

# Preface

## INTRODUCTION

Actor-network theory (ANT) proffers an account for socio-technical research in which neither social nor technical positions are privileged. This is in marked contrast with many other approaches that treat the social and the technical in entirely different ways. These other approaches are then either:

- Technologically driven with a focus on the technical aspects, so treating ‘the social’ as the context in which the events take place, or
- Socially driven where relatively stable social categories are used to explain technological change and the emphasis is on an investigation of social interactions, relegating the technology to context.

Actor-Network Theory originated from research in the social studies of science in the 1980s, principally by Bruno Latour, Michel Callon, and John Law. ANT was designed as an approach to socio-technical research that would treat the contributions of both human and non-human actors fairly and in the same way and considers the world to be full of hybrid entities containing both human and non-human elements. In this socio-technical order nothing is purely social and nothing is purely technical. Law and Callon describe this more explicitly in the following way:

*Explanations of social and technical change must avoid three traps. Two of these take the form of reductionisms. Social reductionism, the doctrine that relatively stable social categories can explain technical change, and technological reductionism, the converse view, that technological change automatically shapes society, are both one-sided, incomplete, and misleading (MacKenzie and Wajcman 1985). But even if the social and the technical are both taken to be important, there is a third trap to avoid. This is the notion that the technical and the social evolve as a result of separate processes and only subsequently interact. By contrast, our aim has been to suggest that they are jointly created in a single process. (Law and Callon 1988:295,296)*

In actor-network theory, an actor is any human or non-human entity that is able to make its presence individually felt (Law 1987) by other actors and is made up only of its interactions with these other actors (Law 1992; de Vries 1995). ANT is thus concerned with studying the mechanics of power as this occurs through construction and maintenance of networks made up of both human and non-human actors. Callon (1986) argues that an actor can also be considered, at times, as a black box, as we do not always need to see the details of the network of interactions that is inside it.

*... it turns out that when you look at what technologists actually do, we find out that they pay scant regard to distinctions between technology on the one hand and society, economics, politics, and the rest on the other. (Law and Callon 1988:284)*

## **ACTOR-NETWORK THEORY: A ROSE BY ANY OTHER NAME ...**

For some time there has been discussion over the name of what we now call actor-network theory. Some suggest that its name should be changed to something more accurately descriptive such as the sociology of translation or actant-rhizome ontology, and in a 1999 book Latour remarked that:

*I will start by saying that there are four things that do not work with actor-network theory; the word actor, the word network, the word 'theory' and the hyphen. Four nails in the coffin. (Latour 1999:15)*

How serious he was about this, however, is open to question as some time later he noted that the name actor-network theory "... is so awkward, so confusing, so meaningless that it deserves to be kept." (Latour 2005: 9). He then went further to say:

*I was ready to drop this label for more elaborate ones like 'sociology of translation', 'actant-rhizome ontology', 'sociology of innovation', and so on, until someone pointed out to me that the acronym A.N.T. was perfectly fit for a blind, myopic, workaholic, trail-sniffing, and collective traveller. An ant writing for other ants, this fits my project very well! (Latour 2005:9)*

## **Using ANT for a Research Framework in Situations Involving Interactions between People and "Things"**

Actor-network theory is based on three principles aimed to ensure that both human and non-human actors are treated fairly and in the same way (Callon 1986):

- Analytical impartiality: Demanded for all actors in the project under consideration, whether they be human or non-human.
- Generalised symmetry: Offers to explain conflicting viewpoints of the different actors using the same neutral vocabulary that works the same way for human and non-human actors so that neither the social nor the technical elements should then be given any special explanatory status.
- Elimination of all *a priori* distinctions between the technological and the social as: "ANT was developed to analyse situations in which it is difficult to separate humans and non-humans, and in which the actors have variable forms and competencies." (Callon 1999:183)

In summary, Callon puts it this way:

*The rule which we must respect is not to change registers when we move from the technical to the social aspects of the problem studied. (Callon 1986:200)*

ANT was designed for use in situations involving people and things – human and non-human actors – and the interactions, influences and associations between them. It was designed, in particular, to give an equal voice to the actions and influences due to the ‘things’ – the non-human actors.

