An Evaluation of Trust Development in Group Collaborations: A Longitudinal Case Study

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Abstract

Trust is referred to as a key facilitator in team collaborations. Evidence shows that different levels of trust are related to different qualities of team collaboration. A lack of trust development in teams presents a significant challenge in group collaboration. In this paper， we review factors associated with the establishment of trust in hybrid teams that collaborate virtually as well as face to face. Further 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. Finally, in the analysis of the experiments we describe patterns of trust development in groups from both individual and group perspectives.

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 (partially) virtual. With the development of technology, groups have started to form a new way of interaction. Electronic communication has been used to enable teams to collaborate virtually. The classical face-to-face collaboration has changed into the form of a virtual relationship using the web [1]. Virtual teams always face challenges that can lead to unproductive processes and failed efforts Due to a lack of presence and body language, such teams face problems with respect to trust.

Many studies have focused on understanding trust in virtual teams. According to the definition of trust of Hoy & Tschannen-Moran [2] and Tschannen-Moran & Hoy [3], 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, providing "internal security" and relates with the internal balance between risk, utility and payback factors that are related with decision making ability within our daily lives [4]. Trust, especially interpersonal trust, is an important concept in psychology and vital to personality development [5], and social life [6][7].

Trust and knowledge sharing play a central role in friendship development. According to what Sharkie [8] has mentioned, "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.

To study trust development in teams there is a need for a trust assessment instrument to draw on generic bases of trust as identified in the literature. In this study we're interested in trust development in teams, particularly in the facilitated collaboration teams, and the factors that are related with trust development over time on individuals collaborating in teams.

2. Types of Trust

The literature identifies various types of trust.

The first of which is "Dispositional trust". Dispositional or 'basic' trust is specific to each individual. Some people are generally more trusting than others. This type of trust is independent of any context [9], and acts as a central ingredient in the

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''healthy personality'' and is linked with individual traits [5], relating to a person's general faith in human nature, that is, a cross-situational general tendency to trust other people [6].

'Interpersonal' trust is developed from an inter-relationship between two or more persons. It is defined by Rotter [10] as, ''an expectancy held by individuals or groups that the word, promise, verbal, or written statement of another can be relied on''. Interpersonal trust is also important for maintaining the health of interpersonal relations [10].

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. For instance, a person lends his or her money to a friend because the friend is trusted to pay back the money later [7]. Other key factors of situational trust have been listed as: benefit or gain [11][12], and the utility of information [13]. A situational decision to trust may occur when there is "much to gain from trusting but little attendant risk" [14]. An important factor in this is that this trust is context specific such that A might trust B to fix his car, but not to handle his finances [9].

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" [9][15]. System Trust might relate with the banking system or a virtual community system and is therefore context dependent [16]. The formal programs and features embedded within so called 'trust-mark' brands [17], such as those used by EBay and Amazon, are often cited as exemplars of trust enabling mechanisms for virtual 'communities of consumption' [18].

Trust has been variously described as being subjective and as a phenomenon which evolves with time through new experiences and observations [19], and as assuming different characteristics at varying phases of a relationship as well as in different types of relationship [9]. Furthermore, trust is "intransitive", which is explained through the situation whereby Alice trusts Bob and Bob trusts Cathy, but it does not necessarily follow that Alice must trust Cathy, implying that the reputation of an agent (human or systemic) helps us to manage complexity.

3. Trust in Virtual teams

Trust involves vulnerability and is only needed in an environment that is uncertain and risky [8]. 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 [20].

Interestingly, the recent dramatic growth in popularity of Intenet-based social networking in sites such as Facebook, MySpace and Bebo presents an interesting 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, been shown to have an effect on the development of trust within teams and thus the team's performance [21]. Castelfranchi, and Falcone 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' [22], the balance for developing deep trust lies with social factors and the use of 'natural language' between participants [23]. Therefore, both social and technical connectivity is required for enabling knowledge exchange and high-level team performance [24].

According to Friedman et al. [25], "People trust people, not technology". Building trust in virtual teams is complicated because time and geographical distance precludes most synchronous communication [26]. DeLuca and Valacich [27] have reported that same-time-same-place communication, such as face-to-face communication, is considered as highly synchronous. Whereas different-time-different-place communication, such as e-mail and e-bulletin-boards, are of low synchronicity. Beise et al. [28] also describe that face-to-face meetings in virtual teams are needed to produce commitment, accountability, and to increase urgency. Drawing on case-based research, Lee-Kelley et al. [29] highlight that better performance in virtual teams is achieved through face-to-face meetings for team development.

