finding, as there are two different factors for two cases that do not change significantly over time, we have investigated qualitative comments about them to find out why these factors are stable.

For the Chinese group, the 'competence' factor did not change significantly.

In the Chinese group, we found some comments related to 'performance' and 'skill', explaining why the 'competence' factors do not change significantly throughout the process.

Comments on competence
Week 9: I think every member *tried his best to accomplish* the work, and we share ideas
Week 2: According to the performance, each of us is *competent* for the work
Week 2: I found everyone in our group can *participate in discussions actively* and submit *high-quality* homework on time
Week 5: During the process, I felt my team members have the skills of fixed attention and positive thinking. We finished our discussion task successfully
Week 7: Our tacit understanding helps the whole team finish the task smoothly

Overall, group members seem to display high interaction; using the thinkLets, they created truly joint results and shared understanding, which could have helped to level out personal performance differences.

The second stable factor in the Chinese groups was honesty. With the traditional education culture, all the participants would like to be honest with the other team members in the collaboration. This is a high cultural value, and behaving dishonestly, or accusing someone of dishonesty, is considered a severe trust breach. For this reason we have not found many comments regarding honesty; perhaps there is a systematic and contextual trust in honesty among students.

In the Dutch groups, a similar stability was found in the benevolence and openness factor. The Dutch team members were more competitive. They divided tasks, and judged each other's performance and contribution. They seemed to focus more on their own contribution than on the overall team result.

Comments on benevolence and openness
Week 1: Even if we're not able to meet with the whole group to discuss things, we make sure we keep everyone updated and keep everyone part of the group even if some can't come to the meetings
Week 2: We know each other a little bit better, and also our capabilities. Because everybody was open to each other

In the Dutch teams, sharing information seemed to be an important value. If you do not perform, you should share the reason, even if it is personal. Also, it is considered important to keep informing all team members, even when they are not present at meetings. Clear communication about expectations seems an important value.

These stable trust factors might point towards more critical values with respect to trust, which are culturally embedded. Honesty and competence are very personal characteristics, In the Chinese context, they were considered stable trust factors, throughout the process; these were not deemed to affect the team performance. In the Dutch context, competence and performance were key factors to determine trust, and openness and benevolence were the stable factors that did not seem to be thwarted, and did offer the group a basis for trust. While more research is required to confirm these factors, it seems that variation in trust is attributed to different factors in different cultural settings.

7 Conclusions and Future Research

This research presents a first exploratory case study to identify patterns in trust building in teams. The instrument allows us to compare the development of trust over time across different factors. We found that the self and group perspectives on trust did not reveal much insight. However, overall we saw distinct patterns in trust development over time depending on the way in which the team was composed, how and under what circumstances they got to know each other, and how they coordinated their joint effort towards final deliverables. Also, we saw a difference in trust due to the level of interactivity in creating joint results. Finally, our results seem to indicate that culture can determine what trust factors affect overall trust perception, and which are more stable, and thus, perhaps more fundamental values in the team.

Participants primarily seem to establish trust early in the project, when they need to form a team, when they set expectations and make plans, and around the delivery, perhaps to consider whether they want to work with their team members in future projects. The teams did not get assignments to 'get to know each other' such as ice breakers, or a social/team building activity, although the Dutch groups had a kick-off week in which the whole class worked together in different groups in workshops and did excursions. It would be interesting to see how such activity affects trust building

and also to see if this postpones or replaces the pattern we found in the first weeks of the project. In our teams, the fluctuation at the end of the project was not very strong. This could be due to the fact that the teams had to hand in weekly deliverables. If the team had to work for several weeks on one end-deliverable, we might see stronger fluctuations in trust perceptions towards the end of the project. Again, this needs to be analyzed using groups with different delivery patterns.

This research still has limitations. As this is a longitudinal study, it takes a long time to gather all the data. For some groups, we collected some incomplete data and had to delete the groups. Additionally, in this research, we only took Chinese and Dutch samples, so other countries are not included in the current research. In future, further investigation and analysis of trust development in a larger number of groups will be considered. We will also apply the same method to the context of other countries and try to compare the different cases and do cross-case global analysis. Investigating trust development is a new and significant branch of facilitated collaboration research. In this field, other future possible work, such as locating the background to global virtual teams, cross-cultural teams, and business teams, by embedding the latest collaboration and communication technologies and tools during the facilitation and collaboration process is also encouraged. Compared with other fields of group collaboration research, from the point of view of trust, this research field will also benefit from a better understanding of the link between human behavior and collaboration system development, business management and theoretical collaboration model building, as well as technology and system enhancement.