## **IJANTTI Research Articles from 2009-2011**

The International Journal of Actor-Network Theory and Technological Innovation (IJANTTI) is now (2012) in its fourth year of publication and has generated a substantial amount of research literature on both actor-network theory in its various applications, and also examples and models of technological innovation. What follows is a summary of IJANTTI articles over the first three years, roughly sorted into categories. (Of course, some articles fit into more than one category so this sorting is at best approximate.)

### **ANT and Educational Research**

A large group of ANT articles relates to educational research, covering both school and university levels. An article by Tummons (2009) explores aspects of higher education in further education provision in England. The article focuses on assessment of a teacher-training course for the learning and skills sector and offers ways of conceptualising the responses of the Further Education colleges where the course was actually run to the systems and procedures established by the University which provided the course. The article suggests that the ways in which assessment processes are regulated and ordered are characterised by complexities for which actor-network theory provides an appropriate conceptual framework.

An article by Manning *et al.* (2010) looks at e-learning and blended learning in a university. The article notes that merely defining a policy in relation to the use of e-learning will not necessarily cause the desired result as first the new ideas have to be adopted by all those involved. The authors suggest that educational technology adoption decisions are made at three levels. Firstly, strategic decisions are made by the university to implement a particular package. Secondly individual academics make adoption decisions regarding those aspects of the package they will use in their teaching and how they will use them. The third level consists of a decision on the balance they will make between on-line and face-to-face teaching. This article questions how decisions are made to adopt one e-learning package rather than another. Once the technology is adopted it then questions how individual academics relate to it and make use of it to deliver some or all of their teaching, and to determine the appropriate blend.

Volume 3, Issue 2 of the journal was a special issue based on the use of ANT for educational research. The first article in this issue (Mulcahy 2011) investigates professional teaching standards and notes that in the context of neo-liberal education policy reform, professional teaching standards have become an important means of managing improvements to school teaching and assuring its quality. Bringing the performative perspective of actor-network theory to bear whereby not only sociality but also materiality is taken into account, the author argues that standards are best understood as shifting assemblies of practice whose nature defines and enacts teacher identity and teacher professional knowledge differently in different locations. Tscholl *et al.* (2011) then present an account of field research into case-based learning in a management course, guided by the questions: ‘what is making change in this setting’, and ‘where is learning located’. In working with ANT sensibilities the authors found that tracing the action offers radically different accounts and possibilities for education research and practice. Rather than con-

ceptualising the curriculum as a mandate which guides a teacher's task of advancing the knowledge of students – the simple story – De Vincentis (2011) explores the curriculum as an object of complexities. Drawing on ANT and the fieldwork resulting from a primary school arts project the article examines the curriculum as a relational effect of education and illustrates how interdependent webs of heterogeneous relations contribute to the entity called the curriculum. Rimpiläinen (2011) introduces an interdisciplinary project entitled: “Ensemble: Semantic Technologies to Support the Teaching and Learning of Case Based Learning” set in a Scottish university. The article's specific focus is on the epistemology of actor-network theory and in particular, the principle of symmetry.

Quinlan *et al.* (2011) note that the teaching of innovative schools of thought calls for innovative methods of teaching. They investigate the challenges associated with teaching actor-network theory, and propose and describe the successes of a creative pedagogical approach of ‘performing’ ANT in the classroom and using this creative pedagogical approach to the teaching of ANT. They argue that it is only through innovative teaching methods that ANT can be effectively explored in the classroom.

In an article on professionalism, Tummons (2011) notes that problematisation of the professional standards for teachers in the UK lifelong learning sector tends to focus on the discourses that the standards embody: discourses that are posited as being based on a restricted or technicist model of professionalism. These fail to recognise the lived experiences of teachers within the sector both in terms of professional knowledge and competence. This article suggests instead an approach drawing on actor-network theory in order to shift the locus of problematisation away from what the standards might mean, to how the standards are physically assembled or instantiated.

In a couple of articles (Tatnall 2009; Tatnall 2010) I investigate the adoption of the programming language: Visual Basic (VB) into the information systems curriculum of an Australian university. VB did this against resistance from two incumbent programming languages, but could not, of course, work alone and so enlisted the assistance of a human ally. The incumbent programming languages, Pick Basic and the Alice machine language simulator, also had their human allies to assist them in resisting the assault of the newcomer. In many ways it is useful to think of all these programming languages as black boxes made up of hybrid entities containing both human and non-human parts along with a conglomeration of networks, interactions and associations. The non-human cannot act alone, but without them the human parts have nothing to contest.

