10 DUE PROCESS AND THE INTRODUCTION OF NEW TECHNOLOGY: THE INSTITUTION OF VIDEO TELECONFERENCING

Joe Nandhakumar
Richard Vidgen
School of Management
University of Bath
Bath BA2 7AY
United Kingdom

Abstract

Actor network theory (ANT) and the later work of Latour on "due process" are used to gain insight into how a new technology, video teleconferencing, has been introduced to a petro-chemical company, Xeon. The hallmark of ANT is a symmetrical treatment of people and things in a single collective. The due process model moves into normative mode and offers the prospect of using ANT ideas to aid planning for the introduction of new technology. The due process model consists of four dimensions: perplexity, consultation, hierarchy, and institution. Facts and values are co-produced through a series of trajectories. Perplexity and consultation are concerned with the issue of "how many are we," while hierarchy and institution address the question "can we live together." The application of these ideas to the Xeon case identifies a range of actants and demonstrates the intensively socio-technical imbroglio that constitutes the provision of video teleconferencing facilities. The paper concludes by arguing that IS should consider how the due process might be designed and that an even-handed approach to human and non-human actors is a fruitful basis for this design.

The original version of this chapter was revised: The copyright line was incorrect. This has been corrected. The Erratum to this chapter is available at DOI: 10.1007/978-0-387-35489-7_33

N. L. Russo et al. (eds.), *Realigning Research and Practice in Information Systems Development*

1. INTRODUCTION

Many global organizations are implementing Internet-based communication technologies such as desktop video teleconferencing, multimedia e-mail, instant messaging, and interactive document sharing to enable organizational communication and the sharing of knowledge. Such technologies are seen as enabling communication and teamworking between geographically and temporally separated organizational actors (Lipnack and Stampts 1997). In traditional approaches to the introduction of new technologies, the social aspects and the technology aspects are seen as mutually interacting, but in a strong sense still separable. This separation can be seen in socio-technical approaches to information system development, such as ETHICS (Mumford 1995), and also in Rogers' (1995) theory of technology diffusion (McMaster et al. 1997).

Actor network theory (ANT) proposes a "single collective" where technical and social decisions are not different in kind, thus necessitating a symmetrical approach to people and things (Callon 1986; Latour 1986 1987; Law 1986). The application of ANT in information systems research has been summarized by Walsham (1997), who identifies relevant "actants"—human and non-human actors—in the information technology domain as including people, organizations, software, computer and communications hardware, and infrastructure standards. The argument for symmetry of people and things indicates that the same conceptual frameworks should be used to analyze both. However, applications of ANT in the IS domain tend to use the framework in descriptive mode, using ANT to explain how certain network configurations of actants have emerged and achieved a degree of irreversibility (Monteiro and Hanseth 1996; Vidgen and McMaster 1996) or to challenge the orthodoxy of fact construction (Bowker et al. 1996). Hespo (1999) introduces a change agent aspect with a proposal to combine ANT and action research; ANT is used to understand the human and non-human stakeholders and action research provides a framework for moving from description to prescription.

Latour's (1998) later work has introduced the notion of "due process," which gives an inkling of how the "parliament of things" (Latour 1993) might work in practice and, therefore, how it might in some sense be designed. The due process model has been applied by IS researchers (McMaster et al. 1999; Whitley 1999) and will be used in this paper to gain insight into the introduction of a new technology, video teleconferencing (VT), in a petro-chemical company.

The structure of the paper is as follows. In the second section, we consider ANT and due process in further detail. The research approach is described in the third section and in the fourth section the due process model is used to interpret the case study. In the fifth section, we summarize the paper and reflect on the strengths and weaknesses of this model.

2. THE SINGLE COLLECTIVE AND DUE PROCESS

Traditionally, the nature of, and relationship between, social and technological elements of information technology have been viewed as a contest between two positions, technological determinism or social constructivism, emphasizing the primacy of the technological or the social elements respectively. There are a number of different intermediate positions, which vary in their handling of technology. For example socio-technical systems theory (Mumford 1995) argues for optimization of both technical and social elements simultaneously for the effective design of systems. The social construction of technology (Pinch and Bijker 1987) perspective assumes that technological artefacts are socially constructed and interpreted, and, therefore, seeks to open the "black box" of technology to sociological analysis.

While attempts have been made to link social and technical systems, these have not been unproblematic. As Grint and Woolgar (1997) point out, such attempts have inevitably resulted in a "disjointed amalgam" and "systems of disequilibrium," since they still treat technology and society as being inherently independent of one another. Technology is still seen as objective, essentially unproblematic and following the laws of the natural sciences; the social aspects of the system are still seen as subjective, problematic and following the laws of the social sciences. Such asymmetrical treatments, which merely wrap social issues around a technical core are not socio-technical in any true sense. While tools for social analysis may be used for the social issues, when the technical core is reached, then the language and analytical tools have to change in order to deal with technical issues. As a result the perception of the "break" is maintained and the belief in the separability of organizational and technological issues reinforced.

The ANT (actor network theory) approach to the sociotechnical debate is to dissolve the dilemma rather than attempt to resolve it (Callon 1986; Latour 1987, 1993). According to ANT, both human and non-human actors need to be enrolled in a heterogeneous network of alliances and their interests aligned in a co-produced black box network of irreversible associations (Callon 1991). With respect to the constitution of knowledge, a central theme of ANT is the notion of fact construction as a collective process (Latour 1987):

> The problem of the builder of "fact" is the same as that of the builder of "objects": how to convince others, how to control their behaviour, how to gather sufficient resources in one place, how to have the claim or the object spread out in time and space. In both cases, it is the others who have the power to transform the claim or the object into a durable whole (p. 131).