Dafoulas and Macaulay [30] 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 collocated teams. A research on trust development over

time on computer-mediated teams by Wilson et al. [31] has also shown that it takes longer for trust to develop in computer-mediated groups because it requires more time for members of those groups to exchange social information. Researchers have looked for an alternative theoretical lens to understand the interplay of teams and communication media, particularly when attempting to solve business problems with little or no face-to-face communication [32].

4. General Trust factors

Based on various literature studies, we identified seven potential indicators of trust development :

4.1 Willingness to risk vulnerability

It is reported that a necessary condition of trust is interdependence, wherein the interests of one party can not be achieved without reliability upon another [33]. 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 which brings with it vulnerability may also alter the form trust takes [3]. Risk is also considered as the perceived probability of loss, as interpreted by the decision maker [34][35]. Trust is then considered as a willingness to be vulnerable under conditions of risk and interdependence [33].

4.2 Confidence

It has not appeared in the in the discussion above, however, it is stated by Tschannen-Moran & Hoy [3] that one of the early puzzles concerning trust was whether it was an individual's behavior or attitude in a situation of vulnerability. According to what Kee & Knox has reported four decades ago [14], a certain amount of confidence is the degree to which the person can be said to trust.

4.3 Benevolence

It is considered that the confidence that one's well-being, or something one cares about, will be protected and not be harmed by the trusted party is considered by many researchers the most common factor of trust in the second half of the last century [2][36][37][38][39][40][41][42][43][44].

4.4 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 [37][42]. Reliability or dependability combines a sense of predictability with benevolence and there is a sense of confidence that the need will be met. [3].

4.5 Competence

Some researchers have stated that when a person is dependent on another but some level of his skill is involved in fulfilling an expectation, and then an individual who means well may not be trusted [36][37][43].

4.6 Honesty

Honesty, which is from person's perspective is related with a person's character, integrity, and authenticity [3]. Rotter [6] defined trust as "the expectancy that the word, promise, verbal or written statement of another individual or group can be relied upon".

4.7 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 [37][43]. It is also stated by researchers that people who are unwilling to extend trust through openness will end up living in isolated prisons of their own making [45].

All these general factors of trust are summarized by researchers from different disciplines. We used these seven factors to develop a trust assessment instrument as described in the next section.

5. Measurement Instrument

To explore and understand trust development in partially virtual teams, we will evaluate each of these seven factors both from a self-perspective (I was trust worthy), and from a group perspective (the group is trustworthy) on a weekly basis. We will ask the group if in general, things changed with respect to the trust in the group, and the activities they performed that week. The results will be used to analyze if we can find patterns of trust development.

In the study we will ask student groups to rate different aspects of trust on a weekly basis during a 7 week project. Each week we ask students to rate trust on these seven factors, and whether it changed

compared to last week. Further, we ask about causes for the change in trust, and overall activities and media used by the team for that week.

We considered different criteria to develop the instrument. We asked for the name, age, nationality and group number of each participant and promised confidentiality. We measured trust from an individual trustworthiness and a trust in the group perspective, using the following questions based on the trust factors described above.

1 I didn't let my group down this week

2 My group didn't let me down this week

3 I am confident about my performance this week

4 I am confident about the group's performance this week

5 I have good intentions for my group

6 The group has good intentions for me

7 I did what I promised to do this week

8 The group did what they promised to do this week

9 I am competent to perform my task in this group

10 The group is competent to perform our task

11 I was honest with my group this week

12 The group was honest with me this week

13 I was open to my group about my progress in this task

14 The group was open to me about the progress in this task

Further we asked an open question. By asking the question we were interested in understanding the students' point of view in terms of why they believe trust has changed in their group.

Finally 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 chat, email, skype, IM, chat, phonecall, etc. Here, we also asked them to specify and elaborate on their answers.

6. Case Study

We have first tried the instrument in a university in the Netherland as a pilot study. In this stage, we only gathered results from 3 weeks in 3 groups, and the results where quite incomplete, therefore not sufficient for the real analysis. Nevertheless, we got no negative feedback on the instrument, no difficulties in interpretation or filling out the form. However, weekly commitment to fill in the questions seems quite a burden for the participants, and some incentive is therefore required to receive complete results.

Next, we applied this survey into a longitudinal case study in a university in China. There were two classes that are participating in the same module. The undergraduate students are aged from 19-20 including males and females. They are divided randomly into different groups to do the team project for 9 weeks. Each of group consisted of about five students. In total, we have 36 participants in 8 groups. In the morning class we had 5 groups, and the afternoon class we had 3 groups.

During the whole semester the students were asked to collaborate to evaluated an e-business website and to explore it's problems to finally come up with solutions and recommendations for usability improvement of the website. The students were asked to collaborate in groups to first go through a problem definition phase and then through the solution phase. The problem definition phase covered the first five weeks of the semester (the first week was an introductory session for students to learn about team collaboration). During week 5 to week 9 the students were asked to collaborate to define alternative solutions.

