Don’t give up the community: a viewpoint of trust development in online collaboration

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Abstract

Purpose – This paper aims to examine the development of trust during online collaboration. The purpose of the inquiry is to improve the understanding of individual trust development in longitudinal online collaboration teams.

Design/methodology/approach – The paper reveals the conclusion of a longitudinal online collaboration case study of two student cohorts over a two-year period, where each cohort is in their first year, based on a previous trust research model. However, the study is conducted in a new context through the implementation of online collaboration tools. Data is collected using longitudinal surveys and in-depth interviews.

Findings – The paper demonstrates that trust development in different online collaboration groups does not follow a particular pattern in this case study. This development is characterised by fluctuation and complexity. Trust development does not attain the ideal state discussed in previous research and trust development is different within each team. The paper provides insight into the complexities of trust development in an online collaboration environment and information system understanding.

Research limitations/implications – The paper demonstrates the findings regarding development features are context-specific and have not been subjected to testing for replication within other settings. The authors intend this for future research.

Practical implications – The observations will help team leaders to understand changes in trust. It will also aid system developers and designers to consider trust development features in future system design for online collaboration environment and tools.

Originality/value – The paper builds upon a previous trust development model but applies it to the context of online collaboration using student groups to analyse the findings over time.

Keywords Collaboration, Teamwork, Trust, Trust development, Team working

Paper type Research paper

Introduction

A commonplace feature of industry supply chains and multinational corporation operations, are dispersed work-based teams that engage people in collaborative work

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across continents (Ardichvili et al., 2003). Studies in human-computer interaction and online communities indicate an increase in the level of attention given to what people do in practice – based on the idea that humans and technology are only understood within a social context (Vicente, 2013). However, an individual’s actions are often mistakenly related with what people want to achieve (Hemetsberger and Reinhardt, 2009). This disparity between intentions and outcomes is typically exacerbated when individuals seek to collaborate in online communities (Casaló et al., 2010). This trend has meant that team members must learn to use the online tools available to them effectively. However, it appears that technical skills do not constitute the only factor enabling a dispersed team to work successfully. Of ongoing interest to researchers studying online collaboration is the effort to address a largely unresolved problem: trust (i.e. Jarvenpaa and Leidner, 1999; Piccoli and Ives, 2003; Wilson et al., 2006; Nolan et al., 2007; Rose and Schlichter, 2013).

Sustainable collaboration over time is very important for online collaboration teams (Kolfschoten et al., 2012). According to Briggs et al. (2003), collaboration technologies have been widely used to pursue sustained success within online collaboration teams. However, some collaboration in online communities fluctuates and is difficult to sustain due to poor trust development. Nolan et al. (2007) have proposed a model for individual trust in online communities and established an ideal state for behavioural characteristics. Nevertheless, trust development has a dynamic nature, particularly over time in longitudinal projects (Rose and Schlichter, 2013). However, there is little research on the development of individual trust in online collaboration teams. Therefore, our first research question is “what are the dynamic features of individual trust development in online collaboration teams over time”? This paper presents the empirical findings obtained from a study of online collaboration involving student cohorts engaged in the completion of a formal task. This study is replicated twice over a two-year period. This inquiry is based on the work of Nolan et al. (2007). Furthermore, our second research question asks whether individual trust development is the same in our case study as it is in Nolan’s ideal state.

**Theory on trust**

**The role of trust**

The literature identifies various types of trust. The first type is “dispositional (basic) trust”. This type of trust is independent of any context (McKnight and Chervany, 1996) and acts as a central ingredient in a healthy personality. It has a major impact on individual traits (Erikson, 1963) and relates to an individual’s general faith in human nature.

The second category is “interpersonal trust” (Rotter, 1967, p. 651). This type of trust develops from an inter-relationship between two or more individuals. Interpersonal trust is important for the maintenance of interpersonal relationship health.

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. A decision to trust based on situation may materialise when there is “much to gain from trusting but little attendant risk” (Kee and Knox, 1970, p. 361).

An additional category of trust, termed “system” or “structural” trust, is particularly relevant to an online environment. System trust denotes an impersonal institutional phenomenon, which is not founded on any property or state of the trustee, but rather on the perceived reliance or properties in the system or institution within which that trust exists (Lewis and Weigert, 1985; McKnight and Chervany, 1996).
Trust in online teams

Technology alone provides connectivity between micro communities of knowledge (von Krogh et al., 2000). However, a balance is necessary for the development of deep trust. This trust is determined by social factors and the use of natural language between participants (Nolan et al., 2007). Therefore, both social and technical connectivity are required to enable knowledge exchange and high-level online team performance (Kolb et al., 2008).

