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TRUST AND TECHNOLOGIES: IMPLICATIONS FOR INFORMATION TECHNOLOGY SUPPORTED WORK PRACTICES

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ABSTRACT

In this paper we empirically investigate the concept of trust using organizational work practices in three groups: within the team, between teams and when interacting with technology. This study adopts Repertory Grid methodology as an interview based technique to elicit important constructs of trust to team members working in two organizations within the energy distribution industry. Thirteen key constructs of trust were identified using content analysis. Drawing on the understanding gained, this paper discusses the implications for theories on trust within teams working with information technology and provides a grounded perspective that could be used as a basis for further research.

1. INTRODUCTION

It is wildly acknowledged that the presence of "trust" is one of the main conditions for effective cooperation among individuals, groups and organizations (Kramer & Tyler 1996; Rousseau, et al., 1998; Miles & Snow, 1995; Snow et al, 1992). The recent advances in information technologies have helped organizations to apply such technologies in innovative ways for supporting work practices in organizations (Slevin, 2000). Such work practices represent a complex blend of human actors and technological systems, where individuals can accomplish tasks and interaction through technological systems that they could not otherwise achieve. It is not clear how organizational members in such complex settings conceptualise trust and with what or whom they can meaningfully speak of building trust relationships.

Much of trust research has recently been initiated, with the potential to produce scholarly understanding of various IS phenomena such as IT enabled virtual teamworking, inter-organizational alliances (Meyerson et. al.,1996; Jarvenpaa & Leidner, 1998; Nandhakumar & Baskerville, 2001) and business-to-business e-commerce alliances (McKnight & Chervany, 2001). A better conceptualisation of the notion of "trust" in organizational settings is however required to enrich our understanding of this complex phenomenon.

This study aims to gain a rich understanding on how organizational members in volatile organizational settings conceptualised trust. Repertory Grid methodology (Kelly, 1955) is used as an interview based technique to elicit constructs of trust in two organizations. Thirteen core constructs were elicited. Differences were found; both within and between the three groups according to participants' scored level of trust for each group. The understanding gained is used to outline implications for theories on trust within and between teams working with information technology.

2. THE CONCEPT OF TRUST IN ORGANIZATIONS

Recently, the concept of trust in organisations has gained increasing attention from management researchers (e.g. Mayer, Davis and Schoorman, 1995; Kramer and Tyler 1996; Rousseau, Sitkin, Burt and Camerer 1998) and computing human factors researchers (e.g., Friedman, Kahn, & Howe, 2000; Olson & Olson, 2000). Trust is often seen by researchers as the most difficult concept to handle in empirical research because of the diverse definitions used in each discipline and the multitude of functions it performs in society (Misztal, 1996). Rousseau et al. (1998:394) therefore claim that there is "no universally accepted scholarly definition of trust".

Many researchers perceive trust in terms of individuals' expression of confidence in others' intention and motives (eg Deutsch, 1958). This viewpoint attributes trust to an interpersonal relationship, as Friedman et al. (2000: 36) claim: "People trust people, not technology". More recently however, researchers perceive trust in terms of optimistic expectation of behaviour of another (eg. Mayer, Davis, & Schoorman, 1995). Lewis & Weigert (1985) distinguish three dimensions of cognitive, emotional and behavioural. Here trust is not seen as an individual attribute but as a collective attribute. The emotional process is when an affective state exists –an emotional bond forms in the relationship between individuals or groups of people, all of which are underwritten by behaviour. Lewis & Weigert (1985) however do not offer any explanation for the social mechanisms that can help develop or impede trust. This theoretical model is useful however in trying to understand how trust is perceived within and across organisations and was used as the theoretical underpinning of Cummings & Bromiley's (1996) Organisational Trust Inventory. It employs the same three dimensions in developing a matrix against three elements of trust as a belief system. By believing in a shared common goal, they maintain that group action should be based on; good-faith efforts to behave in accordance with implicit and explicit commitments; honesty in negotiations preceding those commitments; and not taking advantage of another person even when opportunity presents itself. The study reported in this paper adopts this general model as a basis for the exploration of trust in organizational work practices involving teams and information technology.