Theories of association such as actor network theory (ANT) offer opportunities for true socio-technical treatments insofar as they deal with a "single collective" that privileges neither human nor non-human actants over the other. But a single collective is not merely a notional bringing together of nature and society (i.e., collapsing the two collectives together into one), but is rather an active and critical process through which specific "candidates for existence" are (or are not) admitted. While admitting some candidates, the process explicitly and necessarily excludes others (the enemy).

2.1 Due Process

The outcome of the process of scientific inquiry is the appearance of facts that speak for themselves. These are the results that are generally accepted and institutionalized, such as the law of gravity. At any point in time, there will be new ideas and theories competing for acceptance. For example, there is currently concern about global warming. Every year the planet becomes a little hotter as greenhouse gases build up in the atmosphere, leading to greater extremes in weather—more flooding and storms (as was the case in the UK in October 2000), but also more droughts. John Vidal (2000) reported in *The Guardian* (a national UK newspaper) that the UN-sponsored Intergovernmental Panel on Climate Change suggests a worst-case scenario that average global temperatures will rise by 6°C above the 1990 level over the next 100 years. Five years ago the panel predicted that the worst case was a 3°C rise. The main greenhouse-warming gas is carbon and 23% of carbon emissions are generated by the U.S.—Britain's 3% is the same as that of Africa. According to *The Guardian*,

> Many panel members in the U.S. say that the summary represents the closest thing to a consensus possible in science. They point to the additional data gathered in the past three years, which shows that the world is much warmer than any string of years in many centuries.

On the same day, a counter argument was made on BBC Radio 4 that this is nothing exceptional. In the local paper of one of the authors, *The Stroud News and Journal*, a correspondent made a similar argument on the letters page of October 25, 2000 (Thompson 2000):

> The contributions from manmade activities are very small compared to the CO2 produced by the many natural causes. It is only by the restricted selection of small time scales that global warming can be shown. Such small time increases, as well as decreases, have naturally occurred over hundreds of million years [quoted verbatim].

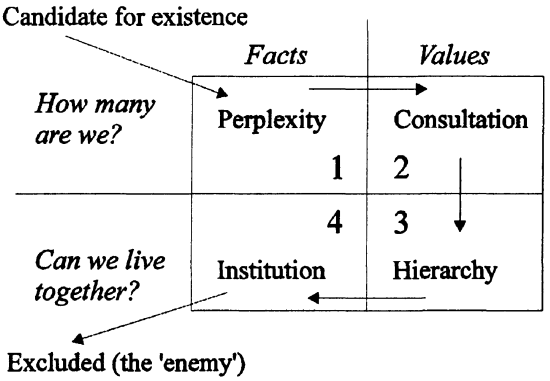

Figure 1. Due Process Model (based on McMaster et al. 1999 after Latour 1998)

Although we might give more weight to a report in *The Guardian*, a national broadsheet newspaper, than to the letters page of a local newspaper, global warming can still cause perplexity (Figure 1) as scientists, the media, concerned citizens, and others debate the facts. For example, if we accept that global warming has facticity, then just how important is it in the overall scheme of things? Values are learnt from others through consultation and can be thought of in hierarchical terms. If it is more important to personal freedom to continue to drive motor cars and it is more important to be able to produce goods at below their true economic cost (i.e., one that includes the cost of environmental damage), then global warming might be rejected from the collective or placed at a level within the hierarchy where the impact is of little significance. Figure 1 shows a vertical division between facts and values, but it also contains a horizontal division: "How many are we in the collective?" and "Can we live together?" This raises the question of which actants are to be considered in the consultation process. With regard to global warming, motor cars and factories might be appropriate, as would human attitudes to public transport. Less obviously, we might include lakes in Scandinavia affected by acid rain and swimmers affected by sharks tempted out of their natural habitat by warmer waters. In other words, there is no limit to the actants that could be consulted in the collective, and some of those might seem altogether spurious (Button 1993). A prescriptive approach to ANT, therefore, must consider the question of what constitutes a due process: how are actants considered for consultation and which are included and which rejected? Once the constituency of the collective has been settled, then the question of whether we can live together can be tackled. With respect to global warming, swimmers in shark-infested waters might not be consulted, but motor cars and attitudes to public transport are consulted. The outcome might be that global warming and attitudes to public trans-

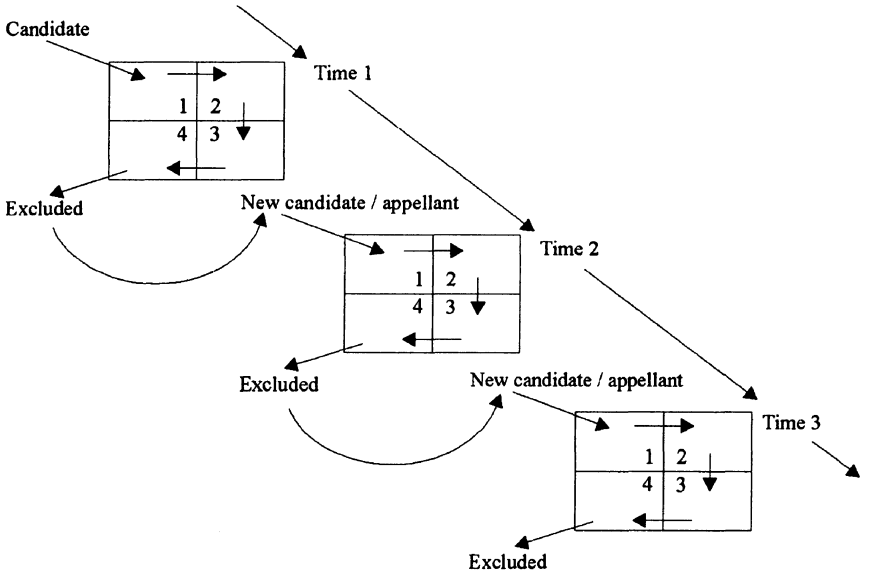

Figure 2. The Dynamic Due Process Model (based on McMaster et al. 1999 after Latour 1998)

port cannot live together with the result that global warming is not institutionalized in the hierarchy, i.e., we cannot live together. New facts and claims will appeal for inclusion over time and any candidate excluded at one time can appeal at a later time (Figure 2). In the case of global warming, it might become the case over time that we have no choice but to live together.