The groups were instructed to work collaboratively using collaboration techniques and methods from Collaboration Engineering [46]. 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 [47]. ThinkLets can be used to create patterns of collaboration such as divergence (brainstorming), clarifying, reduction (selection or elimination), organizing, evaluation and consensus building [46][48]. Each technique is scripted to describe a tool to be used in a certain configuration and with used of specific process guidance. The groups can use these techniques by themselves after short training, as they are intended to be highly transferable [46][48]. The students have been taught in lectures by the slides introducing thinkLets and also sample video of using software which is integrated with thinkLets, they have also done some practice. ThinkLets can be found in the thinkLet book [49].

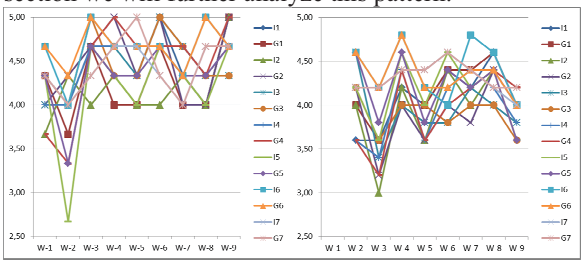
The students started collaboration by doing brainstorming initially, using FreeBrainstorm thinkLet in which they used multiple pages to explore different problem directions, and then they were asked to categorize their ideas about the problem under factors defining website usability using the PopcornSort. Then they were asked to clarify their comments in categories using BucketWalk thinkLet and then to vote using StrawPoll thinkLet. The students went through the same collaboration processes during the solution definition phase.

During the collaboration, they have used some software to support their collaboration, such as QQ Group which is Chinese group chatting software, Renren and Weibo which are Social Networking tools.

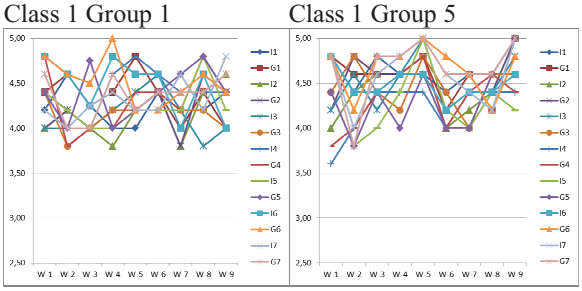
They also use mobile phones and email to communicate with each other. In addition, they had some offline meetings throughout the course. The students filled the survey each week until the 9th week when their project finished. We have successfully collected the data for each group over nine weeks and then done the analysis.

7. Results and Analysis

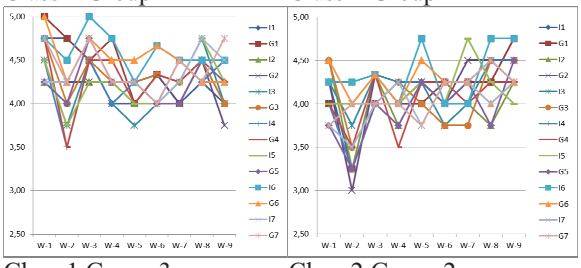
Unfortunately, students only rated the 14 factors weekly, and did not answer the overall questions. The insights about tool use are general, based on informal interviews and observation, as this was not reported by the students. We have taken the mean value of the scores for each group for analysis. Two groups did not report in the first week. The data is shown in the figure1. It shows the trust results in each group. A first observation shows a dip after the first week in most groups and a rather stable continuation of the scores with some fluctuation towards the end. In the next section we will further analyze this pattern.



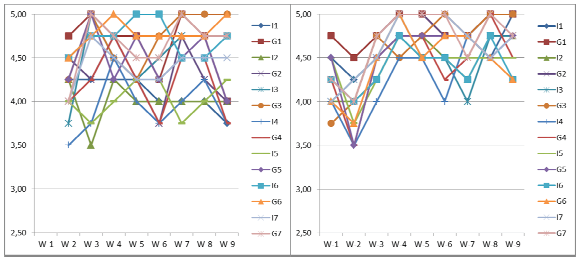
Class 1 Group 1 Class 1 Group 5



Class 1 Group 2 Class 2 Group 1



Class 1 Group 3 Class 2 Group 2



Class 1 Group 4 Class 2 Group 3

Figure 1. Results of all groups

By exploratory analysis of the trust development trend data for different groups from the perspective of individual and group, we have identified some patterns. The average trust changes across groups are also analyzed in the table 1. In table one, an average increase in trust is marked green, while an average decrease of trust is marked red. When trust scores did not fluctuate much, they are yellow. When we consider the individual perspective and group perspective, for most trust factors, we can see that the individual and group behavior is similar in the developing stages. We can also observe that overall, competence and reliability were the most strongly fluctuating factors, followed by benevolence.