Trust within and between teams is a much more complex phenomenon as teams involve multiple, interdependent actors. It is precisely because of this interdependency however, that necessitates some element of trust being present in order for its effective functioning, (Jones & George, 1998). Growing research devoted to teamwork refers to factors such as cohesiveness, co-operation, co-ordination, and effective communication processes as being some of the most important issues in achieving team effectiveness (eg. Mayo, 1993). These interdependent factors have been found to enormously affect team decision making both directly and indirectly.

While information technology is increasingly used to mediate teamworking, Stanton & Ashleigh (2000) argue that team members are often reluctant to trust technology until they have gained experience from using a system and have had positive meaningful feedback from it. Technology is not value neutral but provides a form of 'fittingness' and reliability that follows from features of technology (Friedman et al., 2000). In a study researching user acceptance of information technology, Davis (1993) found that perceived usefulness of a system (i.e. does it perform the task) was fifty percent more influential than the ease of use of the system in determining how much the system was actually used. This research emphasises the importance of designing new systems with appropriate functional capabilities to suit user expectations and how operators will adjust to the different functions of future technology.

Muir (1994) found that operators' perception of trust was only changed by the performance of the machine and people quickly reverted to manual operations when they felt technology was unreliable. When controlling any dynamic system, (e.g. energy distribution system as in the case for this paper), team members are constantly reliant on technology as well as having to multi-task over a period of time. This necessitates greater interdependency both within and between teams. It is therefore important to develop a fuller understanding of the key elements of trust between team members and information technology.

3. RESEARCH SITES

Two companies within the energy distribution industry were used as research sites. The study specifically focussed on sixteen male control engineers, in three groups: within the team, between teams and when interacting with technology, who were interviewed from each company (2 X 8). All participants were either chemical or electrical engineers and had a minimum of 3 years experience working as a control room engineer. In this context engineers continuously control a physically remote plant via bespoke systems to maintain a common goal of balancing generation of energy with demand. Working practices also included monitoring oscillating variables such as changes in flow and pressure, alarms handling, energy storage and organising the maintenance of the physical plant. Consequently there were many layers of sub-tasks within the main function of maintaining a stable system. Engineers were therefore constantly interacting with their systems and each other and the whole socio-technical system was interdependent. Company restructuring had also affected working practices as some within team members were now forced to work remotely from each other; this greatly reduced face-to-face interaction and could subsequently influence the development of trust.

4 RESEARCH APPROACH

The Repertory Grid methodology (Kelly, 1955) was used as a field research technique to elicit important constructs of trust to team members working in energy distribution control rooms. This method was based on Personal Construct Psychology and was introduced by Kelly to explain how people conceptualise their world. It is based on the notion that humans actively generate and test their own hypothesis by constructing a personal system of constructs. They are continually forming and revising these constructs in order to understand and test these hypotheses in relation to their reality. Very much considered as a phenomenological or bottom up approach, this was considered an appropriate and novel method to understand how control engineers constructed the concept of trust within their own work domain. It was also considered that this method was appropriate for this contextual domain, as it produces more meaningful information but also allows the use of a standardised scoring system. This minimises interviewer interpretation as participants have to score applicability of description themselves, (Stewart & Stewart, 1981).

Participants volunteered to give their opinion on the concept of trust within their work context. Three sets of different elements were used to indicate three different groups: within the team, between teams and when interacting with technology. Triads of elements of either people or systems were developed in collaboration with the participants. These were taken from each group and participants were asked what important construct or characteristic made two of the elements similar but different from the third. There were eight elements in each group, and example of elements were: *'the team member I work most with'* (intra-team); *'someone with my job on another team'* (inter-team); and '*the demand forecasting system*' (technology). This produced a positive/negative continuum for each construct. For example participants were asked; 'when thinking about the concept of trust, what characteristic makes the '*team member you work most with' similar to 'your best friend on the team but different from 'another engineer on your shift'*. Participants were then encouraged to think of their own construct, without any interference from the researcher. An example of a construct elicited was 'Understanding', where this was shared by both 'the team member who was worked most with' and their 'best friend

on the team'. The difference was that there was a lack of understanding from 'another engineer on their shift'. Each triad of elements was repeated until all combinations of eight elements had been exhausted, or the participant had run out of characteristics to give. Participants were then asked to score each element using their own constructs along a (1-5) likert scale, indicating the amount of trust perceived from each element. For example if they had given the construct of 'honesty' – 'not open' as important, they then had to assign a score to each set of elements along the continuum of honesty – not open, where 5 = very honest, and 1 = not at all open. Notice that constructs were not necessarily straightforward opposites at each end of the continuum, (e.g. honest-dishonest) but this was left to the participants' perception of the construct or characteristic. Neither did the researcher know who the participant was thinking of in terms of ('*team member most worked with* or *another engineer on their shift*). This method therefore allowed complete anonymity of team members as well as eliminating any researcher bias.

