Abstract

With the increasing development of information technologies, virtual teams have been playing a more and more significant role in organizational collaboration. Trust has become more and more vital in the context of mixed used in face-to-face and global virtual collaboration. There are different perspectives of trust factors in previous studies. This research attempt to analyze individual trust factors and explores new trust factors and their detailed sub-factors in business global virtual collaboration. We interviewed five people with important position in a manufacturing company in China. Through analyzing the interview data, we identified four main important factors: risk, benefit, power and effort, which have significant influence on collaboration. Furthermore, we also proposed sub-factors of each trust factors, which were associated with main factors. We also provide directions for future works.

1. Introduction

With the increasing development of technology for communication and online collaboration, many companies choose collaborative work in virtual team to improve their work efficiency. Virtual collaboration have been playing a more and more vital role in organizational collaboration [1][2][3]. In addition, the updated technology for communication and collaboration online is adopted by more and more people[4]. Collaboration support tools are important for organizations and business for sustainable collaboration over time [5]. Furthermore, China is a large manufacturing and export country in the world. So it is meaningful to investigate trust factors in global collaboration of a manufacturing company.

Trust has been playing a more and more significant role in teams to influence the collaboration. Handy [1] proposed that virtual teams not only need the information technology support, the level of trust in team is also the key to team success.

In previous studies, researchers have investigated trust from different perspectives in different contexts. Some researchers have focused on trust trends and influencing trust factors of virtual teams in business studies [32][40]. Among them, in trust development,
some scholars proposed six individual factors of trust in virtual team and the Scale Balance Model. They also investigate the development of individual trust in facilitated team collaboration [2][3]. Additionally, some scholars have proposed that factors affecting trust in virtual team also has reputation [4][8], ability [4][9], attitudes [5][10], cooperation [6][7] and so on. Nonetheless, there is a lack of the research focusing on the global virtual team, especially in company with global business context. Moreover, previous studies are limited to main trust factors, there is a lack of research on investigating their detailed sub-factors [4]. Therefore, in our research, we attempt to explore what trust factors and sub-factors have significant influence on business global virtual collaboration. In this study, we aim to answer the following research questions, (1) what trust factors have the significant influence in business global virtual collaboration? And (2) what sub-factors are associated with them?

In this research, first, in section 2 we present the background according to related literature review. Then, case study is shown in section 3. Section 4 gives the data collection of our case study. We analyze the results in section 5 and have discussion in section 6. Finally, we present the conclusion, limitation and future work.

2. Background

2.1 Trust in virtual collaboration

Trust can be defined as “The willingness of a party to be vulnerable to the actions of another party based on the expectation that the other will perform a particular action important to the trustor, irrespective of the ability to monitor or control that other party”[6]. According to Currall and Judge [11], trust represents the other positive behaviors’ confident expectation.

With the rapid development of information communications technology, global virtual environment has been used more and more[1]. Trust was selected as the single affect-based focus because it is important for team member perceptions and behaviors to their teams [12] and individuals working of virtual team [13]. Researchers have discussed an alternative theoretical lens to understand the interaction of teams and communication media, especially when trying to solve problems in business under little or no face-to-face communication situation [14]. Additionally, Beise et al. [15] have proposed that face-to-face collaboration in virtual teams are needed to produce commitment, accountability, and to increase urgency.

There are also some researchers attempting to use business model on case studies and conduct interviews to investigate trust development [4][16][17]. But the context of collaboration is generally based on local business which is not involved in global collaboration. We can see that there is lack of business studies of trust factors especially under empirical based case study and interview study in global virtual team collaboration. Therefore, in our case study, we conduct the trust case study of company on the background of global virtual collaboration.

2.2 Factors influencing trust

An analysis of trust factors study, proposed by Hoy and Tschannen-Moran [18], revealed that all of aspects covary together and form a coherent construct of trust. There are different categories of influencing trust factors from previous research [4][19][20][39]. Many researchers continue to propose additional trust influencing factors in their research in the virtual team field [4][16][21]. In addition, Wilson et al.[16] have focused on the cognitive trust and effective trust in the experiments of trust development over time in computer-mediated teams. They have identified risk and reliability
are the two critical elements for trust in computer-mediated teams.

