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Business trust within virtual organisations

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BUSINESS TRUST WITHIN VIRTUAL ORGANISATIONS

Emerging considerations for virtual working in the chemicals industry

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Abstract. The development of Grid computing technologies has stimulated additional interest in the concept of the virtual organization, with the promise of 'always available' processing power seeming to offer sufficient processing power to overcome any technical obstacles to transparent global inter-organizational working. However, whilst the academic literature has given much attention to the theory of virtual organization there have been few viable real-life examples. This paper reports on research undertaken in the UK Chemicals industry where the technical design of Grid middleware was supported by an interpretive investigation of the 'fit' between the needs of industry and the forms of interorganisational working that the middleware was intended to support. The research suggests that this discrepancy between interest in, and implementation of, virtual organizations may arise from a misunderstanding of the role trust plays in existing business practices and the consequent requirements for supporting trust in a virtual organization. Business relationships emerge to be deeply rooted in personal contact and popular and elusive views of looking at virtual organizing need to be reconsidered in favor of a more context-bounded approach.

1 Introduction

In this paper we present the results of fieldwork carried out as part of a large, UK research council funded, e-science project. The project is an inter-disciplinary one and the work described adheres to a tradition of interpretive research that may perhaps be unfamiliar to some of our audience.

The GOLD project (GOLD, 2004) aims to develop Grid middleware as the enabling technology for dealing with trust, security, lifecycle and information management in highly dynamic Virtual Organisations (VOs). The potential application domain for such technology-facilitated interorganisational working is wide, for example construction, electronics, and military applications. The chosen area for the GOLD project is though the speciality, agrochemical and pharmaceuticals sector of the chemicals industry, where the high importance of trust and security imposes very stringent requirements and thus an excellent testbed for e-Science applications. In addition, there are reasons to believe that the Chemicals industry would greatly benefit if new and agile ways of working were made possible.

This is a sector where the UK has a modest $9-12bn share of a $250bn global market (GOLD, 2005). The nature of the products means that much legal paperwork has to be completed for every interorganisational collaboration and Health and Safety authorities, customs, even the police have to be aware of the movement of products between partners. The traditional strengths for companies in this industry have been IP-protectable knowledge, a skilled workforce, plant efficiency, and good reputation. In recent years, however, cheap labour and available plant in new economies have been used to reduce overall price to market, so that production skill and efficiency have become less important as factors for

success. There is therefore increased pressure upon all to *innovate* to maintain their advantage and for *business intensification*: the ability to commercialise innovations more quickly than competitors.

Previously reported attempts at virtual organisation in chemicals production (Wright and Bramfitt, 1999) have claimed very significant cost savings of 92%, with time to market reduced by 66%. However, the experiment was not scaleable. The information necessary to co-ordinate, manage and control outsourced activities in remote locations proved too large in volume and the necessity for ad hoc reconfigurations in response to external events and the evolving state of each project was beyond the capability of existing software platforms.

Recent advances in Grid technologies are seen as the way to render this problem more tractable, offering sufficient and readily accessible processing power to participants, wherever located; the way is thus opened to transparent global inter-organisational working, with outsourced R&D labs, safety assessments, chemical analysis, data analysis, pilot studies, manufacturing, marketing and distribution However, moving to such new ways of working would have considerable implications for an industry where health and safety records and intellectual property rights play such a large role. So while the GOLD project primarily focuses upon technical issues one of the six component workpackages (GOLD, 2005) gives attention to the management implications of VO participation and, in particular, business trust requirements. The initial rationale for attending to trust in the GOLD project thus lay in the belief that *" … Companies participating in a VO must be able to trust each other for their relationships to be productive. This workpackage will provide mechanisms for trust acquisition and management through the use of trust policies. It will also develop Grid services for contract management and automatic dispute resolution."*

Within this statement lie assumptions concerning the nature of trust, arising partly from the more technical literature, wherein trust is oft associated with impersonal risk assessments, and partly from a view of trust that emphasizes trust in systems and procedures. There is however a very extensive literature in sociology and the behavioural sciences that discusses trust in quite different terms (Bachmann, 2001, Tyler and Kramer, 1996, Misztal, 1996, Ammeter et al., 2004, Lane and Bachmann, 1996) We give below a brief introduction to those conceptualisations and then describe the trust requirements that we found existed in practice in the chemicals industry.