4. DATA ANALYSIS

A total of sixty different elicited constructs were reduced to thirteen core constructs through content analysis. Each elicited construct with the same definition (taken from the Oxford English dictionary) was categorised into a core construct, (e.g. constructs such as: open, honest, truthful), were categorised under the core construct of *Honesty*. This was done separately and by two independent researchers. Each core construct was then categorised into one of the three dimensions of emotive, cognitive or behavioural trust, in line with the Cummings & Bromiley (1996) model. For example the constructs confidence, respect, commitment and teamwork were considered to be emotive characteristics and so were categorised under the emotive dimension and so on. The cognitive dimension included the core constructs of – understanding, ability and expectancy as they were considered to be about cognitive processes and the behavioural dimension included the characteristics of honesty, reliability, proactivity, performance, communication and quality of interaction.

This exercise was repeated eight times by each researcher and a Spearman rank correlation was carried out in order to test inter-rater-reliability. The result $r_s = 0.891$ $n = 13$; $p<0.01$ showed a highly significant correlation by calculating the frequency count of core constructs or their subordinates within each group (e.g. intra/inter-team and technology), a hierarchy of trust constructs in terms of importance was developed for the three groups. Mean participant scores for each core construct across all elements were then calculated. This gave an overall participant score for every element and an overall mean group score for each core construct. In order to compare any differences between groups, Freidman ANOVA tests were carried out on the thirteen core constructs. A paired Wilcoxon, test was then used to identify where group differences lay. This non-parametric statistical analysis was used to compare any differences across the dimensions for the constructs of trust. This type of analysis is appropriate when data samples are small and unevenly distributed.

5. RESULTS

Table 1. shows the most important core constructs of trust found within each group (within the team, between teams, and when interacting with technology), presented in a top-down hierarchy. From the thirteen cores constructs categorised, a percentage was calculated for the degree of importance within each group.

As can be seen from Table 1, differences were found in importance of constructs across the three groups, although some commonality in constructs existed. Respondents perceived *quality of interaction*, *understanding* and *confidence* to be an important core construct across the three groups, albeit at different levels of importance in the hierarchy. *Quality of Interaction* was felt to be the most important in respect of trusting technology. *Understanding* was the next common construct across the three groups, which was perceived to be more important within teams, followed by between teams and technology. *Honesty* was perceived as the most important construct within teams, whereas it was third

down the hierarchy between teams. Constructs were more evenly distributed for the inter-team group with *honesty* and *confidence* sharing the same importance, however *honesty* was not applicable to technology group. *Confidence* was perceived to be generally at the same level of importance across the three groups. Differences were found in terms of level of trust by the comparison of scores between groups for each core construct. Mean scores for each construct across group are presented in figure 1.

Importance of Trust constructs within each group		
Trust within team	**Trust between teams**	**Trust in Technology**
"Honesty" – 20%	*"Quality of Interaction"* – 16%	*"Quality of Interaction"* – 21%
"Understanding" – 16%	*"Understanding"* – 12%	*"Reliability"* – 13%
"Respect" – 13%	*"Teamwork"* – 12%	*"Performance"* –11%
"Quality of interaction" & *"Confidence"* – 9%	*"Honesty"* & *"Confidence"* – 10%	*"Understanding"*, *"Communication"* *"Expectancy"* & *"Confidence"* – 10%
"Proactively", "*Reliability"* & "*Communication"* – 6%	*"Communication"* & "*Reliability"* – 8%	*"Proactively"* – 7%
"Teamwork" & "*Commitment"* – 4%	*"Ability"* – 6%	*"Ability"* – 4%
"Performance" & *"Ability"* – 3%	*"Commitment"*, "*Respect"*, "*Expectancy"* & *"Performance"* – 4%	*"Respect"* & *"Honesty"* – 2%
"Expectancy" – 1%	*"Proactively"* – 2%	

Table 1: Hierarchy of perceived importance of constructs shown in percentages.