Regarding the developing trend, we also find that it normally decreases first, and then increase, then it kept stable over stages, while towards the end, the groups display some fluctuation again.

This phenomenon also relates with the patterns of collaboration they went through to collaborate. As the first week was an introduction, and no performance was visible yet, in the brainstorming stage, trust decreased, while in the sorting phase, where more overview of the results was created, trust increased. When the project continued, trust remained stable over some weeks. Although from week 5 to week 6, there are some fluctuations visible, however, the changes are very small. That stage they are switching from the first round of the process for problem solving, to the second round of the process for solution finding. Finally, near the project finish stage, the trust fluctuated in different groups as an end result had to be delivered.

Table 1. Trust development over weeks

Week change	1→2	2→3	3→4	4→5	5→6	6→7	7→8	8→9
I vulnerability	-0,12	0,02	-0,09	0,07	0,08	-0,20	0,11	0,02
I confidence	0,04	-0,10	0,20	-0,09	0,11	-0,24	0,35	0,00
I benevolence	-0,33	0,32	0,00	-0,12	0,08	0,02	0,15	-0,21
I reliability	-0,61	0,46	0,13	0,04	-0,15	0,23	0,01	-0,03
I competence	-0,63	0,42	0,00	-0,02	0,05	0,04	0,21	-0,27
I honesty	-0,27	0,18	0,12	-0,26	-0,01	-0,07	0,23	-0,17
I openness	-0,25	0,35	0,09	-0,13	-0,03	0,03	0,07	0,11
Week change	1→2	2→3	3→4	4→5	5→6	6→7	7→8	8→9
G vulnerability	-0,24	0,02	-0,03	-0,14	0,10	-0,13	0,18	0,00
G confidence	-0,04	0,06	0,15	-0,13	0,03	-0,16	0,34	-0,21
G benevolence	-0,50	0,43	-0,21	-0,01	0,13	-0,04	0,25	-0,30
G reliability	-0,81	0,72	0,05	-0,11	-0,08	0,16	0,14	-0,07
G competence	-0,58	0,64	-0,24	0,04	-0,08	0,06	0,25	-0,16
G honesty	-0,46	0,38	-0,01	-0,20	0,09	-0,08	-0,07	-0,01
G openness	-0,34	0,47	-0,11	-0,03	-0,12	0,12	0,10	0,09

8. Conclusions and Future Research

This research is just a first exploratory step of this kind of case study and further case studies are planned. The instrument allows us to compare the development of trust over time with the different interaction modes and frequencies of the group. This will help us to understand in more detail how different interaction modes relate to trust, and how frequency of interaction relates to trust development. Also, we aim to map the results with the delivery dates of the projects to get an impression of the relation of performance pressure on trust development.

As the study was highly explorative, there are quite some limitations to the results. Firstly, there are some missing data; we did not get detailed information about the interaction modes and overall trust development. Further, two groups did not report in the first week. Next, it seems that more groups need to be surveyed to get a better view of trends. Third, it will be interesting to see if there is a difference in culture in both professional teams and teams from different national cultures. In addition, the measurement instrument we developed, while based on literature, has not been tested or validated in other research. The seven factors might also be extended, one suggestion is to include attentiveness as a factor in the study, and to enable statistical analysis of results, an extension of the number of constructs per factor and an instrument validation are required.

The results show some initial tentative patterns in trust building. It showed that in most groups trust decreased after the introduction week, while it increased after accomplishing the first task, or because more overview of results was created in the organizing task, enabling better assessment. We saw a lighter fluctuation in trust towards the end of the project when results were created as well. Further, a pattern that we saw emerge is that the factors reliability and competence were the most strongly fluctuating factors. These patterns are interesting and require further research. Participants seem to establish trust primarily early in the project, when they need to form a team and 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' like ice breakers, or a social/team building activity. 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 in the end of the project was not very strong. This can 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.

The work presented in this paper is an ongoing research. In future, further investigation and analysis of trust development in larger number of groups will be considered. Other data collection method such as interviews will be considered to understand more about patterns found with respect to individual and group perspective trust analysis. 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 significant and a new branch of facilitated collaboration research. A longitudinal investigation method to different cases by undertaking experiments is also preferred. In this field, other future possible work, such as locating the background to global virtual teams, cross-culture 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 a better understanding of the link between the human behavior and the collaboration system development, business management and theoretical collaboration model building, as well as technology and system enhancement.

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