2 Conceptualisations of Trust

Trust embraces constructs of ethics, morals, emotions, values and natural attitudes and combines a variety of fields, including philosophy, psychology, sociology, political science, computer science, economics and organisational behaviour ((Tyler and Kramer, 1996), p.115). It is, consequently, a complicated and multifaceted concept (Ammeter et al., 2004) and difficult to frame it in a single definition (Jones and Bowie, 1998). In an attempt to unravel this conceptual difficulty trust is here studied as an element of collaboration in the context of organizations, rather than as any aspect of individual personality.

Although definitions of trust remain impartial, as they focus only on specific aspects of the concept they share some common elements. In particular, trust requires the eagerness of an actor – the 'trustor' - to enter into a position of complexity and uncertainty ((Luhmann, 1979), p.4) and thus, become vulnerable due to the threat of opportunistic behaviour of another actor – the 'trustee' (Gallivan, 2001). Therefore, there are two interrelated conditions in every instance of trust; the condition of risk (Misztal, 1996) and that of interdependence, which are both prerequisites for trust to arise (Costa, 2003). This happens because without both conditions there is no need for trust (Gallivan, 2001).

In the context of the business environment, with the continual increase in the number and variety of exchange relationships, complexity and uncertainty cannot be faced without trust (Lane, 1998). Luhmann described trust as an effective mechanism of reducing complexity, and its absence can cause chaos to prevail (Luhmann, 1979). He argued '" ... trust is a mechanism by which actors reduce complexity of their system of interaction through the adoption of specific expectations about the future behavior of the other by selecting amongst a range of possibilities' (cited in (Lane, 1998), p.12).

Organisations are, within the trust literature, viewed as mechanisms that develop shared meanings among the social actors and thus trust (Bachmann, 2001); they are patterns of social action that combine both *formal regulations* and *informal cultural understandings* which have obtained applicability over time and shape social actors' behaviour (Bachmann, 2001), (Lane and Bachmann, 1996). Consequently, as institutions they depend on shared beliefs, shared experience and background assumptions among the

social actors and are to a high degree self-validating (Lane and Bachmann, 1996). However, such mechanisms function in a *latent* manner (Bachmann, 2001), as they direct expectations long before sanctions have to be considered (Luhmann, 1979). In such institutions, rules and norms function as background structures that mitigate against risk and coordinate people's expectations during their interactions (Lane, 1998). Legal norms, rules and potential sanctions are examples of just such institutional arrangements. Legal norms seem to encourage trust as on the one hand, and rules provide directions to people's actions while, on the other hand; potential sanctions prevent them from misbehaving (Luhmann, 1979), (Giddens, 1990). Grey and Garsten emphasize that these regulations must be socially constructed within communities, in order to function successfully and that trust is achieved " ... through the enrolment of individuals into these values rather than selecting individuals who already share common values" (Grey and Garsten, 2001). In addition, systems of technical and professional knowledge are assumed as source of system trust. More specifically, Giddens argues that standards of expertise are main sources of system trust (Giddens, 1990). In this respect, system trust is then integrated into organisational routines (Grey and Garsten, 2001), which offer a 'common grammar' and lead people's decisions in their interaction without at the same time restraining them. What is more, authority also contributes to the development of systems trust (Luhmann, 1979), (Bachmann, 2003). The roles that people have in organisations and in society in general is, it is argued, a matter of the specific competences that they have, making others dependent on them (Shapiro, 1987),(Luhmann, 1979). Despite this dependency, when roles and responsibilities are explicitly and clearly identified (Kasper-Fuehrer and Ashkanasy, 2001), system trust is encouraged as people place their confidence on the competence and the abilities that the roles indicate rather than on the persons per se (Giddens, 1990), (Jones and Bowie, 1998). In the context of virtual organisations, where hierarchical relations are limited, people need to know to a greater extent who has what expertise in order to facilitate trust (Grey and Garsten, 2001), (Luhmann, 1979).

Studies of trust in the context of virtual collaborations have identified an especial difficulty, usually identified as the "virtual paradox". This paradox arises from the perceived demands of high levels of mutual trust and collaboration (Jones and Bowie, 1998), something that the nature of virtual organisations, i.e. working remotely, seems to impede. Handy argues that "*.... paradoxically, the more virtual an organisation becomes, the more its people need to meet in person*" (Handy, 1995), p.46. . Similarly, Knights *et al*. characterize trust as the 'Achilles heel of the virtual realm' (Knights et al., 2001). It is towards identifying whether such a paradox would exist in manufacturing speciality chemicals through short-term and changing virtual collaborations, and what the implications might be for the technological facilitation of such collaborations that we undertook a series of interviews with chemicals firms in the UK..