3. RESEARCH APPROACH

The research study was carried out in a large petro-chemical company, Xeon (a pseudonym), on the implementation and use of Internet-based communication technologies to foster communication and virtual teamworking among actors. Xeon has operations in more than 70 countries and annual operating revenues of over 50 billion dollars and more than 50,000 employees world-wide.

The research approach adopted in this study is qualitative (Walsham 1993) involving a collection of detailed, qualitative data on design, implementation, and use of Internet-based communication technologies in a specific organizational context. The study involved observations and unstructured and semi-structured interviews with people who were involved in designing and using Internet-based communication technologies at Xeon. The study specifically

focused on participants of two teams at Xeon: members of the knowledge management group, who were also the early adopters of Internet-based communication technologies; and managers from a large construction project, who were seen as the "champions" of using Internet-based communication technologies. During 1997 and 1998, one of the authors spent on average one day a month at Xeon, observing and interviewing team members. Over 40 interviews were conducted with team members. Many of the team members were interviewed several times over the research period to assess the changing interpretation of the events over time. Time was also spent on interacting with team members and observing the actual practices of virtual teamworking by being with participants at Xeon.

Documents have been examined, including documentation on benchmarking, training manuals and Internet-based support documents such as "frequently asked questions." During each visit, detailed field notes were taken to record observations and events. Most of the interviews were tape recorded and transcribed. The study resulted in hundreds of pages of field notes from observations and interview transcripts. Initially the field notes and interview transcripts were read and re-read to identify concepts, capturing the ideas or phenomena described by the quotations, incidents, opinions, events, and actions.

We used the concepts and relationships provided by ANT and the due process model to "stimulate theoretical sensitivity" during our data analysis. As Orlikowski and Baroudi (1991) note, theoretical concepts or frameworks can focus research questions and field observations in interpretive research. In our case, the aim was to be sensitive to the collective of people and things and the process through which the VT technology becomes black-boxed and achieves an irreversible position in the network. We, however, remained reflexive about the role of due process model in shaping our perception and limitations in understanding the research phenomenon.

4. DUE PROCESS AND THE INTRODUCTION OF VIRTUAL TEAMWORKING AT XEON

The concept of virtual teamworking began to evolve in 1995 following an information technology conference organized by Xeon. The conference was proposed by Xeon's technology advisory board, which included academics (one of the authors was present) and experts from within and outside the company, and was aimed at exploring the potential impacts of information technologies for the next five years. The board believed that there was potential for performance improvement from using information technologies that would continue to accelerate changes in the nature of work at Xeon. The conference focused on three main themes: customer linkage, teamworking across geographical boundaries, and accessing organizational knowledge. Following the conference,

senior managers at Xeon decided to evaluate the concept of teamworking all the way and as a result initiated the virtual teamworking project. To begin with, the virtual teamworking project was conceived as "an experiment" with an investment of $16 million in the first year. At that time, the project was seen as a way to learn about new ways of working enabled by emerging technology and to illustrate the potential of that technology.

Five pilot virtual teamworking projects were set up with willing participants from different parts of the company to foster collaboration both within and among Xeon's business units and between their contractors and partners in joint ventures. Some of the teams became the champions of using virtual teamworking facilities. The CEO, who was also a keen user of the virtual teamworking technologies, promoted the use of VT technologies among senior executives. The project was led by a senior manager who had a strong conviction about teamworking and the effectiveness of coaching in managing change. While Xeon's core business processes and technological infrastructures were built around the telephone, faxes, e-mail, and air miles, the virtual teamworking project team members were engaged in training and coaching organizational members to change ways of working with new collaborative technologies.

During 1997, management of the virtual teamworking project was taken over by a newly formed group known as the knowledge management group. The virtual teamworking technologies were integrated, delivered, and supported as part of Xeon's information technology infrastructure. New users were trained to work with the new technologies and to develop skills in virtual teamworking. At that time, the virtual teamworking facilities—VTPC—consisted of a high power desktop personal computer (PC) that included Internet-based desktop video teleconferencing and scanning facilities, multimedia e-mail, shared whiteboard, and groupware/file transfer applications.

4.1 How Many Are We? Perplexity and Consultation

4.1.1 Perplexity

A new actant has appeared: VTPC. This candidate for existence causes perplexity. What is it? How do we use it? How does it affect me? Who and what else are affected? The pilot projects and the $16 million pump-priming investment will initiate the process of consultation and hierarchy, but they do not guarantee that the end result will be the institutionalization of VT.

When virtual teamworking technologies were proposed at Xeon, organizational actors had a degree of awareness of the technologies. For example, the desktop video teleconferencing facilities were seen as enabling people to interact with colleagues in different locations as if they were in the same location. The

scanner was seen as a useful tool for converting paper documents into electronic form. Multimedia e-mail would add further facilities such as creating, sending, and storing video clips and voice messages to conventional e-mail. A shared whiteboard would allow actors to see and work with the same documents, spreadsheets, and diagrams in different locations and to work on them simultaneously. Application sharing was seen as extending the similar features to other applications on their personal computer. Information-sharing databases would allow actors to store and access a variety of documents that were enriched by sound and video in addition to text.