In an article that relates to both education and feminist issues, Rowan and Bigum (2009) note that despite more than 30 years of gender reform in schools, the number of girls enrolled in IT subjects in the post-compulsory years of education has remained persistently low. The article focuses on identifying reasons for this and ways in which the situation could be changed. The authors discuss differences between the researchers' perception of this problem compared with those of the participants, and use ANT to highlight the gaps, tensions and contradictions within the data and to question the extent to which the enrolment of girls in IT is indeed ‘a problem’.

Finally, in relation to research in special education, Adam (2011) argues that Petri Net concepts (when used qualitatively) have some similarities to ANT. The original research that this article is based on was undertaken using an actor-network framework to develop a model for e-learning for students with learning difficulties in special schools in Victoria, and this article explores the qualitative use of Petri Nets to supplement this ANT treatment. The article notes that the places from Petri Nets bear a strong resemblance to the actors in ANT, and the triggers or transitions are somewhat analogous to ANT's translations.

## ANT and Research into Information and Communications Technologies (ICT)

In the very first issue of *IJANTTI*, an article by Cecez-Kecmanovic and Nagm (2009) investigates the evaluation of information systems project proposals by using ANT to provide a better understanding of their development and evaluation in practice and ways in which the evaluation process shapes and ensures the selection of the best IS projects. In a later issue, an article by Elbanna (2009) argues that for researchers studying ICT, ANT provides a theoretical inclusion of what used to be considered different poles, in analytically and including a wide array of actors that were formerly considered to be of different nature and from different levels of analysis. Using the analytic perspective of ANT, Linden (2009) relates research examining electronic mailing list discussions by the Linux kernel developers, and found many posts that expressed the developers' dislike for the revised version of the Linux General Public License – but all for different reasons. These opinions provide details of differences between open source software and free software, and illustrate that for a proper understanding there is a need to consider both human and non-human actors. Iyamu (2009) notes that the focus in IT projects has predominantly focused on technologies and less on the non-technical components. His study focused on the connection between the technical and non-technical, including the relationships between actors in the development and implementation of IT strategy.

Cordella (2010) suggests that research into information infrastructures has mainly focused on studying the process that both shapes and stabilises information infrastructures and of studying the role played by information infrastructure in leveraging business performance. Using ANT as an ontological foundation to analyse the relations among actors, this article proposes the concept of information infrastructures in action to highlight their dynamic nature, leading to a consideration of these not as stable entities, but rather as entities performed through relations. In relation to enterprise ICT architecture, Iyamu (2010; 2011) notes that organisations experience difficulty in managing technology, changing from system to system, implementing new technology, maintaining compatibility with existing technologies and changing from one business process to another, and relates two case studies, analysed from an ANT perspective, in order to better understand the related socio-technical influences. Cole (2010) investigates the relationship between the social and the material in ICT and considers this under the banner of socio-materiality.

Another ICT related article (Jonsson and Holmström 2010) focuses on the use of sensors as part of remote diagnostic systems in industrial organisations, noting that context awareness forms a core concern in ubiquitous computing. The study shows that the process of desituating context – capturing context and transferring it to another context – is critical for the successful use of the technology and that by conceptualising the world as heterogeneous socio-technical networks, ANT can help to analyse the intertwined relationship between human agency, technology and contexts to further our knowledge about desituation of context. Evolution of an organisational intranet is the subject of an article by Underwood and Tabak (2011) in which they compare concepts of materiality with actor-network theory's black-boxing. In the article they argue that information systems need to become material through due process and that questions arise as to what types of material allies are useful in this process, and whether these allies can co-evolve with the system.

## ANT and Healthcare Research

The information intensive environment of healthcare research has been a topic that has attracted a number of ANT articles. Wickramasinghe and Bali (2009) proffer a network-centric approach to healthcare to allow free and rapid sharing of information and effective knowledge building. They assert that if we are to realise such a vision the application of Social Network Analysis combined with Actor-network Theory (S'ANT), provides useful analytical tools and analyses. In a related article (Wickramasinghe, Bali and Goldberg 2009) the S'ANT approach is advocated as a means to analyse the case for the application of a pervasive technology solution in the form of a wireless-enabled mobile phone to facilitate superior diabetes management.