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Appendix 1: Survey Questions

Please rank each item on a scale of 1–5; 1 is strongly disagree, 3 is neutral, and 5 is strongly agree.

1 a) I didn't let my group down this week				
1	2	3	4	5
1 b) My group could rely on me this week				
1	2	3	4	5
1 c) My group could depend on me this week				
1	2	3	4	5
2 a) My group didn't let me down this week				
1	2	3	4	5
2 b) I could rely on my group this week				
1	2	3	4	5
2 c) I could depend on my group this week				
1	2	3	4	5

3 a) I'm confident about my performance this week
1 2 3 4 5
3 b) I'm sure I did what was expected of me this week
1 2 3 4 5
3 c) I know I performed well this week
1 2 3 4 5
4 a) I'm confident about the group's performance this week
1 2 3 4 5
4 b) I'm sure the group did what was needed this week
1 2 3 4 5
4 c) I know the group performed well this week
1 2 3 4 5
5 a) I had good intentions for my group this week
1 2 3 4 5
5 b) I wanted the best for my group this week
1 2 3 4 5
5 c) I wanted my group to succeed this week
1 2 3 4 5
6 a) The group had good intentions for me this week
1 2 3 4 5
6 b) The group wanted the best for me this week
1 2 3 4 5
6 c) The group wanted me to succeed this week
1 2 3 4 5
7 a) I did what I promised to do this week
1 2 3 4 5
7 b) I did what I said I would do this week
1 2 3 4 5
7 c) I fulfilled all tasks as we agreed this week
1 2 3 4 5
8 a) The group did what we promised to do this week
1 2 3 4 5
8 b) The group did what we said they would do this week
1 2 3 4 5
8 c) The group fulfilled all task we agreed to do this week
1 2 3 4 5
9 a) I was competent to perform my task this week
1 2 3 4 5
9 b) I could do what I was supposed to do this week
1 2 3 4 5
9 c) I was well able to fulfill my tasks this week
1 2 3 4 5
10 a) The group was competent to perform our task this week
1 2 3 4 5
10 b) The group could do what we were supposed to do this week
1 2 3 4 5
10 c) The group was well able to fulfill our tasks this week
1 2 3 4 5
11 a) I was honest with my group this week
1 2 3 4 5
11 b) I handled with integrity towards my group this week
1 2 3 4 5
11 c) I was truthful with my group this week
1 2 3 4 5

12 a) The group was honest with me this week
1 2 3 4 5
12 b) The group handled with integrity towards me this week
1 2 3 4 5
12 c) The group was truthful to me this week
1 2 3 4 5
13 a) I was open to my group about my progress this week
1 2 3 4 5
13 b) I kept my group fully informed about my progress this week
1 2 3 4 5
13 c) I told the group everything about my progress this week
1 2 3 4 5
14 a) The group was open to me about the progress this week
1 2 3 4 5
14 b) The group kept me fully informed about our progress this week
1 2 3 4 5
14 c) The group told me everything about our progress this week
1 2 3 4 5

Overall I think we have established less/more trust in our team this week:
Please explain why the trust in the team changed.

Appendix 2: Results of ANOVA Analyses

Factors	Significance (F test)		
	In total	Over time	Individual versus group
Results of ANOVA (Chinese sample)			
Risk	2.56**	2.43*	3.53^{ns}
Confidence	2.38*	2.02*	3.64^{ns}
Benevolence	3.04**	2.60**	6.57*
Competence	0.73^{ns}	0.36^{ns}	3.67^{ns}
Honesty	1.03^{ns}	0.77^{ns}	3.17^{ns}
Openness	1.96*	2.08*	0.92^{ns}
Results of ANOVA (The Netherland's sample)			
Risk	2.36*	2.66*	0.55^{ns}
Confidence	2.57*	2.95**	0.25^{ns}
Benevolence	1.99^{ns}	1.93^{ns}	2.37^{ns}
Competence	2.07*	2.33*	0.46^{ns}
Honesty	3.20**	3.38**	2.09^{ns}
Openness	0.64^{ns}	0.57^{ns}	1.07^{ns}

** Sig. < 0.01; * Sig. < 0.05; ^{ns} Sig. > 0.05

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