Despite this awareness of the capabilities of the VT technologies, there were questions about the functionality that the new facilities could provide. Some of the technologies, such as operating systems software, were selected while others were rejected without much consultation. The project leader, therefore, suggested that the new technologies should enhance functionality to persuade new users to make use of the technologies. He claimed that:

> this [VTPC] is new technology, and most customers are already suspicious of IT solutions and may be looking for excuses to stay with their current tool kit. This usually will require additional resources because everyone else is already working to support current needs. If it does not meet expectations from a functional point of view, people may not give it a second chance.

Concerns were raised about the security of electronic documents held in different locations. Many others were skeptical about the usefulness of the technologies. There were also concerns about the "immaturity" of the technologies and user support. One of the technologists commented that:

> until we get to that stage when they [VTPC] are as reliable as phones and they are as simple as phones, then the culture change, if you like, of doing this thing sitting there [desktop video conferencing] is going to need a lot of support.

There was a period of perplexity when these technologies were planned for introduction. The first hurdle in IS implementation is, therefore, to negotiate the perplexity in order to move to consultation. If this project had been mooted a few years earlier, it is possible that the perplexity would have resulted in rapid expulsion. As it is, the VT technologies have enough weight, i.e., they are sufficiently black-boxed, to be considered for institutionalization: actors know enough about the capabilities in general terms to accept VT as a fact, but that does not mean it will stick.

4.1.2 Consultation

Through readings of the interview data and the observations of work practices at Xeon, it was possible to highlight human and non-human actors and to consider their relationship with the network candidate, VT technology. As the introduction of the technology was a largely informal process with little overt design, the pilot implementations did not consider the actants explicitly in the planning process. In our analysis of the case, we hope to show the broad range of actants that are involved and need to be enrolled for VT to take its place in the network (Table 1). We focus on the non-human actors and abstract actors, such as qualities attributed to humans, rather than traditional stakeholder categories (Freeman 1984; Mason and Mitroff 1981). We have provided quotes from the interviews to illustrate the source of the actants in Table 1. Although this leads to a lengthy table, we feel it is important to maintain the richness and diversity of the situation. We have also resisted the temptation to order the actants into neat categories, such as human, non-human, and abstract, since this may appear to further the socio-technical divide.

4.2 Can We Live Together? Hierarchy and Institution

4.2.1 Hierarchy

Examination of the case data has given us a rich perspective on the network of associations that VTPC impinges on, and an idea of the alignments and inscriptions that will need to be made for VTPC to be black-boxed such that the pilot projects become irreversible. The position of the actants in the network depends on values. For example, as indicated in Table 1, some of the organizational actors perceived video teleconferencing as inadequate for maintaining ad hoc exchanges and mutual social relationships among the team members in remote locations for continuous teamworking. One of the managers explained that:

> It is the physical bit, when you are in the office building...at the coffee machine you meet up with people, you see them on a daily basis, you can have ad hoc meetings.

However, they used VT effectively for forming task-based temporary alliances, which, in the absence of personalized relationships, depended on a body of collective organizational knowledge and diverse skills for solving problems. One of the managers explained that:

Table 1. Potential Actants Involved in the Collective

Actants	**Potential actants involved in the collective of VTPC and organizational members**
Audit trail	While video teleconferencing was proposed as a substitute for many routine face-to-face management team meetings, one of the senior managers recalled that: the downside of video conferencing is...no audit trail, there is no record of what happens unless you take notes...no back-up...a month ago—and it costs me nothing—everything...in an e-mail somewhere and I could recover it.
Existing communications networks (bandwidth)	The proprietary communication networks were seen as restrictive in terms of standardization and bandwidth. Investment in higher bandwidth communications was a requirement.
Existing PCs	Existing PCs were seen as inadequate for use with new technologies and the new ways of teamworking. These needed to be enrolled through upgrades or excluded by replacement with new equipment.
The Internet (TCP/IP)	Internet communication protocols were seen as a basis for the new standardized network. Enrolling these standards into the network was an important part of the success of the VTPC technology.
Body language	Actors were able to convey the body language more effectively with new technologies than conventional phone, fax, and e-mail. One of the team members claimed that: our project manager in particular is a very strong body language person....In the meetings exceptionally so...you can really tell the mood by how he is holding his body, shoulders, sitting forward or back. On VTPC screen [he is] a lot more effective than just on the phone, or just an e-mail.
Senior management authority	Senior managers were able to extend their authority over subordinates in remote locations. One of the team members stated that: I've been in video conferences where I've felt so uncomfortable that I've had to finish them, where I've...maybe not delivered something and someone...I can handle it over the phone but when you see them as well [on the VTPC screen] it is quite a shock, you know you have got the control—just to cut it— but you dare not.
Management sanction	Many saw the technologies as enabling them to legitimize their activities. One of the junior manager explained that: [VTPC] allows more senior people to be able to look in, if you like, more junior [virtual] meetings a week. We have meetings and we have been in with somebody quite senior for 15 minutes, it just costs them 15 minutes of time but it has brought a level of authority and significance to our workshop, which we couldn't otherwise have had.