A number of researchers have demonstrated interest in conducting investigations into trust in online teams. This is supported by technology in various ways. Jarvenpaa and Leidner (1999) used surveys to measure trust changes over time within global virtual teams through the use of case studies. Piccoli and Ives (2003) measured trust over time within temporary virtual teams using student groups. Lewicki et al. (2006) focused on interpersonal trust measurement among virtual teams by specifying behaviour and three specific conceptualisations of psychological approaches. In the work of Wilson et al. (2006), a longitudinal interpersonal trust measurement approach was demonstrated using surveys. They concluded that face-to-face groups developed better trust than virtual teams. In relation to online business communities, Nolan et al. (2007) measured individual trust development over time and proposed a balance model. In a facilitated collaboration teamwork perspective, Cheng and Macaulay (2008) measured trust development over time for online student collaboration groups using a spider diagram. A trend of minor changes was revealed. In terms of social networking service, Sarker et al. (2011) revealed the trust and performance present in different models in global virtual teams using the social networking approach. Cheng and Macaulay (2013) investigated trust in online collaboration teams by focusing on trust factors and the relationship among their sub factors. Through the use of a longitudinal interpretative case study, Rose and Schlichter’s (2013) research measured dynamic accounts of trust for longitudinal project teams in which trust suffered breakdowns but later recovered. Jarvenpaa et al. (2004) concluded that individual trust will affect virtual teams differently in different situations. The results of research exploring trust in online teams can vary due to different purposes, settings, case studies, approaches, and contexts.

Dynamic accounts of trust

The development of trust in online teams can be either static or dynamic. However, in terms of progress over time, most trust development within online teams is dynamic rather than static. Some scholars have recognised this characteristic. Kanawattanachai and Youngjin (2002) conducted a preliminary investigation of the dynamic nature of trust within high- and low-performing online teams in terms of cognitive and affective dimensions. More recently, Rose and Schlichter (2013) investigated trust development in the implementation process for a longitudinal hospital project through the use of interviews. They intended to manage the dynamic trust relationship by developing two approaches: decoupling and re-engaging. Trust relations suffered various breakdowns during the project, but the project finally recovered.

In trust development, influence factors are significant (Cheng and Macaulay, 2013). Trust plays a pivotal role in the reduction of complexity, providing internal security, and determining the dynamic balance among risk, utility, and payback factors that affect decision-making ability in our daily lives (Abdul-Rahman and Hailes, 2000). Trust development research also highlights the problem of risk (Lewicki and Bunker, 1996; Wilson et al., 2006). Kollock (1996) also determined that risk and trust are
dynamically related for an individual’s perceptions of risk within a range of community-based contexts. In the category of situational trust, key factors in the development view are benefit or gain (Lewicki and Bunker, 1996; Tan and Thoen, 2003), and the utility of information (Shapiro and Varian, 1998). The factors of interest, power, and effort have also been considered as important factors for trust in collaboration (Moxon, 1993; Dyer, 1995; Cheng and Macaulay, 2013).

Additionally, in Nolan et al.’s (2007) research, six individual trust factors were categorised together according to the literature. They also measured their development in four interactive pairs in balance over time in online communities. The six factors are presented in their research as: risk (R) – associated with the provision of information to unknown recipients and action taken upon information received from them; benefit (B) – an overall perception that involvement will result in individual gain; utility value (U) – indicated by high information quality such that it can be absorbed into immediate practice; interest (I) – indicating an inherent interest in the system and the information available; effort (E) – which is exerted to acquire information; and power (P) – an individual’s ability to influence others using their superior knowledge and/or access to information.

Nolan et al. (2007) found that their development was dynamic, ranging from initial participation to full participation, and made note of an ideal state for the development trend. This was presented as the individual trust development model.

Trust development model

Upon consideration of the aforementioned literature, the model proposed by Nolan et al. (2007) is the most appropriate to answer our research questions. For this reason, we use this model in our work. This model can be used to investigate the individual trust development by the creative view of trust balance pairs changing over time focusing on the six individual trust factors identified earlier.

Nolan et al. (2007) proposed that each of the above six factors be evaluated with relation to one or more of the others in a type of balance. Therefore, in their work, they investigated and finally generated four interactive balance pairs based on their research analysis. The four pairs were presented as “U vs R”, “U vs I”, “P vs I”, and “B vs E”. For example, the cognitive utility value is always increasing and influencing risk, which is always decreasing over time. The development of this balance pair is one of their concluded ideal states. The changing balance of the four pairs over time was shown to be interactive. In their longitudinal research, they also analysed trust development at three stages over time: “no participation”, “partial participation”, and “full participation”.