Individual trust factor is the trust factor based on individual levels [2]. These factors represent conflicting priorities of the individual [3]. Deutsch [22] defined that trust is an expectation by an individual in the occurrence of an event such that expectation leads to behavior. The theory is also mentioned by Frost et al. [19] in trust definition. There are many trust factors, which are allocated according to different previous studies and some of them can be seen as individual factors. Reliability [24][25] could be considered as an individual trust factor. A person whether he is reliable or not, it is important to measure trust. In addition, trust is conceived as the extent to which people are willing to rely upon others and make themselves vulnerable to others [19][23]. Cooperation is measured as a behavior outcome of trust, and Wilson et al. [16] mentioned that cooperation was a binomial measure at the individual level. Reputation [18][26] could also be considered as an individual trust factor. In previous studies, it is mentioned that a reputation of trustworthiness is a valuable asset to individuals and businesses alike. A good reputation can increase the individual trust.

Additionally, Nolan et al. [3] have further deconstructed individual trust in online business communities into six components parts: risk, benefit, utility value, interest, effort, and power. Among these six factors, the higher the utility value, benefit, interest and power are and the lower the risk and effort are, the higher the degree of trust is [32]. It is also proposed that each factor is evaluated by individuals which are in relation to one or more of the others [3].

3. Case study

According to the approach used in previous studies [16][27][28], this research has chosen case study method. China is a major manufacturing country and has the largest export in the world [17]. So it is interesting to explore empirical investigation within a manufacturing company. We have investigated a case study in a large manufacturing company of China (Company A). Company A is a listed Company and a leading Chinese company in caps making industry, which consists seven subsidiaries in China. The company’s headquarters is located in Shandong Province. It is a sole professional manufacturer in China covering production and sale of aluminum Plate, printing aluminum Plate, various anti-fake and anti-theft aluminum cap, plastic cap and aluminum plastic cap, and producing full or semi-automatic production line, CNC presses, computer, carving by computer designing, cold-punching mould, and injected mould for various kinds of caps. All products are popular in both China and abroad. By these, the company has become the largest production base and distributing center for anti-forging and anti-theft aluminum caps and the largest base for aluminum Plate coating printing. The company has an important department, international trade department, which does business internationally and expands international market, such as Europe, America, Asia, Africa and Australia.

As a company with international business, Company A has a lot of requirements for global virtual collaboration between company and foreign partners. Sometimes, members in company and foreign customers also need to fly to each other’s countries to negotiate business in a face-to-face way. In addition, the members in headquarters and subsidiaries could fly to each other to have face-to-face meetings besides virtual collaboration.

International trade department is mainly responsible for arranging global virtual collaboration. There are two main kinds of virtual collaboration tools that used by the company: e-mail is for negotiating and transferring documents; and Skype is for online communication and meeting. Additionally, they
adopt a video conferencing system called Seegle to carry out online meeting (Figure 1).

![Diagram of virtual collaboration tools in Company A]

**Figure 1.** Tools of virtual collaboration in Company A

### 4. Data Collection

Our data is collected through a series of semi-structured audio-taped in depth interviews. We have visited the headquarters to conduct interviews. We identified and successfully interviewed five managers from different department, who participate in global virtual collaboration. Interview Person 1 (I1) is the secretary of president, who has four years’ work experience in the company and has experience in virtual collaboration. She is mainly responsible for company conference and preparation job.

Interview Person 2 (I2) is the executive secretary, who has eight years’ work experience in the company. She is in charge of company administration working.

Interview Person 3 (I3) is the manager of administration department, who has sixteen years of working experience. He is in charge of responsible for mutual communication and coordination of all departments and administration and logistics.

Interview Person 4 (I4) is the manager of network department, who has fourteen years’ working experience. He is in charge of controlling working of network department and managing electricity and networks.

Interview Person 5 (I5) is the manager of international trade department, who has eight years’ working experience and participates in global collaboration over eight years. He is in charge of maintaining contact with international customers and arranging global collaboration.

We have conducted in-depth interviews for all interviewees. Interview questions were designed based on the individual trust factors [4]. Each interview took about half hour to one hour due to different situations. The data from each interview will tell how their individual trust develops over time and what important factors are influencing their individual trust development over time. Some new important trust factors are found in this case.

### 5. Results

Our results are presented as a series of observations in interviews. There comments are based on their reactions to the collaborative activity.

#### 5.1 Trust factors and sub-factors

According to Nolan et al.[3], there are six individual trust factors in online business communities, which are Risk, Benefit, Utility Value, Interest, Effort and Power. Cheng and Macaulay [4] have also identified some new trust factors in their research of student context. We validated the previous six individual trust
factors in our case and three additional factors from previous research. We also found some new sub-factors in the second level which are related to them. Based on the semi-structured interviews, the initial coding interview results have been categorized into associated trust factors, including trust factors and their sub-factors. However, in our case, we found that Interest and Utility Value did not have a significant influence to trust. Risk, Benefit, Effort and Power are the main individual trust factors in this case.