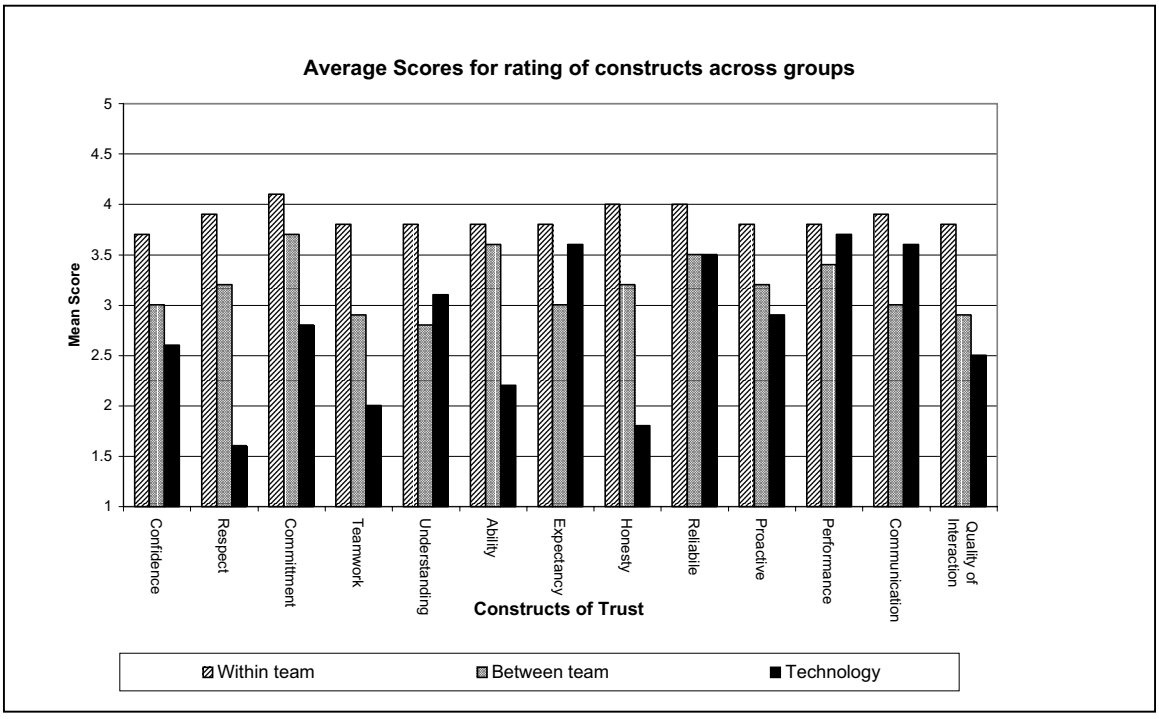

Figure 1: Bar chart showing mean scores of core constructs by groups.

6. DISCUSSION

Analysis of variance results showed that feelings of trust in terms of *confidence, respect, commitment* and *teamwork* were significantly higher within teams than between teams, which from a social psychological perspective (Turner, 1982), is what one would expect as an in-team identity is formed over time. Team members working together within the same team are more likely to have developed higher trust through a sense of belonging when they reach this identification stage of trust (Lewicki & Bunker, 1996).

A higher feeling of trust was also expected with physically co-located teams, as they have more opportunity for social interaction, exchanging non-verbal cues, sharing group norms and can therefore develop greater interdependence. Some members from the same team however were working in separate control rooms and yet in-team emotive trust still scored significantly higher than between team members. This seems to suggest that higher emotive trust is developed from tightly cohesive teams all working together over long periods of time with a common goal.

Although *confidence* was considered of common importance across all three groups, analysis of scores showed that engineers felt significantly less *confidence* in their technology. This warrants some concern as all team members had at least three years experience of the systems and the majority had even longer. The *teamwork* construct was rated favourably for the between team group in level of importance, however was significantly lower when scored. This indicates a lower level of trust with regard to sharing the same values and goals with those members on different teams.