If certain factors outweigh their counterparts, it is posited that individuals are more likely to collaborate in an online community. In Figure 1, the conditions for the three levels of collaboration are illustrated. The lowest rectangle depicts low participation, in which the risk of sharing outweighs the utility value of the information, interest outweighs utility value, interest outweighs power, and the effort exerted in obtaining the information outweighs its perceived benefit. The conditions for full participation, depicted in the top rectangle, are the direct opposite. If each condition set is notionally held in equal balance, individuals will be undecided and likely to participate, albeit without undue commitment. The individual trust model takes cognisance of people’s engagement in reflexive internal conversations (Archer, 2000) – continual self-monitoring in relation to goals, emotional reactions to this self-perception, and the compromises we reach as a result. As such, the model attempts to depict sensemaking
(Weick, 1995), in which sense usually refers to people’s understanding of a situation (Vlaar et al., 2008). Thus, at any particular moment in time, the variables of the balancing factor among the individual variables are determined by the vicissitudes of cognition, affects, and aims. These emerge simultaneously to interact and develop sense, which the actors confer to the project (Garreau, 2009).

**Research method and data collection**

We have adopted a case study research approach in this work. A case study is considered an ideal methodology when a holistic, in-depth investigation is required (Feagin et al., 1991). A case study is often used to answer research questions such as “how” and “why” (Yin, 2009). Case studies are also useful to expose details which data collection and analysis methods are known to hide (Stake, 1995). This applies whether research is experimental or quasi-experimental.

This research is exploratory and will develop an understanding of how individual trust develops over time in the context of online collaboration teams. According to Tellis (1997), multiple cases could strengthen results by replicating pattern matching and increasing confidence in the robustness of the theory at hand. Thus, in our research, the use of two cohorts of students in two academic years allows for the replication of the findings within this context. Peterson (2001) has mentioned when using students as a research subject, researchers should be cautious in generating universal principles, as students are more homogeneous. However, in our study, the participants are required to have the same purpose and a similar background to finish the collaboration tasks together. Thus, we expect to group homogeneous participants in student groups. Furthermore, as our study is the exploratory stage of a longitudinal project, we decided to use student cases. In addition, students undertaking a group
project are frequently used as a sample for researchers testing or evaluating techniques and models in online collaboration research (Kwok and Ma, 1999; Ma, 1996; Kwok et al., 2007; Richards, 2009). In trust research, many researchers have used student samples to conduct research in the background of virtual teams and online communities (e.g. Jarvenpaa and Leidner, 1999; Piccoli and Ives, 2003; Jarvenpaa et al., 2004; Wilson et al., 2006).

In this research, we have chosen two cohorts of first year IT Management for Business undergraduates over two academic years at a UK university. These two cohorts are very similar sub-cases that could also be considered a subset that represents a bigger case. After study of the first cohort of first year students in the first year of our study, we replicated the same study in the second year of our study with another fresh first year undergraduate student cohort. The purpose of this process is to obtain further data, as well as validate the findings using independent groups to provide more accurate results. The use of small groups is typical for the study of online teams (Goggins et al., 2011). Additionally, in Goggins et al.’s (2011) research, it was reported that, in the online community field of research, more studies have focused on semi-virtual teams than on completely online environments (Wilson et al., 2006). Thus, in our work, we have decided to conduct this case study in a semi-virtual online collaboration environment.

In our study, each of the cohorts consisted of eight student groups, each containing six students. In total, over the two years, 16 groups and 96 students participated. All participants were motivated to participate due to course credit requirements. The cohorts were tasked to evaluate and complete a real web-based project during an IT laboratory session using a collaboration process over the course of the academic year. This collaboration process was designed in accordance with Briggs and Vreede (2001) and Kolfschoten and Vreede (2009). GroupSystems™ (ThinkTank) is a tool that can be used for group support in web-based collaboration (Kolfschoten et al., 2012). We have chosen ThinkTank as the online collaboration platform. The platform allows each group to create sessions, and complete collaboration work such as brainstorming, categorising, and voting. The students were all novices with regard to this software at the outset of the team project.

Data collection
The purpose of this research was to assess levels of trust over time. The data were collected using a combination of a survey and semi-structured interview. An online collaboration session was completed once a week. Our surveys were conducted at three points during the academic year: at the beginning of the first semester, before the Christmas holidays, and at the project’s completion at the end of the second semester. An individual student would complete three surveys per year, with the sequence being repeated the following year with the next cohort. Anonymity was also applied in the survey (Bragge et al., 2007).