To test our assumptions and to identify some of the practical requirements for virtual working in the Chemicals industry a matrix, covering all combinations of size of company, product type etc was created. . With the assistance of a trusted third party from the relevant trade association representative companies were then selected for every combination and interviews were conducted with CEOs and senior managers. These were semi-structured interviews lasting one to three hours, focusing upon the ways in which business was currently done and the prospects for virtual working. All interviews were recorded, transcribed and analyzed with the help of hermeneutic analysis software. We below discuss the key points emerging as the situated meaning of trust towards customers and suppliers.

3 Customer Relations: The meaning of trust

Interactions with customers are naturally the key activities in chemical companies, so having a trusting relationship with customers was highly valued by most of the individuals that were interviewed. Trust does not, however, seem to be associated with the protection and secure use of data. As one CEO explained:

"*... If the customer has a patent for a product, it is already in the public domain. So exchanging the structure, there is no secret in that, it is in the pattern they published it they have the rights. It is a highly regulated industry. I think people are sometimes a bit neurotic about secrets. There is so much b****** about it!* "

This finding contradicts studies which view the 'secure' interchange of data as a priority for the creation of VOs, ignoring the importance of existing, accepted ways of working and shared values.

Kasper-Fuehrer & Ashkanasy (Kasper-Fuehrer and Ashkanasy, 2001), for example, recognize the importance of shared beliefs and identity but overemphasize the reliability of secure ways of working in order to establish trustworthiness. Similarly, early results from the GOLD project gave emphasis to technical interpretations of trust, secure exchange of data and authorization-authentication tools.(Wu and Periorellis, 2005)

But the meaning of trust in the day-to-day operations of chemical engineering organizations is more experiential and distant from many of the descriptions of trust in the literature of computing and virtual organizations. One CEO tried to explain the process he follows to trust others in the following way:

" ... I think if you know somebody a lot and you have an experiential relationship you can look at your experience and decide how many times has that person disappointed you. I think there is another level of trust when you are looking forward and people normally need to be able codify the information you are giving them in their own matrix. So, I come along and say we need to work on this and this will make loads money. Firstly, you will be thinking the issue of being credible in believing in this idea and secondly it is sharing the benefits of the credible, what evidence do I have for that? So I think there are a lot of value judgments that happen that are either made, or that are chucked away and destroyed because they are not credible nothing to do with the purchase. Too good to be true or completely not understandable…Then it does not start. It is a complex issue. "

3.1 Experience and personal judgement

This description of trust illustrates a surprising finding that we encountered many times. Decision-makers in the chemical engineering sector rely heavily on experience and personal judgment and to a lesser extent on accepted norms such as the proof of financial credibility. This complements earlier findings in the engineering sector and virtual organizations which have stressed the importance of 'personal trust' rather than 'system trust' in this context (Clases et al., 2003, Gallivan, 2001)

Table 1 presents some initial aspects of trust in everyday life of chemicals organisations. This table summarises the findings of this research so far in themes of what is meant by trust; the means of communication in establishing trust; symbols of trust; and those actions or events that might represent a perceived violation of trust.

Table 1. Emerging meaning of trusting customers in chemical engineering organisations

Meaning of trusting	*Means of communication in establishing trust*	*Actions of trust*	*Symbols of trust*	*Perceived violation of trust*
Customer interested to buy	Face-to- face contact, e-mail, phone call	Initial commitment to buy.	Verbal agreement that both parties will proceed in collaboration.	
Customers are genuine businesses in the ch.eng. sector	Phone, e-mail	Ask for name and address	Phone call or e-mail message to establish identity of customer	
Customers are creditworthy	E-mail, post	Ask for a bank reference, letter of credit	The bank reference or letter of credit	
Customers operate in a legal and safe way	E-mail, post	Ask for references from health and safety authorities, Chamber of commerce, even the police.	The references themselves. Confidentiality agreements.	
Customer will pay for order			Contract, terms and conditions, penalty clauses.	Fail to pay at all or do not pay on time

A first obvious meaning of trust when entering in a relationship with a customer is their genuine interest to buy. Such interest is expressed via sales visits, in professional exhibitions, or via e-mail and phone call. Face-to-face is very important at this early stage of dealings with customers and even with customers that are already known to the company face-to-face interaction is considered irreplaceable. In the words of one CEO: *" … We use big words like trust. I think it is easier if you look somebody eye to eye to decide whether you trust them or not…Nothing can replace face-to-face contact particularly at the early stages of negotiation".*