Investigating the adoption of ICT in medical general practices in a rural area of Victoria, Deering *et al.* (2010) use ANT to analyse the very complex decisions taken in its adoption. These decisions involve many actors, both human and non-human and, rather than characteristics of the technology itself, it is often seemingly unimportant human issues that determine if and how ICT is used in General Practice. In one case, for example, non-adoption was because the father of the present Practice Principal was not comfortable with ICT and as he was not far off retirement no one wanted to make him feel uncomfortable by introducing this technology. An article by Bielenia-Grajewska (2011) uses an ANT approach to discuss how websites create and maintain the online identity of healthcare providers. She indicates that an ANT approach makes it possible to study the role of living and non-living entities in shaping the online identity of healthcare suppliers and to concentrate on the networks and systems within e-healthcare as well as the flows and interrelations constituting it.

Knowledge creation techniques tend to focus on either human or technology aspects of organisational development and less often on process-centric aspects of knowledge generation. In relation to healthcare knowledge exchange, the ability to extract germane knowledge to enable rapid and effective decision making is central. Two more articles (Bali and Wickramasinghe 2010; Wickramasinghe, Tatnall and Bali 2010) suggest that to truly understand knowledge creation and transfer it is important to view knowledge creation and all socio-technical organisational operations that result in knowledge generation through the rich lens of actor-network theory.

## Business and Government Research and ANT

Uden and Francis (2009) note that the service sector is now the dominant economy in the industrial world and that services have become the key value driver for companies. The rapid growth of services has implications for academic knowledge creation, education, business practice, and government policy, but there is a lack of understanding of the science underlying the design and operation of service systems requiring new conceptual understandings and theoretical underpinnings. The authors suggest that ANT could be used as a theoretical lens to study the development and adoption of service innovation. Naidoo (2010) writes that despite growth in technology-based service delivery options, implementation of contemporary forms of service channels continues to be for organisations and that current conceptualisations of IS implementation are too narrow and highlight only some aspects of this phenomenon. The article uses the ANT conceptual elements of inscription and translation to describe how the design and use of this self-service technology emerged from co-entanglement between the technological and social.

Another article (Ariani and Yuliar 2009) uses ANT's notion of translation to investigate bio-fuel development in Indonesia. It notes that despite the activities of scientists, business people, policy makers, and farmers, adoption of bio-fuel innovation seems to remain very limited. Kasimin and Ibrahim (2009)



point out that in Malaysia, major IT transfer in the public sector is usually due to policy implementation involving central government directives to implementation agencies. Their research has shown that the technology transfer process usually also involved many phases. In the article they described an approach based on actor-network theory and concepts of technology transfer stages and found that ignoring issues emerging from interactions between stakeholders not only delayed the transfer process but also did not fully achieve the original project objectives.

In an article relating a research approach using both Structuration Theory and Actor-Network Theory, Iyamu and Roode (2010) describe IT-business strategy and the way that business uses this either to increase their competitiveness, or often just to survive. The article points out that little is known about non-technical factors, including people, and their impact to the development and implementation of IT strategy and uses these theories to analyse how non-technical factors influence IT strategy.

Based on a case study of the Arizona Stock Exchange, Muniesa (2011) outlines how computerisation challenged the definition of the stock exchange in the context of North American financial markets in the 1990s. The article forms a sociological appraisal of market devices and examines how several kinds of apparatus contribute to the formation and deformation of market realities, in resonance with the viewpoints emphasised throughout ANT

An article by Cordella (2011) discusses the dynamics associated with the implementation and deployment of an information infrastructure designed to standardise work practices, based on a case study conducted in a pharmaceutical research and development organisation. The article discusses the dynamic interplay between technology and its users through the role played by local characteristics, contingencies, and practices in shaping a protocol to standardise work practices. Ekundayo and Diaz Andrade (2011) use ANT and Activity Theory to follow the trajectory of an artefact that makes it possible to go up and, once up there, to go down. We might call it a lift, but the authors avoid this characterisation in order to trace its evolution. From an ANT perspective their analysis of the evolution of this artefact shows the dynamic and provisional characteristics of the network of actors. From an Activity Theory perspective, it reveals how the goal-direction of this artefact mediates our actions. Diaz Andrade (2010) notes that assuming symmetry between human and non-human actors is a fundamental tenet of ANT. The article examines the use of electronic mail systems, especially the automatically generated Out of Office message to emphasise the distinction between agency and intentionality. The notions of intermediaries and mediators are introduced not only to corroborate that the division between the social and the technical is artificial but also to reveal the difference between non-human agency and human intentionality.