The survey (see Appendix) was designed to ascertain the participant’s position regarding the six trust factors. A participant was required to respond to the statements using a scale of 1-5, with 1 representing the strongest disagreement and 5 representing the strongest agreement. An individual’s scores for each statement were aggregated to compute a single score for the factor, which was then averaged. The individual’s values were then averaged to indicate the mean value of their group (see Tables I and II). This method is in accordance with previous survey research evaluating trust value over time (Jarvenpaa and Leidner, 1999; Wilson et al., 2006; Piccoli and Ives, 2003).
The survey mean results for the two cohorts in the test groups are provided in Tables I and II.

The three values under each factor indicate the mean values at the beginning, middle, and end of the project. For example, the risk factors during the three stages for cohort one Group 1 were 2.2, 2.7, and 2.8.

We have created two trust development models by comparing the mean values of the groups during the three stages. These models are illustrated in Figures 2 and 3. It is seen that the two trust balance models for the two very similar cases, each containing eight groups, do not follow a particular pattern. Instead either the same development trend or the reverse trend at all stages is seen, although a few balance pairs maintained the same status between some stages.

A total of 20 semi-structured interviews were also conducted in the two cohorts. These interviews were conducted orally and taped. Monetary compensation was provided as an incentive to the interviewees. The interview questions were designed according to Adair’s (2004) team-building theory and individual trust factors (Nolan et al., 2007). An individual’s interview was conducted for 30 minutes to an hour.

Data analysis
The trust development model illustrates the development trend of the six trust factors. The data obtained using the survey were analysed by group and inserted into the trust balance model. We have performed analysis for all of the 16 groups in this case study. In this paper, we have used three samples as examples. Sample 1 is shown in Figure 4. Sample 2 is shown in Figure 5, and sample 3 is shown in Figure 6.

<table>
<thead>
<tr>
<th>Group</th>
<th>Risk</th>
<th>Benefits</th>
<th>Utility value</th>
<th>Interest</th>
<th>Effort</th>
<th>Power</th>
</tr>
</thead>
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<td>3.6-3.6-4.0</td>
<td>29.3-36.4-1</td>
<td>39.3-34.3-9</td>
<td>43.3-38-39</td>
<td>27.2-29.26</td>
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<td>4.0-3.5-4.2</td>
<td>35.3-33.3-5</td>
<td>40.3-35.4-3</td>
<td>41.3-36-42</td>
<td>33.3-31.25</td>
</tr>
<tr>
<td>3</td>
<td>2.2-2.1-2.5</td>
<td>4.0-4.6-4.3</td>
<td>37.3-37.3-9</td>
<td>42.3-43-40</td>
<td>43.4-42-48</td>
<td>26.29-3.33</td>
</tr>
<tr>
<td>4</td>
<td>2.6-2.4-3.0</td>
<td>3.8-3.7-3.8</td>
<td>35.3-34.2-4</td>
<td>40.3-39-34</td>
<td>36.3-38-42</td>
<td>28.25-2.33</td>
</tr>
<tr>
<td>5</td>
<td>2.3-2.6-2.3</td>
<td>3.2-3.5-4.7</td>
<td>34.2-39-4.7</td>
<td>36.3-36-43</td>
<td>37.3-38-50</td>
<td>27.29-3.63</td>
</tr>
<tr>
<td>6</td>
<td>2.5-2.0-3.0</td>
<td>3.6-4.1-3.6</td>
<td>35.3-39-3.9</td>
<td>38.4-41-3.4</td>
<td>39.4-0.37</td>
<td>29.24-2.83</td>
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<tr>
<td>7</td>
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<td>4.3-4.6-1.7</td>
<td>42.4-2.2-7</td>
<td>41.4-4.2-25</td>
<td>43.4-5.0</td>
<td>24.3-3.40</td>
</tr>
<tr>
<td>8</td>
<td>2.1-1.9-2.5</td>
<td>3.7-3.8-3.8</td>
<td>37.3-4.4-3</td>
<td>38.4-0.47</td>
<td>44.4-0.47</td>
<td>25.2-7.33</td>
</tr>
</tbody>
</table>