This is in contrast to much of the literature, wherein enthusiasts of distant ways of communicating argue that the great advantage of virtual work lies in reducing the need to travel (Cairncross, 1998). We have found in our interviews support for the notion of the 'virtual paradox', whereby virtual working generates an increased need to travel ((Handy, 1995, Knights et al., 2001, Woolgar, 2002). This seems most evident at the early stages of a relationship. The customers of the chemical engineering industry studied are, in general, other businesses and none of the companies in our study had dealings with the general public. The B2C models of e-business were not applicable. In fact, in none of the interviewed companies was business initiated electronically. Although customers might approach the companies via the web this would be merely the initiating signal for personal contact. Most of the individuals interviewed stressed the importance of face-to-face interactions at the initial stages of dealing with any customer. Sales representative visits and trade exhibitions are valued for the opportunities they provide to meet face-to-face. After establishing a relationship with a customer then other means of more distant communication can be added or even substitute for the face-to-face contact.

3.2 Document transmission

An area where the technical concerns over authentication and security have been thought to be of particular importance is the storage and secure transmission of documents. Our interviews confirmed document handling as a requirement for virtual working since we found formal documentation acts to some degree as a trust-surrogate. The most basic requirements for trust, in so much as without these there can be no business discussions are provision of permanent address and to be accredited as creditworthy; the latter normally being done by a bank reference. In some cases more credentials are required, as an Operations Manager explains: *"...With Europe it is very simple. We have to make sure that the samples' documentation & form are correct and that they are properly labelled and identified. There are some countries that we need a letter of credit. We do not give them the goods until the money is in a reputable bank. Then we deliver the goods. Again different countries have different formalities in terms of the documentation that you have to have and things that have to be stamped or signed by the Chamber of Commerce. This is no problem really."*

Furthermore, in an industry that is so heavily regulated many documents are required concerning health and safety, the allowed legal use of products, safe transport etc. This is a highly complex process and each product has to comply with the regulations of each country it is transferred through (if transported by land). However, producing and collecting such documentation is part of the procedure that chemical engineering organisations have to follow and there are generally no problems in producing or gaining such documentation. This finding suggests that although 'system trust' (Giddens, 1990, Luhmann, 1979) is of great importance in the context of the chemical engineering sector it is encapsulated in well established codes of practice and business norms and not regarded as problematical. This finding partly contradicts studies which overemphasise the importance of system trust, reliance on formal rules and legalised procedures, regardless of the business context. (Sitkin, 1995)

3.3 Legal redress

Perhaps the most fundamental element of a trust relationship between two organizations is that the customer will pay for the products that have been ordered. Most of the literature on VOs supposes this may be taken for granted but we found that, intentionally or unintentionally, customers fail to pay on time or (fortunately very rarely) fail to pay at all. These represent breaches of contract so a company certainly has cause for legal redress and compensation; the VO literature tends to assume that redress to the law is automatic but we found this is not so. In some cases the manager recognizes the difficulties of the defaulter as ones that he/she might themselves fall prey to, is sympathetic to a degree and work towards a

solution. Chemical engineering organizations will seek legal advice but only in extreme cases will follow the legal route since there is great sensitivity about not wanting to damage their image and reputation.

This very 'real' dimension of trust about the consequences of paying (or not) and the willingness (or not) to follow the legal route, in the context of chemical engineering organisations and possibly in other business sectors, is frequently neglected in studies of trust in virtual organisations. Actions taken as a result of such consequences resemble Ciborra's concept of drifting (Ciborra, 2002) and the continuous interventions of actors in order to 'make things work'.

4 Supplier Relations: The meaning of trust

Another important interaction with others is the dealings with suppliers. Similarly to Table 1, Table 2 describes some key stages and relations of trust with suppliers in the context of chemical engineering organizations.

4.1 Shared history

When dealing with suppliers, as with customers, face-to-face contact is very important in the early stages of a relationship. Supplier relationships differ somewhat though in that these, as many of our informants stressed, become established over time and do not change just because prices of raw materials fluctuate slightly. This is a crucial finding since so many of the business models in the literature naively assume a free global market in which the electronic version of 'economic man' reacts to seek lowest price. In reality a shared history with existing suppliers is of key importance and in many cases more important than commercially competitive prices of raw materials. As a chemist in one of the organisations explained:

Table 2. Emerging meaning of trusting suppliers in chemical engineering organisations