Leadership has been identified as one of the critical factor in the successful development of e-government projects in developing countries (Priyatma and Mohamed 2011), but empirical studies linking the outcome of e-government projects and the role of leadership are very limited. This article argues that ANT translation concepts provide an appropriate framework to trace and monitor how leadership has been practiced effectively in an e-government project in a developing country.

## Communications, Publishing, and Social Networking

An article by Bielenia-Grajewska (2009) discusses the place of ANT in one type of intercultural communication: translation. The article shows how ANT is useful in this area of cross-cultural communication, raising issues such as translators, translation, languages, texts and units and so involving both human and non-human entities that are treated as an ecosystem.

Zammar (2010) examines the role of the actors in a social network service and considers the triggers and challenges they represent to social networking between today's communities and businesses. The

article suggests that a Social Network Service is the product of the evolution of social liaisons and the emergence of online communities of people who are interested in exploring the concerns and activities of others. The author hopes that the article will trigger an exploration of the potential role of ANT in the social network service context.

An article dealing with the spread of open access to scholarly publishing (Kennan, Cecez-Kecmanovic, and Underwood 2010) explores some of the issues associated with giving non-human actors a voice of their own in ANT based research. Does this increase understanding of the issue to hand or does anthropomorphism detract from these? The article discusses these broader issues and presents findings from an ANT field study which investigated the implementation of institutional repositories and their relationship to the spread of open access to scholarly publishing.

## Technological Innovation

A new technology will only be adopted if potential users make a decision to do so, and it is useful to consider the adoption of any new technology in terms of innovation theory (Tatnall 2011) for which there are several different approaches, the most significant being: the Theory of Reasoned Action (Fishbein and Ajzen 1975), the Theory of Planned Behaviour (Ajzen 1991), the Technology Acceptance Model (Davis 1986), Diffusion of Innovations (Rogers 1995; Rogers 2003) and Innovation Translation (Latour 1986; Law and Callon 1988; Latour 1996).

In a couple of articles (Tatnall 2009; Tatnall 2009) I examine and compare the Innovation Diffusion and Innovation Translation approaches to theorising technological innovation, giving examples of how each approach is used in different situations. The articles suggest that while there are many advantages to the use of a Translation approach it is too simplistic to suggest that Translation always offers a better approach than Diffusion. It is suggested that a Translation approach typically offers a better understanding of individual adoptions, but that for large scale movements, Diffusion has some value.

Gonçalves and Figueiredo (2010) make use of an ANT approach based on Programs of Action to explore the description of innovation cases to discover internal referents that conveys their meaning. The article revisits examples like the application of ANT to obstetrics and gynaecology and the making and evolution of the computer mouse. It then outlines the case of two firms, one in the semiconductor industry and the other in the plastics mould industry, to illustrate a way to research the building of an ANT view for engineering innovations. In another article (Gonçalves and Figueiredo 2010) they write that as they are deeply involved with ANT applications in engineering domains they often cross through its fundamentals. They point out that envisaging ANT as a paradigm can prove valid in the engineering design field, but that it is sometimes necessary to go back to its roots, and that Obligatory Passage Points and Immutable Mobiles are two of the fundamental concepts that needed to be revisited and unfolded.

The next few articles relate to research making use of innovation theory, but using approaches other than ANT to theorising this.

Making use of a technology-organisation-environment (TOE) framework, Alawneh and Hattab (2009) describe an extended model used to examine technological, organisational and environmental factors that influence e-banking adoption in Jordanian banks. The research described looks at technology readiness, competence, bank size, financial resources commitment, business-IT strategy alignment, adequacy of IT professionals, availability of online revenues, competition intensity or pressure and regulatory support environment. Study of the phenomenon of chasm that often exists in the diffusion of innovation is the topic of the next article (Rayna, Striukova and Landau 2009) that looks at devising



a theoretical framework to explain the ability of some firms to cross this chasm, while others cannot. An article by Kripanont *et al.* (2009) describes research which used TAM (and its derivatives) to model adoption of Internet technology by academics in Business Schools in Public Universities in Thailand. In an article examining phenomenology and hermeneutics as research traditions, Lukaitis (2011) proposes a philosophical basis for their use and notes that socio-technical approaches to understanding innovation adoption at core rely upon finding meaning from data that must be interpreted and discusses a way of framing research so that a level of trust can be associated with research outcomes. Data visualisation, using an Innovation Diffusion approach, is the subject of an article by Bingley and Burgess (2009) that describes the development of a visual aid to depict the manner in which Internet applications are being diffused through local sporting associations.