5.1.1 Risk

For risk, there are three main sub-factors in this case, which are time difference, technical problem and emergency change. Teams may face more complexity when members cross multiple time zones, in large part because there are increased difficulties in scheduling and coordinating work activities[15][16][17]. As problems arise, it will increase the risk in virtual teams, thus affecting collaboration trust. The sub-factor of technical problem and emergency change will increase risk of trust. Table 1 presents more details and examples of comments.

<table>
<thead>
<tr>
<th>Sub-factor</th>
<th>Comments examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time difference</td>
<td>15: If the time difference is over eight hours, it will be difficult to arrange time and communication. 13: It is difficult to achieve time unity.</td>
</tr>
<tr>
<td>Technical Problem</td>
<td>11: The network instability will cause the communication breakdown. 12: Sometimes, the microphone is broken and the fault postpones the meeting. 13: If the server is stable and smooth, it will be fine. Otherwise, it will be a problem.</td>
</tr>
<tr>
<td>Emergency change</td>
<td>13: Sometimes, there is a sudden change of time for the meeting.</td>
</tr>
</tbody>
</table>

5.1.2 Benefit

In our case, according to the interview data, enriching experience and learning things are frequently mentioned benefits by the interviewees. Table 2 presents more details and examples of comments.

<table>
<thead>
<tr>
<th>Sub-factor</th>
<th>Comments examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enriching experience</td>
<td>15: I learned more about this things, expanded my thoughts and had more experience in handling this issue. 13: I got more experience with international customers in communication.</td>
</tr>
<tr>
<td>Learning things</td>
<td>11: I can learn more knowledge about industrial technology and improve my ability. 12: From the collaboration, I can learn more knowledge about this thing.</td>
</tr>
</tbody>
</table>

5.1.3 Effort

For effort, the sub-factors are categorized as motivation, job position and personal attitude. These factors will lead participants to dedicated more effort to the collaboration. Table 3 presents more details and examples of comments.

<table>
<thead>
<tr>
<th>Sub-factor</th>
<th>Comments examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motivation</td>
<td>13: A sense of accomplishment motives us to try our best. 14: Serious attitude towards work motivates more effort in collaboration.</td>
</tr>
<tr>
<td>Job position</td>
<td>11: One who has a higher position, it is necessary to pay more effort for works. 13: whether to pay more effort is related to specific job positions.</td>
</tr>
<tr>
<td>Personal attitude</td>
<td>13: it is important that to pay</td>
</tr>
</tbody>
</table>
efforts with a good attitude and personality.
I4: I try my best to do works due to my serious attitudes.

5.1.4 Power

In our case, power such deconstructed into positively related main sub-factors as professional skills and job position. Table 4 presents more details and examples of comments.

Table 4. Interview Comments of Power

<table>
<thead>
<tr>
<th>Sub-factor</th>
<th>Comments examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professional skills</td>
<td>I1: professional skills can affect power.</td>
</tr>
<tr>
<td></td>
<td>If one has a strong professional skill, we will trust him more.</td>
</tr>
</tbody>
</table>

Job position
I1: The higher positions, the higher power to affect others.
I2: Maybe I do not have the power because I am not the manager.

In order to better understanding the relationships between trust factors and their sub-factors in our case study, the cognitive mapping [29] method is used. All factors and sub-factors in figure 2 are positively correlated.

Table 4. Interview Comments of Power

5.2 Other Factors and Their Sub-factors

In our case study, we also validated other trust factors adapted from literatures [2][4] rather than six individual trust factors. Additionally, among these new factors, we found that the factors of motivation, cooperation and reliability have significant influence on trust. In the followings, I will analyze the three factors and sub-factors associated with them.

5.2.1 Motivation

In our case, according to the data analysis of interview transcripts, three main sub-factors, which are results of work, work attitude and rewards, are related to the motivation. Table 5 shows more details and examples of comments.

Table 5. Interview Comments of Motivation

<table>
<thead>
<tr>
<th>Sub-factor</th>
<th>Comments examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Results of</td>
<td>I1: A sense of accomplishment after</td>
</tr>
</tbody>
</table>
work     finishing works motivate me to collaboration well.
I3: The good results make us to collaboration well.

Work attitude  14: A good work attitude is the main factors for motivating our collaboration.

Rewards      11: Company will give material rewards if someone does the work well.
I5: If we accomplish the target, department have motivation policy to give rewards.