Actants	**Potential actants involved in the collective of VTPC and organizational members**
Air travel, agents, hotels, taxi companies, hire cars	The introduction of VTPC is a threat to the position of the travel and ancillary industries in the Xeon network. traditionally a problem would have meant people flying up to site and maybe a process engineer, a metallurgist or so but we found showing people these pictures, and good quality pictures, you could get to resolution of problems a lot quicker.
Offices and meeting rooms	Offices and meeting rooms are transformed by VTPC but not necessarily excluded. The "virtual presence" provided by the technology was often seen as inadequate for interaction. One of the team members explained the limitation of video teleconferencing as: In this group it was a group of five or six people they become "ants" on the screen.
Social interactions (the virtual coffee machine)	The virtual coffee machine is not necessarily a direct replacement: We try to have what we call virtual coffee sessions, which were dreadful...all around the world we tried to get together and have a cup of coffee and sit down and look at each other, and you can't be spontaneous now, you can't do it, you can't force it.
Alliances	Often such alliances also extended outside the organization. For example, the VTPC enabled specialist consultants from contacting organizations (who were working for Xeon), to videoconference with their other petro-chemical clients, who were often Xeon's competitors. By not having to physically go to their clients to deal with their problem, the experts were able to get back to the contract work at Xeon after the videoconferencing session.
Time zones	One of the managers recalled: you have got more problems of time zones. That is a difficulty there, which is why we have our team meetings [at 4:00 or 5:00] on a Monday afternoon so that at least it is still early morning for most of them there [USA]. But at least we have some sort of overlap time.
Isolation	Many of the participants had a constant fear of isolation. One of the team members explained: In my team some people [are] based in [town x], some people based in [town y] and then odd ones kind of all over...slowly people started to migrate to the biggest center for the meetings. It was classic...instead of going to my base office, which was in [town x], I would go to [town y] because I knew the boss was going to be there for a start...but then there was the deep scare that if the [VTPC] broke down I will be where the action is...I'm not going to be left out.
Existing communication modes (e.g., e-mail and telephone)	Many began to see the potential advantage of additional forms of communication enabled by new technologies. A senior manager recalled his experience as: We had a number of locations with people...and there's always a communication problem...the first experience we had [with the introduction of the new technologies] was the added dimensions in communication.

Actants	**Potential actants involved in the collective of VTPC and organizational members**
Budgets (e.g., savings on travel)	Managers who used VTPCs in their division reported savings in time, travel costs, and less rework in projects. One construction manager revealed that his "business saved over $4.5 million in one year."
Emotion	The team members, however, sought to have face-to-face meetings when they felt that the meetings would involve sharing of feelings and emotions. For example, one of the team managers expressed: anything that is going to raise emotion— it seems totally natural for me to go and be there...any strong emotional feedback where I need assurance that people are really getting it they understand the issue.
Knowledge	The broadly accepted need for knowledge management is used to legitimize the introduction of VT technology, despite the concept of knowledge being poorly defined and understood within Xeon.
Temporary teams	Many saw the technologies as enabling them to form "task-based" temporary teams. For example, one of the managers explained: traditionally that [a problem] would have meant people flying up to the site... but we found that by showing people those pictures, you could get to resolve problems a lot quicker, not always... sometimes you do need to physically see the thing but quite often skilled people could say, "well I could see by the way that failed [and] what caused it."
Project champion	Although some of the teams became the champions of using virtual team-working facilities, one of the senior managers from the construction project recalled: It is a term that is a little bit out of vogue now...stand up and be counted, this is something we are going to do...it is essentially someone who will lead and take ownership for that particular activity.
Working practices	Many saw the new technologies as helping change working practices. One of the senior managers explained: we are really looking at the application of the stuff, what you can do with the technology as opposed to "isn't it a clever piece of technology but how can we really change what we are doing" and I think it is from approaching the use of the technology that way that you will start to innovate in terms of "we can actually do this in a different way, or we have been able to pick up a piece of information this way that we haven't been able to do before" and that sparks off a whole new process.
Multipoint bureau	Multipoint bureau was seen as an unreliable and immature technology. One of the junior managers recalled: if you have a multipoint, you have to arrange it through a bridge, the technology is still immature, its kind of like, an analogy we use, its kind of like a mobile phone, these things don't always work, I've wanted to throw mine out of the window many times, but at the end of the day it's good value and it's worth me hanging on to.

> At first we were quite concerned about people dropping into our office [via VT] from all over the place. But we managed to get over that. The ease of communication that it's [VT] given us and the tools that it's given us to communicate far more effectively with our design engineers has caused us to reduce our normal down time. We get a very, very quick timely resolution of any problems that we have, which in turn has helped us to become more efficient and has reduced the manpower costs that we would normally incur during this time in the project. To give you some idea, the manning levels at the moment are 50% of the projected manning level that we would be running at this time.

Face-to-face meetings were still seen as essential for actors to participate in activities happening at the "backstage" (Goffman 1990) where participants exchanged and shared feelings and emotions. One of the junior managers explained:

> we are having a global team meeting in two weeks time...the big joke is—"can't you do this virtually?"—I say no we can't do it virtually, we can get so far virtually but until we have a real good drink and a good meal and a good social chat at length we are not going to be a "real team"... .We can then use technology to maintain it [relationship] and obviously it's going to slide.

Table 1 is helpful in identifying the relevant actants in the situation, but it is unstructured and provides little guidance concerning how the due process might be facilitated and guided. As the actants need to be represented in, we decided to attempt to identify spokespersons that might speak on behalf of the people and things affected by and affecting the VTPC situation (Table 2).

Pouloudi and Whitley (1997) provide guidelines for identifying stakeholders and show how once the obvious stakeholders have been identified (e.g., customers, suppliers), then further stakeholders emerge as a result of interactions with the situation, such as interviews. Things cannot speak for themselves and, therefore, need faithful human representatives; we suggest that identifying actants (human, non-human, and abstract) provides a broad base for finding humans to speak on behalf of people and things and could form an input to a modified, i.e., more even-handed form of stakeholder analysis.