Even though computer systems play a major role in their everyday functioning, team members appeared to have little *respect* for the technology, neither were they generally *committed* to it. If behavioural constructs such as *performance* or the *quality of interaction* was low from technology, these perceptions may have influenced people's feelings of *confidence* and *respect* towards the technology. As Muir's (1994) established trust in automation did not increase through experience but only changed with the competence of the machine; in other words the perceived behaviour of the technology.

The construct of *understanding*, which included subordinates such as knowledge, experience and familiarity, was perceived to be an important construct across all groups. From mean scores and confirmatory statistical analysis it is apparent that generally team members have a better *understanding* of the technology than of colleagues in other teams. This may be because they experienced more information sharing with their various systems than with people in other teams. Alternatively, the differences could simply be because these team members have very little or no physical face to face contact with inter-team members. With very limited social interaction, there is no opportunity to build relationships, hence a general lack of mutual understanding between teams is apparent here.

Conversely authors Cerulo (1997) claim that with the growth in dispersed teams, where there is an absence of physical presence, technology is forcing people to re-adjust to the concepts of social interaction. Cerulo (1997) found that even when physically remote, complete strangers could exhibit personal, informal and even intimate exchanges through computer mediated communication (CMC). She maintained that rather than physically collocated, relationships were built upon sharing the same goal or task. Similarly, Walther & Burgoon (1992) found that reciprocity and trust could develop over time even when groups of students with no prior history worked together on a collaborative project using only CMC. This indicates that 'cognitive' trust can develop without social cues and/or familiarity, even when people are remotely working as long as they do share some commonality. In this case the shared understanding was the joint project the students had to complete within five weeks. In any professional setting such as the control room environment in the current study, one would normally expect there to be a mutually shared objective even between teams. This *expectancy* comes from the nature of process control where the whole system runs on a continuous 24 hours basis and relies on total interdependency between members. These results therefore suggest that although

people are task focussed within their individual teams, the same inter-team objective has been lost or has not been developed, creating an absence of trust between teams. Alternatively, it may be that inter-team relations were not perceived to be as trusting due to a competitive rather than co-operative ethos that still exists between teams in these work domains.

Team members also showed a higher *expectancy* of the systems than from people in other teams. This maybe a learned response based on past experiences of not having their expectancies met or because they have less interaction with members of other teams than the technology. Muir & Moray's (1996) research found that trust and/or distrust could develop in technology, as when in constant error mode, participants learned to compensate and make adjustments. Results indicated that trust grew over time confirming that to develop trust in automation, people do need experience. The differences in *ability* of the technology show that it does not always meet the *expectations* of the team members.

Results implied that team members were significantly more *honest* within their own teams than with members of other teams. This may present cause for concern in any organisation, but particularly in an environment where interdependency with other departments including support, planning, as well as outside agents are all crucial to the success of the continuous process. Participants also perceived that they had better *communication* and exchange of interaction with systems than from people in other teams. As communication is the key element of co-operative teamworking, it would seem that there are some serious issues to be addressed with regard to raising the level of trust *between* teams. *Reliability* was an *important* construct in technology, although results did not reflect this and suggested that systems were not very reliable – similar to members of other teams. Research suggests that machine behaviour needs to be both consistent and reliable in order to foster and maintain trust in technology, (Muir & Moray, 1996). Perceived *performance* across all three groups was considered to be fairly stable, although the technology scored higher in *performance* than between-team members.

The construct of *quality of Interaction* was defined as the *way* in which people and systems interact. Although it incorporated many subordinate constructs (i.e. personable, informal, approachable, etc.), it was rated as the *most important* construct in the between-team and technology group. Results however did not support this, as team members viewed the *quality of interaction* between teams and from technology significantly less than from their own within-team. This may present immense problems in terms of designing new technology. If information is not meaningfully or adequately represented in terms of enabling better interaction, then team members will be reticent in accepting it, not be proactive in using it and hence take longer to trust it, (Davis 1993). Engineers were reiterating this perception in this study. Therefore, in order to raise the level of trust in system technology, design needs to be aware of users expectations and systems should be created that respond in a human centred way.