Table I. Case 1 (first-test cohort) results for all stages

<table>
<thead>
<tr>
<th>Group</th>
<th>Risk</th>
<th>Benefits</th>
<th>Utility value</th>
<th>Interest</th>
<th>Effort</th>
<th>Power</th>
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<td>3.8-3.6-4.2</td>
<td>40.3-34-3.9</td>
<td>40.3-36-4.0</td>
<td>28.3-6.42</td>
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<td>45.3-7-2.7</td>
<td>44.3-5.3-3</td>
<td>46.4-7.29</td>
<td>27.3-3.25</td>
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<td>2.1-2.3-2.8</td>
<td>4.3-3.3-3.4</td>
<td>40.3-1-3.2</td>
<td>37.3-3.3-3.5</td>
<td>43.3-6-3.8</td>
<td>28.3-3.28</td>
</tr>
<tr>
<td>12</td>
<td>1.6-1.5-2.2</td>
<td>4.9-3.2-4.4</td>
<td>50.3-0.4-0</td>
<td>48.4-3.3-8</td>
<td>47.4-5.43</td>
<td>26.3-3.28</td>
</tr>
<tr>
<td>13</td>
<td>1.6-2.6-2.6</td>
<td>4.4-4.2-4.3</td>
<td>41.4-2.3-9</td>
<td>38.3-8-40</td>
<td>41.4-5.39</td>
<td>22.4-3.33</td>
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<tr>
<td>14</td>
<td>2.1-2.6-2.6</td>
<td>3.8-3.5-3.7</td>
<td>43.3-3-3.5</td>
<td>40.3-6-3.6</td>
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<td>42.4-1.4-3</td>
<td>42.4-5.43</td>
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<tr>
<td>16</td>
<td>1.8-2.1-2.3</td>
<td>4.0-3.4-3.7</td>
<td>35.3-5-3.4</td>
<td>37.3-3-3.7</td>
<td>35.3-5-3.9</td>
<td>1.8-2.5-2.9</td>
</tr>
</tbody>
</table>

Table II. Case 2 (second-test cohort) results for all stages
Sample 1
In the initial stage, the utility value outweighed the risk. The participants felt that they had acquired more utility value than risk, such as “in the beginning you get more value”. However, participants felt that there was more interest than utility value. An example was “At first it was interesting because I did not know any of the group members”. At the same time, power was seen to be weak in the initial stages, such as “initially I found it hard to encourage people”. The initial effort expended by the participants was higher than the benefits they accrued, as one person stated: “I did put in more effort in a sense to try and get the team to build their skills and knowing each other, communicating with each”.

In the middle stage of the study, the balance of utility value and risk and that of utility value and interest remained the same. However, the balance of power and interest had equalised by this stage, as some noted: “I’ve increased it because in the other groups I’m like the leader who organises the meetings”. However, benefit increased, whereas effort decreased, possibly as a result of improved skill levels: “I have got leadership skills and communication skills”.

As the study ended in the final stage, with the assignment deadline looming, all of the balances changed. Utility value and risk both increased and were in equilibrium. Interviewees made comments such as the following: “trying to overcome the problem of motivation; people not contributing work”. Conversely, interest appeared to wane for reasons such as the following: “when we had quite a lot of work building up for the courses and that’s when I felt like people weren’t giving this project enough”. At the same time, power also increased: “I think skills have improved by my ability to
influence people and motivate people”. The balance of benefit and effort reverted to its initial state, with benefits decreasing and effort increasing.

Sample 2
In the initial stage, the balance of utility outweighed risk and interest outweighed power. The participants provided similar reasons as seen in sample 1: “we were put into the group work; definitely learnt a lot of skills”. However, the perceived utility value was higher than interest in this group. This cohort also differed from sample 1 in that there was an equal balance of benefits and effort. They gained benefits at the beginning, as described in the following statement: “my networking skills have improved at the start of the semester”.

In the middle stage, the utility and risk remained the same, with neither factor displaying any increase or decrease. The interest appeared to increase at this stage and outweighed the utility value. The reasons given were, for example: “it was really interesting working with team members”. The power was seen to increase in comparison to the interest, enabling equilibrium, although the mean score for both factors displayed increases: “slightly more confident because working in a team you have to develop on your confidence and my team members helped me with that a lot”. The balance of benefits and effort remained the same, with both factors displaying increases in their mean scores: “communicating or people giving me the confidence to talk whereas in a team”.

The balances also changed during the final stage. The utility value decreased, whereas risk increased: “communication was another important thing”. The interest
also declined at this stage, causing it to be in equilibrium with the utility value. Similarly to sample 1, the power increased, with similar reasons being indicated: “I have strengthened my ability to persuade others with the group work”. The balance of benefits and effort also changed, with group members indicating that they were expending more effort during the final stage: “I put a lot more effort in the later stages once we knew exactly what we were doing”.

**Sample 3**

The participants perceived greater utility value than risk during this stage, whereas they perceived more interest than power at the beginning of the project, which is similar to the previous samples. The evidence obtained, for example: “learnt communication skills” supported this observation. In addition, the subjects also had the same perceptions of U vs I. At the same time, they perceived more benefits than effort during the initial stage: “I have developed my team management skills and contacting everybody and also there may be presentation skills”.