### Re-Interpretation of Innovation Research Using ANT

Two articles take innovation research done using the Technology Acceptance Model (TAM) and Innovation Diffusion and re-analyse the data from an ANT perspective. One (Al-Hajri and Tatnall 2011) was based on research done in the mid-2000s on inhibitors to the uptake of Internet technologies in the banking industry in Oman. Given the socio-technical nature of this investigation however, another approach to adoption of innovations was worth investigating, and this article reported a re-interpretation of the original study using innovation translation. The second article (Charnkit and Tatnall 2011) used data collected for a study using TAM to investigate knowledge conversion processes in a Thai Government Ministry. The original TAM study investigated the relationship between technology support and management aimed at increasing knowledge sharing. This paper briefly outlines the findings of the original study and discusses how an ANT study would have approached this material in a quite different manner to that of TAM.

## CONCLUSION

From stories of building the French Electric Vehicle (Callon 1986), the TSR2 Military Aircraft (Law 1988), and the Aramis railway system (Latour 1996) to Portuguese Navigation (Law 1986) and Scallops and Fishermen (Callon 1986), research literature on actor-network theory has come a long way. ANT has been around since the mid-1980 but it is only over the last 15 or so years that it has grown to become a fundamental part of the approach of many of us to socio-technical academic research.

Technological innovations are adopted for a variety of reasons, but these are often not the reasons proposed by the instigators and promoters of these technologies, and are often not entirely rational. This paper described the articles, both of ANT and of studies of technological innovation based on other theoretical approaches, from the first three years of the *International Journal of Actor-Network Theory and Technological Innovation*.

There are those who say that ANT has run its course and needs to change fundamentally and there will always be those who make suggestions like these. For most of us, however, the value of making use of a little or a lot of ANT in our research is clear. We should also be allowed a little freedom to mould and shape ANT to our own needs and taste.

*Arthur Tatnall*  
*Victoria University, Australia*

## REFERENCES

- Adam, T. (2011). A Petri Net model for analysing e-learning and learning difficulties. *International Journal of Actor-Network Theory and Technological Innovation*, 3(4), 11–21. doi:10.4018/jantti.2011100102
- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50(2), 179–211. doi:10.1016/0749-5978(91)90020-T
- Al-Hajri, S., & Tatnall, A. (2011). A Socio-technical study of the adoption of internet technology in banking, re-interpreted as an innovation using innovation translation. *International Journal of Actor-Network Theory and Technological Innovation*, 3(3). doi:10.4018/jantti.2011070103
- Alawneh, A., & Hattab, E. (2009). E-banking diffusion in the Jordanian banking services sector: An empirical analysis of key factors. *International Journal of Actor-Network Theory and Technological Innovation*, 1(2), 50–66. doi:10.4018/jantti.2009040104
- Ariani, Y., & Yuliar, S. (2009). Opening the Indonesian bio-fuel box: How scientists modulate the social. *International Journal of Actor-Network Theory and Technological Innovation*, 1(2), 12.
- Bali, R. K., & Wickramasinghe, N. (2010). RAD and other innovative approaches to facilitate superior project management. *International Journal of Actor-Network Theory and Technological Innovation*, 2(3), 33–39. doi:10.4018/jantti.2010070103
- Bielenia-Grajewska, M. (2009). Actor-network theory in intercultural communication – Translation through the prism of innovation, technology, networks and semiotics. *International Journal of Actor-Network Theory and Technological Innovation*, 1(4), 53–69. doi:10.4018/jantti.2009062304
- Bielenia-Grajewska, M. (2011). Actor-network-theory in medical e-communication – The role of websites in creating and maintaining healthcare corporate online identity. *International Journal of Actor-Network Theory and Technological Innovation*, 3(1), 39–53. doi:10.4018/jantti.2011010104
- Bingley, S., & Burgess, S. (2009). Using data visualisation to represent stages of the innovation-decision process. *International Journal of Actor-Network Theory and Technological Innovation*, 1(2), 13–30. doi:10.4018/jantti.2009040102
- Callon, M. (1986). The sociology of an actor-network: The case of the electric vehicle . In Callon, M., Law, J., & Rip, A. (Eds.), *Mapping the dynamics of science and technology* (pp. 19–34). London, UK: Macmillan Press.
- Callon, M. (1986). Some elements of a sociology of translation: Domestication of the scallops and the fishermen of St Brieuc Bay . In Law, J. (Ed.), *Power, action & belief. A new sociology of knowledge?* (pp. 196–229). London, UK: Routledge & Kegan Paul.
- Callon, M. (1999). Actor-network theory - The market test . In Law, J., & Hassard, J. (Eds.), *Actor network theory and after* (pp. 181–195). Oxford, UK: Blackwell Publishers.
- Cecez-Kecmanovic, D., & Nagm, F. (2009). Have you taken your guys on the journey? – An ANT account of IS project evaluation. *International Journal of Actor-Network Theory and Technological Innovation*, 1(1), 1–23. doi:10.4018/jantti.2009010101