5.2.2 Cooperation

Cooperation is more associated with the factors of willingness to do, information sharing, and responsibility in our case. The more willingness to do and information sharing, it will have better cooperation. Table 6 shows more details and examples of comments.

Table 6. Interview Comments of Cooperation

<table>
<thead>
<tr>
<th>Sub-factor</th>
<th>Comments examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Willingness to do</td>
<td>14: If someone is willing to do the work, the team will cooperate well.</td>
</tr>
<tr>
<td>Information sharing</td>
<td>11: it is very important because information sharing can let others know the issue more clearly.</td>
</tr>
<tr>
<td>Responsibility</td>
<td>13: The most related is all people’s responsibility. Someone with strong responsibility will promote the cooperation.</td>
</tr>
</tbody>
</table>

5.2.3 Reliability

For our case, two main sub-factors, which are same target and ability to work, are frequently mentioned in relation to the trust factor of reliability. The same target, and good ability to work give the individuals more reliability. Table 7 shows more details and examples of comments.

Table 7. Interview Comments of Reliability

<table>
<thead>
<tr>
<th>Sub-factor</th>
<th>Comments examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Same target</td>
<td>11: If someone doesn’t have the same target, it will affect the efficiency and reliability.</td>
</tr>
</tbody>
</table>
I3: Everyone in team has the same target. It is related to reliability. |
| Ability to work | I2: He has strong ability to work; others can give him work with trust. |

6. Discussion

Based on analysis, we can conduct some findings:

First, trust factors in global virtual collaboration in company context are different from those found in previous studies in other context. In our case, we investigated a Chinese company, which has international collaboration. That is a unique context compared to previous studies. There is some difference with previous results based on British companies [3]. We also found there are different trust factors in different contexts, which has been proposed by other researchers in previous studies [3][4].

Second, according to six individual trust factors, we confirmed four key main factors in our case context: risk, benefit, effort, and power. Based on the research in individual trust development of Nolan et al. [3], we found that risk, benefit, effort and power are important in global business collaboration. Interest and utility value have little significance in trust. We also put forward theirs sub-factors. For risk, time difference, technical problem and emergency change are considered to be the key sub-factors.

For benefit, there are two main sub-factors: enriching experience and learning things. For effort, the sub-factors are categorized as motivation, job position and personal attitude. For power, it is considered professional skills and job position as the sub-factors.

Third, we found three trust factors: motivation, cooperation and reliability rather than six individual trust factors. We found that motivation, cooperation and reliability are the
key factors for trust in global business collaboration context. For motivation, results of work, work attitude and rewards, are related. For cooperation, willingness to do, information sharing, and responsibility have strong influence in collaboration. For reliability, the same target, and good ability to work can be considered as sub-factors. Among them, same target and information sharing are new sub-factors in global business virtual team. This should pay the attention to future work, especially for Chinese context.

7. Conclusion and future work

Trust is a complicated topic and is always worthwhile to study. This research mainly based on the theoretical work of Tschannen-Moran and Hoy [18], Nolan et al. [3], Adair [30], Cheng et al. [4]. This research is just a first exploratory step of trust factors and these kind of further case studies are planned.

Practically, this research has explored trust factors in global virtual collaboration through a case study of a global manufacturing company in China. As the largest world manufacturing industry country, China is meaningful to have better understanding with trust factors in collaboration in manufacturing background. By analyzing the interview data regarding the trust factors and their sub-factors which have affected individual trust in the collaboration, we have validated the six trust factors in previous research [3]. From the research, we found four important factors valid for this case: risk, benefit, effort, and power. Additionally, we also validated other trust factors, including motivation, cooperation and reliability. Furthermore, we have identified the main trust factors are associated with different sub-factors.

Theoretically, at first, this research lies in the extension of Nolan et al. [3]’s trust development research and testing trust factors in a new context. This research not only validates individual trust factors proposed by previous studies [3][13][27][30], but also suggests some new trust factors. Second, it identified the relationship between the factors and sub-factors in a further depth view. We categorized the sub-factors into its main related trust factors. In addition, we found the new trust factors and relationship models which extended the literature [3][4][16] in new context of trust factors in virtual collaboration.

Nonetheless, there are some limitations in this research. First, the models, findings and results founded in this research are limited in this special context. It has not been tested in other industry context and areas. Second, this research is a longitudinal study and this is the initial stage and not fully finished. There may be changes with the research in further data collection and analysis. Additionally, we only conducted the interviews in one company. In the future work, it will be expand to other companies and generate more findings in different stages.

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9. References