In the middle stage, this group was subjected to different conditions than the previous samples. The utility and interest were the only factors to remain the same, with some participants stating: “we were all confused and we didn’t know what to do”. This also reflected participants’ loss of interest. Power outweighed interest during this stage, as students “obtained different ideas and different knowledge”. The balance of U and R reversed so that risk now outweighed utility: “somebody doesn’t do their work”. The balance of benefits and effort also reversed, with effort outweighing benefits. This
lack of balance was also evident by the interviews: “employee event presentation reports, that was the busiest time”.

In the final stage, the balances changed again. The utility value increased, developing equilibrium with risk. Although risk was still increasing, encompassing such activities as “building a web site”, the utility value was also increasing during this stage, as participants “gained more skills, particularly communication skills” towards the end of the project. However, “U and I” remained balanced, with both increasing rather than decreasing as in the previous stage. A participants’ perception of power increased during the middle as opposed to the final stage. Finally, interest grew, eventually outweighing power. In contrast to the previous two sample groups, most effort was expended during the middle stage: “I have learnt a lot from doing the report”.

**Trend analysis**

An overall trend analysis was performed in Tables I and II, using the six trust factors, by taking the average score for each trust component in all groups at each stage of the project. The results are plotted in Figure 7.

The trends seen in Figure 7 display notable changes in the actions and perceptions of students across the 16 groups. The perceived levels of benefit, utility value and interest fell by 4, 3, and 5 per cent, respectively, whereas risk increased by 33 per cent, effort increased by 3 per cent and power increased by 12 per cent. From these measures, it appears that the beneficial aspects of the online community tool decreased, whereas the ostensibly negative aspects increased. The power is the only anomaly, as it
Don’t give up the community

Figure 6. Trust development in Group 15

Figure 7. Graph showing the trend of trust components for all groups
increased by 12 per cent. Power can be either a positive or a negative factor, depending upon its roots and the motives of those holding it. We now proceed to discuss each of the above factors in relation to our findings.

**Benefit**
In this context, benefit relates to an overall perception that involvement will provide individual gain. The perceived benefit gradually increases as the individual learns how to use systems and becomes familiar with tools. The perceived benefit decreased by over 12 per cent between stages 1 and 2 before levelling out for the remainder of the project. Once individuals believe that they understand a task or project, the perceived benefit will decrease. It appears that the effort expended in using the system in question generally outweighed the benefits.

**Effort**
Commensurate with the comments relating to benefit, individuals believed that the effort required using the system actually increased (by 3 per cent) as the project progressed. This finding is strange when analysed independently, as it would generally be assumed that once a system has become familiar, it would become easier to use and therefore require less effort. However, when positioned as a balancing factor with benefit, the reasons become clear; i.e. with the prospect of the accrual of only marginal benefits from an action, the action itself becomes a chore.

**Interest**
Interest declined during the course of the project by 5 per cent. As indicated previously, the system had a certain utility value because of its compulsory status within the project. Students may have adopted suboptimal behaviour for information and knowledge transfer and capture as a reaction to the system’s marginal benefit and the effort required for its use. It is widely accepted that the transfer of rich and tacit information is notoriously difficult or even impossible using online tools such as those addressed in this study. A user will quickly perceive these limitations, and interest will decrease as a result.

**Risk**
The overall perceived risk increased by a substantial 33 per cent over the course of the project. In Group 7, this risk increase was particularly high as they encountered storming and norming problems during the second phase of the project. In Group 3, perceived risk increased during the final phase, as reports were made that team members were working to different agendas or becoming demoralised. In cases such as these, in which groups are either unable to bond or are beginning to disintegrate, doubt will clearly surface regarding the intentions of fellow team members and information sharing will decrease.

Although not explicitly identified within the data, an additional reason for the increased sense of risk exhibited across all groups may be found in the context of this student-focused inquiry. The sharing of knowledge within student teams, whether virtual or co-located, can be a fickle exercise. As Barnes (2001) reports, in online work groups, particularly student work groups, work is often organised without strong predetermined rules or central authority. The participants in such teams are mutually susceptible and may lack the sufficient maturity to remain on task, in a sense, sacrificing the self for others.
Power
Individual power exhibited an overall increase of 12 per cent, although this was achieved almost entirely by the second phase. Within this context, it appears that persuasive power was developed and used. In terms of French and Raven's (1959) power types, some interview data indicates instances of expert power and referent power: “I have strengthened my ability to persuade others with the group work”, “I've increased it because in the other groups I'm like the leader who organises the meetings”.

Utility value
The utility value decreased by 5 per cent overall. However, the context is very important. Mandatory use of a system for virtual teams will maintain its utility value but limit its potential. The natural language used between participants on Facebook, studied in the coat-tailing project, which was framed within a finite period and with a clear end point, presents a completely different context for this model (Nolan et al., 2007). Previous studies' business context was in a continuous, longitudinal exchange of information.