7. CONCLUSIONS AND IMPLICATIONS

This study set out to gain a contextual understanding of how team members in volatile organizational settings conceptualised trust. Results have enabled a richer insight into the difficulties of articulating and measuring this complex concept. Results suggest that whilst team members emphasised the *importance* of trust in their work context, the amount of constructs initially elicited seemed to indicate a wide variance in the way that trust was construed or how it could be made explicit. Engineers initially had difficulty talking about such emotive issues, but as each construct was evaluated, it became more apparent that they did share a commonality in their language of trust through their perceived importance of *quality of interaction, understanding* and *confidence*. In terms of the level of trust scored, however, it is suggested that they did not share feelings of *confidence, respect* or *teamwork* because of the short fall in *quality of interaction openness* or the other behavioural constructs. Although researchers try to develop questionnaires to measure concepts such as trust, it is considered that the facets of trust are too ambiguous and methodologies should not be driven by reductionist approaches. Although labour intensive, the Repertory Grid method seems to produce data richness which gives a more in-depth appreciation of trust.

Although from the frequency results, (in terms of importance), team members *expected* trust to be high in terms of '*confidence*, *understanding* and *quality of interaction'* across all three groups, results in terms of *degree* of trust scored were significantly lower than expected. This suggests that even when team members believe a person or information technology system to be trustworthy and feel some sense of belonging to another team member or their computer, trust does not actually exist without tangible evidence of this being present. In other words the team members needed observable behaviour in order for trust to develop. Perhaps the collective attribute that Lewis & Weigert (1985) suggest does not begin with the cognitive process but is more likely to be driven by social action that is context bound. Theoretically, an interdependent team with a shared common goal should inherently possess some degree of trust, (Cummings & Bromiley, 1996). This assumes that members will be motivated or willing to take risks in the pursuit of that goal and/or from the saliency of group identity. Exhibiting actions will reinforce the cognitive element of collaborative decision-making and skill interdependency that will enhance team knowledge (Anderson, 1982).

Furthermore, behavioural factors will reinforce a feeling of collectivism between members. When team trust is displayed explicitly this reinforces *confidence* within and between teams, thereby enhancing interdependency. It therefore seems that the *way* trust is displayed explicitly is what reinforces the other states. It is of course acknowledged that there are necessary antecedents of trust in the form of a belief system or *expectancy* of other members or groups that promotes the willingness to take risk in order to achieve reciprocal rewards. However, rather than values, attitudes emotions and moods that drive the team *into acting*, (Jones & George, 1998), in a face-to-face or virtual team it is considered that it is *through the actions* of members that will positively or negatively reinforce the ability to trust or be trustworthy. It is possible that this model can also be applied to information technology as it is through the competency, (e.g. consistent and reliable behaviour) of the information technology system, that ensures the growth of trust in the operator of the system. The degree of trust, although expected and seen to be important by team members within and between teams and in technology did not exist in matching expectation when not supported by action.

The insights gained from this study seem to indicate that in order to nurture trust in teamwork or more generally work practices within organizations, the level of awareness to *take action* (Hawisher & Morgan, 1993) needs to be raised. Findings also suggest that the more isolated people become from each other, the less trust they perceive in each other, which emphasises the need to make trust more observable, through active responses. In some instances, the scores of trust in technological systems (e.g. *performance* and *communication*) were higher than scores for team members in other teams. Research into global teams (Jarvenpaa & Leidner, 1998) found that high trusting teams were those that exhibited high performance. They achieved this through displaying consistent proactive behaviours, giving consistent and timely feedback and constantly negotiating with each other. Even when members had difficulty with carrying out a particular task, communicating the reasons *why* was considered a positive act and reinforced trust.

As organisations move further away from face-to-face interactions and reliance on technology becomes even more ubiquitous, it is vital that systems are designed that comply with human natural abilities. Type of information and the way that it is consistently displayed through technology can also enhance or impair psychological processes, in terms of psychological remoteness, distraction and loss of situational awareness; all of which can debilitate performance (Wellens, (1988). It is therefore imperative that as the workforce becomes even more remote, design technology embraces this fact, enabling human interaction and distributed decision making easier rather than harder. Commonly, more people have to communicate and interact with the world of work via machine, and they therefore need to be able to trust the systems they are using. In order to do this system interfaces must match human expectation in terms of understanding how the system works and how it will help achieve better performance.

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