- Charnkit, P., & Tatnall, A. (2011). Knowledge conversion processes in Thai public organisations seen as an innovation: The re-analysis of a TAM study using innovation translation. *International Journal of Actor-Network Theory and Technological Innovation*, 3(4), 32–45. doi:10.4018/jantti.2011100104
- Cole, F. T. H. (2010). Negotiating the socio-material in and about information systems: An approach to native methods. *International Journal of Actor-Network Theory and Technological Innovation*, 2(4), 1–9. doi:10.4018/jantti.2010100101
- Cordella, A. (2010). Information infrastructure: An actor-network perspective. *International Journal of Actor-Network Theory and Technological Innovation*, 2(1), 35–52. doi:10.4018/jantti.2010071602
- Cordella, A. (2011). Emerging standardization. *International Journal of Actor-Network Theory and Technological Innovation*, 3(3), 49–64. doi:10.4018/jantti.2011070104
- Davis, F. (1986). *A technology acceptance model for empirically testing new end-user information systems: Theory and results*. Boston: MIT, Doctor of Philosophy.
- De Vincentis, S. (2011). Complexifying the ‘visualised’ curriculum with actor-network theory. *International Journal of Actor-Network Theory and Technological Innovation*, 3(2). doi:10.4018/jantti.2011040103
- de Vries, G. (1995). Should we send Collins and Latour to Dayton, Ohio? *EASST Review*, 14(4).
- Deering, P., Tatnall, A., & Burgess, S. (2010). Adoption of ICT in rural medical general practices in Australia - An actor-network study. *International Journal of Actor-Network Theory and Technological Innovation*, 2(1), 54–69. doi:10.4018/jantti.2010071603
- Diaz Andrade, A. (2010). From intermediary to mediator and vice versa: On agency and intentionality of a mundane sociotechnical system. *International Journal of Actor-Network Theory and Technological Innovation*, 2(4), 21–29. doi:10.4018/jantti.2010100103
- Ekundayo, S., & Diaz Andrade, A. (2011). Mediated action and network of actors: From ladders, stairs and lifts to escalators (and travelators). *International Journal of Actor-Network Theory and Technological Innovation*, 3(3), 21–34. doi:10.4018/jantti.2011070102
- Elbanna, A. R. (2009). Actor network theory in ICT research: A wider lens of enquiry. *International Journal of Actor-Network Theory and Technological Innovation*, 1(3), 1–14. doi:10.4018/jantti.2009070101
- Fishbein, M., & Ajzen, I. (1975). *Belief, attitude, intention, and behavior: An introduction to theory and research*. Reading, MA: Addison-Wesley.
- Gonçalves, F. A., & Figueiredo, J. (2010). How to recognize an immutable mobile when you find one: Translations on innovation and design. *International Journal of Actor-Network Theory and Technological Innovation*, 2(2), 39–53. doi:10.4018/jantti.2010040103
- Gonçalves, F. A., & Figueiredo, J. (2010). Negotiating meaning – An ANT approach to the building of innovations. *International Journal of Actor-Network Theory and Technological Innovation*, 2(3), 1–16. doi:10.4018/jantti.2010070101
- Iyamu, T. (2010). Theoretical analysis of strategic implementation of enterprise architecture. *International Journal of Actor-Network Theory and Technological Innovation*, 2(3), 17–32. doi:10.4018/jantti.2010070102