Discussion of findings
The trust development balance model used to analyse the 16 groups within the two student cohorts in this case study, obtains the following findings.

Trust development within online collaboration teams is characterised by fluctuation
This feature was evident in all of the groups in this case study. In terms of not only the individual groups but also the student cohorts, the trust factors fluctuated across stages and the balance of trust development increased and decreased during the stages in no particular pattern. This result is also compatible with the findings regarding dynamic fluctuation of trust observed by previous researchers (e.g. Lee and Moray, 1992; Mayer and Davis, 1999; Rose and Schlichter, 2013).

Trust development within online collaboration teams is characterised by complexity
In our study, we have found that trust development is complex, as previously proposed in (Laeequddin et al., 2010). This complexity can be deconstructed into the following features: repetition, which is the value of trust factors, could be increased and then decreased; dormancy, which is the capacity of trust development to be dormant or static at a certain stage; similarity, which means that with regard to development within different teams, some trust factors could be similar at a certain stage; diversity, which means that there are various trust development patterns but a particular pattern is not followed; and stability, which means that although there are trust changes over time, in general or for different groups, there are no significant changes in value and trend such as a change from a value of 1 to a value of 4. For most groups, the value of the change was no larger than 1 point.

Trust development in online student collaboration teams is different from the ideal state of online business communities
In this research, we have used the model of Nolan et al. (2007) for trust development in a new context, for which we have chosen student groups. Nevertheless, we found that with regard to both overall and individual group trust development, the trust balance model is not equivalent to that which Nolan et al. (2007) proposed as the ideal state
model of online business communities. This divergence could also be explained by the research of Jarvenpaa et al. (2004) since these two contexts are different.

Trust development is different within different online collaboration teams. We have found that trust development is different in different groups. No two groups exhibit exactly the same development trend, although some aspects may be similar. This finding indicates that trust development is different within different teams. Although the experiment and case settings are the same for all of the groups, because of the differing backgrounds of the participants and other impact factors (e.g. Cheng and Macaulay, 2013), teams could be similar but not the same. Each team is unique. Thus, the results for the various teams are different. This result could also explain why the trust development within two cohorts, which is an average of that within the cohort teams, is different.

Conclusion
In this study, we have conducted a longitudinal case study of individual trust development within online collaboration teams. We have adapted the trust development balance model of Nolan et al. (2007) in our study, and used it as a model for trust development in a new context. In this research, we used 16 student groups to collect data, of which eight groups constitute the first student cohort and the other eight groups constitute the second student cohort. The data has been collected using longitudinal surveys, as well as in-depth interviews. In our research, we aim to answer the two research questions proposed at the beginning of the paper. In response to the first question, we have ascertained the development of trust's dynamic features: fluctuation and complexity. We further deconstructed complexity into repetition, dormancy, similarity, diversity, and stability. In answer to our second research question, we found that trust development within online collaboration teams in our specific context, student teams, could not match that found in the ideal state shown by Nolan et al. (2007). Furthermore, we found that trust develops differently within different teams.

Theoretical contribution
We have extended the model proposed in Nolan et al. (2007) to a new context: online student collaboration teams. Nolan’s model is developed specifically in terms of online business communities; thus, it may have limitations in terms of its use. We have tested this model in our research context and validated that the ideal state of Nolan’s model is not attained in our context. Nonetheless, this finding supports the work of Jarvenpaa et al. (2004), which has indicated that trust development differs in different situations. Furthermore, regarding student participants on different teams, trust development is different because each student group is different.

We have also contributed to the current understanding of trust in information system research. Our research on trust contributes to that on the second category of trust, “interpersonal trust” (Rotter, 1967). This category has inspired significant scholarly research (Jarvenpaa and Leidner, 1999; Jarvenpaa et al., 2004; Wilson et al., 2006). In addition, our research also contributes to research on the third category of trust, “situational trust”, in that it has investigated trust development in local semi-virtual collaboration work but not trust with regard to other work. Our trust research is also different with other types of collaboration situations, such as global cross-cultural teams (Jarvenpaa and Leidner, 1999). The same is the case in the context of Nolan et al. (2007), which is related to the online business community but not
personal life. At the same time, our research contributes to research on the fourth category, “system trust” (Lewis and Weigert, 1985; McKnight and Chervany, 1996). Our research context has been limited to the use of our chosen “ThinkTank” online collaboration system rather than another context, such as Rose and Schlichter’s (2013) Enterprise Resource Planning (ERP) system. In our case study, the collaboration process, which was developed in accordance with Briggs and Vreede (2001), was also used to facilitate the collaboration.