Table 2. Potential Spokespersons for VTPC-Related Actants

Actants	Representatives—Xeon	Representatives—other
Audit trail	User management	—
Existing communications networks (bandwidth)	Network administrators	Telecoms suppliers
Existing PCs	IT support	IT suppliers
The Internet (TCP/IP)	Network administrators	—
Body language	Training (presentation coaching)	—
Senior management authority	Senior management	—
Management sanction	Senior management	—
Air travel, travel agents, hotels, taxi companies, hire cars	Travel services	Travel companies
Offices and meeting rooms	Building services, IT services	—
Social interactions (the virtual coffee machine)	Human resources	—
Alliances	User management	Suppliers, customers, partners
Time zones	Human resources	—
Isolation	Human resources	—
Existing communication modes (e.g., e-mail and telephone)	Building services, IT services	—
Budgets (e.g., savings on travel)	Finance	—
Emotion	Training (personal development)	—
Knowledge	Knowledge management team	—
Temporary teams	User managers	—
Project champion	Project champion	—
Working practices	Human resources, process innovation	Partners
Multipoint bureau	IT services	IT suppliers

4.2.2 Institution

Our reading of the situation is that VT technology has achieved a degree of institutionalization that goes beyond the pilot status of the initial implementations, although there is a long way to go before it will be as black-boxed and

irreversible as the telephone (or even e-mail). The actors' routinized practices in response to their new hierarchy of values helped to establish some of the new changes. For example, three new forms of relationships were enacted around the use of new VTPC technologies:

- online sharing relationships;
- extending authority relationships;
- task-based temporary relationships.

Many teams began online sharing of documents such as contractual documents, presentations, planning documents, and engineering drawings. Many of the face-to-face routine management team meetings were also replaced by video teleconferencing. Through such online interactions enabled by the use of VTPC, senior managers were able to extend their authority over subordinates. VTPC enabled them to form task-based temporary teams of specialist consultants from the contracting companies to deal with engineering problems on remote sites, without having all the specialists permanently located on those sites.

While these changes became institutionalized, there were many proposed changes and established practices which were discarded. For example, one of the managers recalled that:

> We even toyed with the idea of random reconnecting two people once a day, almost a lottery...you might find yourself connected to somebody you don't know. We decided not to do that in the end.

Such changes were rejected by the participants as an outcome of consultation and hierarchy, although many established face-to-face routine management team meetings were replaced by video teleconferencing. Many of them saw the VTPC and the associated new work practices as institutionalized. One of the senior managers explained that:

> It doesn't mean to say that there aren't sceptics, and it doesn't mean to say that there aren't units out there that are never used. Of this many VTPC units, this many are used quite a lot, this many will be really core people who say this is fundamental to the way I work. And the CEO has really pushed it, he has said this is a great idea, he uses it, if [the CEO] stopped using it I don't think it would stop in the rest of the organization. I think it has become embedded across the organization, at all levels of the organization.

However, people still had the potential of refusing to use the VTPC and some had chosen to do so. One of the senior managers stated that:

> I guess the reason we don't get the negative is that people who feel that don't use it, it is not as widespread that you have one of these in everybody's office, so if you really don't feel comfortable and it is not your way of working then you, in a sense, can avoid by saying, well I haven't got a VT unit, I'll talk to you on the phone, or I'll send you an e-mail. So I guess it hasn't got pervasive enough for it to become an issue, in other words people can avoid it, and the ones that want to use it are the ones who think it is really great, really helps.

Currently, users are allowed to choose between VTPC and a conventional PC. As the VT-based work practices became more established, the technological components of the VTPC continue to become a stronger part of Xeon's information technology infrastructure.

5. REFLECTIONS

A model of due process has been applied to gain understanding about the acceptance of new technology. The candidate for existence, video conferencing technology, initially causes perplexity: there is a new fact, but what does it mean and what are its implications? In the consultation phase, we identified a range of human and non-human actors through analysis of case study data in order to show the complexity and fragility of actor networks. We deliberately avoided the temptation of categorizing actants as human or non-human, preferring to take an even-handed approach. Consultation is followed by hierarchy, where the organization attempts to order the network of associations according to the values of the actants. Institution is one outcome of consultation and hierarchy, but so is exclusion from the collective, as is all too often the case with IS projects (Lyytinen 1988; Lyytinen and Hirschheim 1987).

Our first reflection is that the thinking in terms of the dynamics of due process seems to be a useful perspective on new technology institution and IS implementation in general. The Latourian model of due process, which is grounded in actor network theory, helps to gain insight into the socio-technical imbroglio that characterizes the collective. Our analysis in Table 1 suggests a rich association between technology and humans. An understanding of the broad range of actants that need to be enrolled to achieve network stability is an essential aspect of technology institution. The due process network perspective

has led us to look at aspects of institution that often remain hidden or unarticulated. These are the actants that might help us understand better the process of institution.

One implication of ANT is that all actors are to be treated even-handedly, whether they be developers, users, body language, conference rooms, networking standards, coffee machines, Murphy's law, fate, and so on. These are some of the heterogeneous allies that must be lashed up for a stable network to emerge. Button (1993) is critical of ANT and refers to Law's (1986) description of a Portugese Galley, which is a product of men, sailcloth, wood, etc. Button points out that:

> However, we should presumably also say of air (because men must breathe), of food (because men must eat), of microbes (because during the course of these things people would be sick)... .Any list of "actors" in their sense is likely to be only a very short and—given their approach—quite arbitrary selection from the effectively infinite list of actors involved (Button 1993, p. 23).

Button then criticizes ANT for not addressing the details of the associating of elements in the network and argues that what is missing is an account of the working practices that resulted in the resources coming together and from which a galley emerged. Another way of viewing this criticism is that ANT is a useful way of describing network development, such as Latour's (1984) account of the development of pasteurization, but that it is lacks explanatory power. Latour (1991) recognizes this and argues that:

> The *description* of socio-technical networks is often opposed to their *explanation*, which is supposed to come afterwards. Critics of the sociology of science and technology often suggest that even the most meticulous description of a case-study would not suffice to give an explanation of its development. This kind of criticism borrows from epistemology the difference between "how" and "why," between stamp-collecting—a contemptible occupation—and the search for causality—the only activity worthy of attention (p. 129).