Meaning of trusting	Means of communication in establishing trust	Actions of trust	Symbols of trust	Perceived violation of trust
Suppliers have the appropriate raw material	Face-to-face contact, e-mail, phone call	Initial commitment to sell.	Verbal agreement that both parties will proceed in collaboration.	
Suppliers are genuine businesses in the chemicals industry	Phone, e-mail	Ask for name and address	Phone call or e-mail message to establish identity of supplier	
Suppliers operate in a legal and safe way	Visits, audits, use of local agents	Ask for references from health and safety authorities, chamber of commerce, even the police.	The references themselves. Audit documents. Confidentiality agreements.	
Suppliers delivering on time	Phone call, e-mail, post	Commitment to deliver on time	Promise to deliver on time	Missed delivery dates

" … Because of the nature of the products we are making we have to go through quite a long drawn out approval \process. Because of the fact that we have to produce, store, a lot of evidence that we can change supplier without actually affecting our product. That means that we have a lot of barriers in changing suppliers. Normally we will not change suppliers that frequently. Typically, for a major raw

material and we will have one or two suppliers and w e might change every couple of years. We will not change just because prices dropped a couple of cents'.

4.2 Visits and inspections

A further difference arises from the need for a company to be assured that its suppliers operate in a safe and legal way. This is not merely a question of assuring the quality of the received product; it is feared that the purchaser may be liable if the supplier is breaching health and safety regulations and social or environmental consequences ensue

Many of the organizations we interviewed routinely visit overseas production locations, especially the location of strategic suppliers, carrying out inspections and periodic audits. The use of local agents who act on their behalf is also common practice in the industry. The existence of these 'local' agents is underlines the importance given by the chemicals companies of understanding local needs despite operating in a global environment. It confirms Woolgar's rule of virtuality that 'the more global the more local' (Woolgar, 2002) and contradicts studies which suggest that distance is not important in the age of the virtual organizations (Cairncross, 1998).

4.3 Meeting expectations

Finally, the most important thing for a supplier to be considered trustworthy is that they deliver on time. Considerable delays at delivery times do not seem to occur very often. As an Operations Manager explained:

 " … Ok, you get occasions that suppliers let you down. But it is not very often. The supplier wants to sell the chemical, they do not do it deliberately, and they want to make the profit. They vary in terms of their reliability, do what they say. Because it is very important in supplier chain to have the chemical when we want it so time is very important. If we say we need such a product on such and such a date because our manufacturing programme is set up for that date. If it does arrive we have to change programme and lose time."

By experience and past knowledge of the supplier, individuals in chemicals organisations tend to know which suppliers are more likely to delay delivery. Depending on the length of the delay fines could be imposed for a considerable delay and in cases where the delay has caused great financial loses the supplier will most likely not be used in the future. This finding is emphasising the importance of experience and knowledge in trust relationships in the context of chemical engineering organisations. Again, personal and experiential knowledge (Whalley and Barley, 1997) seem to be of greater importance in choices of suppliers rather than abstract rules and procedures. This has significant implications for the technologies that one might choose to develop to facilitate virtual working. There would, for example, be little chance that supplier selection by autonomous software agents would be accepted by the chemicals companies to which we spoke.

5. Concluding Observations

One workpackage of the GOLD project has used interpretive methods to augment the technical development of tools and middleware. Part of this work has attended to the meaning of trust in the context of chemicals trading relationships. Despite being a heavily regulated industry and one that follows to a great extent legalised processes in doing business, experiential knowledge and personal trust seem to be of great importance in the instituting and the operating of contacts with customers and suppliers.

The GOLD project has been mainly focused on providing the technical means by which to support standardised mechanisms for virtual collaboration in the chemicals industry. The already existing demonstrator software shows that software facilitation for virtual working is possible, and that automatic audit trails of communications, protection of documents etc will be useful to the industry. But whilst necessary such things are not sufficient. Consideration must be given to legacy ways of working and accommodating the requirements and idiosyncrasies of the particular industry. Informing the technical development with the interpretive strand has been extremely valuable in this.

The importance of face-to-face communications both with customers and suppliers and the understanding of the local (country) context in which customers and suppliers operate has emerged from this study. This complements previous discussions on the contradictory nature of virtual organisations (Woolgar, 2002). It seems that trust in chemical engineering organisations is heavily dependent upon personal, professional and experiential knowledge rather than reliant upon rules and legal processes. Formal rules and procedures remain important, providing the basis for contractual collaborations with suppliers or customers. However, the final decisions on making a deal with a customer or a supplier, as this study has suggested, is mainly based on the professional and personal judgments of individuals.

These are initial findings and are still in an early stage; however they underpin the importance of understanding how trust relationships develop in practice in a specific context prior to the design of technical artefacts.

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