In addition, our research contributes to trust development research of online collaboration teams. Our research used the case study approach (Rose and Schlichter, 2013; Cheng and Macaulay, 2013) by using surveys to measure trust development (Jarvenpaa and Leidner, 1999; Piccoli and Ives, 2003) and is similar to the three stages survey used by Wilson et al. (2006). Our study also used interviews with the participants after collaboration (Nolan et al., 2007; Rose and Schlichter, 2013). However, our research findings are based on our specific context, which is different from Jarvenpaa and Leidner’s (1999) global virtual teams, as well as Piccoli and Ives’s (2003) temporary virtual teams. In addition, our context is different to the comparative approach of Wilson et al. (2006), the social networking viewpoint of Sarker et al. (2011), and the ERP longitudinal industry project implementation context of Rose and Schlichter (2013). In our findings, the dynamic feature of trust development is similar to Rose and Schlichter’s (2013) research, in which trust fluctuates during the longitudinal period, but has a different focus. We focus on trust development rather than trust management solutions. The findings regarding complexity could also be linked to and explained using Cheng and Macaulay’s (2013) online collaboration research of various trust impact factors. This conclusion, that trust development within different teams is different, also validates the research of Jarvenpaa et al. (2004).

In addition, this research provides clues from the trust development view for sustainable online collaboration process design, such as in the work of Kolfschoten et al. (2012).

Practical implication
Practical implications of this study are very clear and positive. First, the study can strengthen the self-confidence of participants and leaders in the online community, as trust development is different from team to team and does not follow a particular pattern. This result offers possibilities for facilitators and team managers in various fields. Second, the study will have a practical implication for group leaders in their monitoring of trust changes to perform trust control and interventions in organisations and companies. Trust is characterised by various trends that could be changed using particular interventions or other efforts. Finally, the study will motivate system and software developers to design and consider trust monitoring and management in the future through an understanding of trust development.

Limitations and future work
This research also has limitations. For example, the student context may not be applicable to other contexts, and our findings were not validated in other cases. Our context is semi-virtual collaboration and involves individuals with the same background, which is another limitation. Additionally, we have not measured trust development relating to other aspects such as performance. However, these limitations are the subject of future work. It will also be informative to include more case studies to validate our findings in other contexts, such as cross-culture global teams and

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purely virtual teams. Another suggested direction could be to investigate design
research of online collaboration processes and systems through emphasis on trust
development.

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**Further reading**


Appendix. Trust Evaluation Survey

The Purpose of this Survey is to evaluate the individual trust development in teams.

Please choose value scale from 1 to 5, 1 = strongly disagree, 3 = neutral, and 5 = strongly agree. Please consider each statement separately. To what extent do you agree or disagree with the following statements:

Part A:
1. I am unhappy to provide information to other team members.
2. I am unhappy to receive and act upon information from other team members.
3. The physical environment has limited the ability of the team to collaborate.
4. Resource problems have limited the ability of the team to collaborate.
5. The lack of background knowledge of others has limited the team performance.
6. The lack of skills of others has limited team performance.
7. Team members have different perceptions of the problem being investigated.
8. Different perceptions of the problem has limited team effectiveness.
9. Some team members are unwilling to compromise.
10. There isn’t a good team spirit in my team.
11. I don’t like the anonymity feature of Think Tank.
12. Anonymity caused some problems in collaboration within my team.
13. I feel that some team members want to dominate the group.
14. I found it difficult to make a contribution to the team.

Part B:
15. I am satisfied with being involved in my team.
16. I share the same objectives with others in my team.
17. I share mutual benefits with others in my team.
18. I have gained some networking benefits from the team collaboration.
19. I have gained some personal benefits from the team collaboration.
20. I have gained benefits which can be used for future projects.

Part C:
21. I have gained high quality information through team collaboration.
22. I absorbed the information gained through my team collaboration.
23. What I learned from group collaboration can be put into immediate practice.

Part D:
24. I am interested in collaborating with others in my team.
25. I have an interest in the information shared with other team members.
26. I have an interest in the contribution made by other team members.
27. I share social interests with members of my team.
28. I have an interest in the topics of my team collaboration.
29. I want to continue working with my team in the future.

Part E:
30. I have made a significant effort to obtain information and make a contribution.
31. I have made a significant effort to help the team achieve its goal.
32. By making more effort I can help the team achieve better results in future.

Part F:
33. I have a superior knowledge compared with others in my team.
34. I have a superior access to information compared with others in my team.
35. I have the ability to influence others in my team.
36. I have improved my abilities to influence others through working in the team.

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