Rather than dwell on the descriptive aspects, we propose that ANT ideas be used to inform action, such as using the diverse actants of Table 2 to identify human representatives (stakeholders) that might form a parliament of things.

The second reflection is on purpose and intentionality. We feel it would be inappropriate to view the process of network formation as one of randomness where the outcome cannot in any sense be predicted, directed, or managed. While we have included a broad range of actants together in Table 1; they differ in their capability to have "intentionality" (human agency—c.f. Giddens 1984; Pickering 1995). We recognize that technologies do not act like humans because they lack intentionality (Pickering 1995). Jones (1999) claims that intentions, organized around plans and goals are important in understanding human agency in a way that is not the case for technologies. As Jones argues, however, this does not mean that human plans and goals are always explicitly formulated or that human actors are fully aware of their motivations or capable of realizing them—the "slight surprise of action" (Latour 1999). Intentional human actions also often result in unintentional consequences (Giddens 1984). Ciborra (1996) argues that such purposeful actions can also result in technology "drift." He claims that "drift is thus the outcome of the match between the two actants (Callon 1991): technology [VTPC] and humans in their various roles of sponsors, users and designers [junior and senior managers]" (Ciborra 2000). Pickering (1995) claims that human and non-human (technologies) are "constitutively intertwined." These are so mangled together that it is impossible to separate them clearly. Rather than making an analytical separation between human agency and non-human agency, Table 1 focuses on the actants that need to be considered in the mediation of technology and humans.

The third reflection is concerned with the design of due process. Once again, it seems that ANT ideas provide a basis for gaining understanding, but it is less clear how the ideas might be used prescriptively in IS. The due process at Xeon was not a designed process as such and whatever design intention there was, it was certainly not based on the ideas of ANT and due process. In planning for new technology and IS implementation, we need to consider how a due process might be designed with the intention of achieving a successful outcome—a black-boxed and irreversible technology. This appears to ignore issues such as fairness and ethicality, but these are actants that can be consulted and which can be ordered in the hierarchy. The question then is: how can the various actants be represented in the parliament of things such that due process is enacted? Human actors need representatives, as we see in parliamentary democracy. Non-human actors also need representatives, and we have proposed candidate spokespersons for actants such as time zones, air travel, and meeting rooms. Where the actants are more abstract, such as emotion, management authority, and ethicality, finding suitable spokespersons becomes more difficult, but possibly it is actants such as these, which are not represented in organizations, that should be given particularly close attention. Representation is necessary for consultation, but the design of the due process must also be effective when ordering values

(hierarchy). A range of metaphors might be adopted, including democracy, the court room, expert opinion, mob rule, etc. Perhaps it is time for the heterogeneity of technology and IS to be reflected in more diverse and imaginative approaches to the design of due process. We give the last word to Latour: "belief in causes and effect is always, in some sense, the admiration for a chain of command or the hatred of a mob looking for someone to stone" (Latour 1988, p.162).

6. REFERENCES

Bowker, G., Timmermans, S., and Star, S. L. "Infrastructure and Organizational Transformation: Classifying Nurses' Work," in *Information Technology and Changes in Organizational Work*, W. Orlikowski, G. Walsham, M. Jones, and J. I. DeGross (eds.), London: Chapman & Hall, 1996.

Button, G. "The Curious Case of the Vanishing Technology," in *Technology in Working Order: Studies of Work, Interaction, and Technology*, G. Button (ed.), London: Routledge, 1993.

Callon, M. "Some Elements of a Sociology of Translation: Domestication of the Scallops and the Fishermen of St Brieuc Bay," in *Power, Action and Belief*, J. Law (ed.), London: Routledge & Keagan Paul, 1986, pp 196-233.

Callon, M. "Techno-Economic Networks and Irreversibility," in *A Sociology of Monsters: Essays on Power, Technology, and Domination*, J. Law (ed.), London: Routledge, 1991, pp 132-161.

Ciborra, C. U. "Drifting: From Control to Drift," in *Planet Internet*, K. Braa, C. Sorensen, and B. Dahlbom (eds.), Lund, Sweden: Studentlitteratur, 2000.

Ciborra, C. U. "Introduction: What Does Groupware Technology Mean for the Organizations Hosting It," in *Groupware and Teamwork: Invisible Aid or Technical Hindrance?*, C. U. Ciborra (ed.), Chichester, England: John Wiley, 1996, pp. 1-19.

Freeman, R. E. *Strategic Management: A Stakeholder Approach*, Marshfield, MA: Pitman, 1984.

Giddens, A. *The Constitution of Society*, Cambridge, MA: Polity, 1994.

Goffman, E. *The Presentation of Self in Everyday Life*, London: Penguin, 1990.

Grint, K., and Woolgar, S. *The Machine at Work: Technology, Work and Organization*, Cambridge, MA: Polity Press, 1997.

Hepso, V. "The Involvement of Human and non Human Stakeholders: combining Actor Network Theory and Action Research," in *Proceedings of the Twenty-Third IRIS*, Copenhagen, Denmark, August 1999.

Jones, M. "Information Systems and the Double Mangle: Steering a Course Between the Scylla of Embedded Structure and the Charybdis of Strong Symmetry," in *Information Systems: Current Issues and Future Changes*, T. J. Larsen, L. Levine, and J. I. DeGross (eds.), Laxenburg, Austria: IFIP Press, 1999, pp. 287-302.

Latour, B. *Pandora's Hope*, Cambridge, MA: Harvard University Press, 1999.

Latour, B. *The Pasteurization of France*, Cambridge, MA: Harvard University Press, 1984.

Latour, B. "The Politics of Explanation: An Alternative," in *Knowledge and Reflexivity: New Frontiers in the Sociology of Knowledge*, S. Woolgar (ed.), Newbury Park, CA: Sage, 1988.

Latour, B. "The Powers of Association," in *Power, Action and Belief*, J. Law (ed.), London: Routledge & Keagan Paul, 1986, pp. 264-280.

Latour, B. Seminar Series, "Information Systems or Networks of Transformation?" and "The Politics of Nature," given at the London School of Economics and Political Science, London, January- March, 1998.

Latour, B. *Science in Action*, Cambridge, MA: Harvard University Press, 1987.

Latour, B. "Technology is Society Made Durable," in *A Sociology of Monsters: Essays on Power, Technology, and Domination*, J. Law (ed.), London: Routledge, 1991, pp. 103-131.

Latour, B. *We Have Never Been Modern*, New York: Harvester Wheatsheaf, 1993.

Law, J. "On the Methods of Long-Distance Control: Vessels, Navigation and the Portugese Route to India," in *Power, Action and Belief: A New Sociology of Knowledge?*, J. Law (ed.), London: Routledge, 1986.

Lipnack, J., and Stampts, J. *Virtual Teams: Reaching Across Space, Time and Organizations with Technology*, New York: John Wiley, 1997.

Lyytinen, K. "Stakeholders, Information System Failures and Soft Systems Methodology: An Assessment," *Journal of Applied Systems Analysis* (15), 1988, pp. 61-81.

Lyytinen, K., and Hirschheim, R. A. "Information Systems Failures: A Survey and Classification of the Empirical Literature," *Oxford Surveys in Information Technology* (4), 1987, pp. 4, 258-309.

McMaster, T., Vidgen, R., and Wastell, D. "Diffusion and Translation in Technology Transfer," in *Proceedings of the Second IFIP 8.6 Working Conference on Diffusion and Adoption of Information Technology*, T. McMaster and D. Wastell (eds.), Ambleside, UK, May 14-17, 1997.

McMaster, T., Vidgen, R., and Wastell, D. "Networks of Association and 'Due Process' in IS Development," in *Information Systems: Current Issues and Future Changes*, T. J. Larsen, L. Levine, and J. I. DeGross (eds.), Laxenburg, Austria: IFIP Press, 1999.

Mason, R., and Mitroff, I. *Challenging Strategic Planning Assumptions*, New York: Wiley, 1981.

Monteiro, E., and Hanseth, O. "Social Shaping of Information Infrastructure: On Being Specific About the Technology," in *Information Technology and Changes in Organizational Work*, W. Orlikowski, G. Walsham, M. Jones, and J. I. DeGross (eds.), London: Chapman & Hall, 1996.

Mumford, E. *Effective Systems Design and Requirements Analysis*, London: Macmillan, 1995.

Orlikowski, W. J., and Baroudi, J. J. "Studying Information Technology in Organizations: Research Approaches and Assumptions," *Information Systems Research* (2:1), 1991, pp. 1-28.

Pickering, A. *The Mangle of Practice: Time, Agency and Science*, Chicago: University of Chicago Press, 1995.

Pinch, T. J., and Bijker, W. E. "The Social Construction of Facts and Artifacts: Or How the Sociology of Science and the Sociology of Technology Might Benefit Each Other," in *The Social Construction of Technological Systems*, W. E. Bijker, T. P. Hughes, and T. Pinch (eds.), London: MIT Press, 1987, pp. 17-50.

Pouloudi, A., and Whitley, E. "Stakeholder Identification in Inter-organizational Systems: Gaining Insights for Drug Use Management Systems," *European Journal of Information Systems* (6), 1997, pp. 1-14.

Rogers, E. M. *Diffusion of Innovations* (4th Edition), New York: Free Press, 1995.

Thompson, I. "A Few Facts to Consider on Wind Turbine Issue," *The Stroud News and Journal*, letters page, October 25, 2000.

Vidal, J. "Earth Will Get Hotter Than Expected," *The Guardian*, October 27, 2000.

Vidgen, R., and McMaster, T. "Black Boxes, Non-human Stakeholders, and the Translation of IT Through Mediation," in *Information Technology and Changes in Organizational Work*, W. Orlikowski, G. Walsham, M. Jones, and J. I. DeGross (eds.), London: Chapman & Hall, 1996.

Walsham, G. "Actor Network Theory and IS Research: Current Status and Future Prospects," in *Information Systems and Qualitative Research*, A. S. Lee, J. Liebenau and J. I. DeGross (eds.), London: Chapman & Hall, 1997, pp. 466-480.

Walsham, G. *Interpreting Information Systems in Organizations*, Chichester, England: John-Wiley, 1993.

Whitley, E. "Habermas and the Non-humans: Towards a Critical Theory for the New Collective," in *Proceedings of the Critical Management Studies Conference*, C. H. J. Gilson, I. Grugulis, and H. Willmott (eds.), Manchester School of Management, July 14-16, 1999 (http://www.mngt.waikato.ac.nz/ejrot/cmsconference/documents/Information%20Tech/Habermas%20and%20the%20non-humans.pdf).

About the Authors

Joe Nandhakumar is a senior lecturer in Information Systems in the School of Management at the University of Bath. Previously he was a Lecturer in Information Systems in the Department of Management at the University of Southampton. He gained his Ph.D. in Information Systems from the University of Cambridge, Department of Engineering. His current research interests focus on the social and organizational aspects of the development and use of information technologies in organizations. Prior to joining the University, he worked for several years in software development and accounting projects in multinational companies. Joe can be reached by e-mail at mnsjn@bath.ac.uk.

Richard Vidgen is a lecturer in Information Systems in the School of Management, University of Bath. After working in industry in information systems development for many years he joined the University of Salford in 1992, where he completed a Ph.D. in systems thinking and IS quality. His current research interests include web implementation quality and IS development methodologies. Richard can be reached by e-mail at mnsrtv@management.bath.ac.uk.