- Iyamu, T. (2011). Institutionalisation of the enterprise architecture: The actor-network perspective. *International Journal of Actor-Network Theory and Technological Innovation*, 3(1), 27–38. doi:10.4018/jantti.2011010103
- Iyamu, T., & Roode, D. (2010). The use of structuration theory and actor network theory for analysis case study of a financial institution in South Africa. *International Journal of Actor-Network Theory and Technological Innovation*, 2(1), 1–26. doi:10.4018/jantti.2010071601
- Iyamu, T., & Tatnall, A. (2009). An actor-network analysis of a case of development and implementation of IT strategy. *International Journal of Actor-Network Theory and Technological Innovation*, 1(4), 35–52. doi:10.4018/jantti.2009062303
- Jonsson, K., & Holmström, J. (2010). Desituating context in ubiquitous computing: Exploring strategies for the use of remote diagnostic systems for maintenance work. *International Journal of Actor-Network Theory and Technological Innovation*, 2(3), 40–55. doi:10.4018/jantti.2010070104
- Kasimin, H., & Ibrahim, H. (2009). Exploring multi-organizational interaction issues: A case study of information technology transfer in the public sector of Malaysia. *International Journal of Actor-Network Theory and Technological Innovation*, 1(3), 70–83. doi:10.4018/jantti.2009070105
- Kennan, M. A., Cecez-Kecmanovic, D., & Underwood, J. (2010). Having a say: Voices for all the actors in ANT research? *International Journal of Actor-Network Theory and Technological Innovation*, 2(2), 1–16. doi:10.4018/jantti.2010040101
- Kripanont, N., & Tatnall, A. (2009). The role of a modified technology acceptance model in explaining internet usage in higher education in Thailand. *International Journal of Actor-Network Theory and Technological Innovation*, 1(2), 31–49. doi:10.4018/jantti.2009040103
- Latour, B. (1986). The powers of association . In Law, J. (Ed.), *Power, action and belief: A new sociology of knowledge?* (pp. 264–280). London, UK: Routledge & Kegan Paul.
- Latour, B. (1996). *Aramis or the love of technology*. Cambridge, MA: Harvard University Press.
- Latour, B. (1999). On recalling ANT . In Law, J., & Hassard, J. (Eds.), *Actor network theory and after* (pp. 15–25). Oxford, UK: Blackwell Publishers.
- Latour, B. (2005). *Reassembling the social: An introduction to actor-network theory*. Oxford, UK: Oxford University Press.
- Law, J. (1986). On the methods of long distance control: Vessels, navigation and the Portuguese route to India . In Law, J. (Ed.), *Power, action and belief: A new sociology of knowledge?* (pp. 234–263). London, UK: Routledge & Kegan Paul.
- Law, J. (1987). Technology and heterogeneous engineering: The case of Portuguese expansion . In Bijker, W. E., Hughes, T. P., & Pinch, T. J. (Eds.), *The social construction of technological systems: New directions in the sociology and history of technology* (pp. 111–134). Cambridge, MA: MIT Press.
- Law, J. (1988). The anatomy of a socio-technical struggle: The design of the TSR2 . In Elliott, B. (Ed.), *Technology and social process* (pp. 44–69). Edinburgh, UK: Edinburgh University Press.

- Law, J. (1992). Notes on the theory of the actor-network: Ordering, strategy and heterogeneity. *Systems Practice*, 5(4), 379–393. doi:10.1007/BF01059830
- Law, J., & Callon, M. (1988). Engineering and sociology in a military aircraft project: A network analysis of technological change. *Social Problems*, 35(3), 284–297. doi:10.1525/sp.1988.35.3.03a00060
- Linden, L. (2009). Linux kernel developers embracing authors embracing licenses. *International Journal of Actor-Network Theory and Technological Innovation*, 1(3), 15–35. doi:10.4018/jantti.2009070102
- Lukaitis, S. (2011). Applying hermeneutic phenomenology to understand innovation adoption. *International Journal of Actor-Network Theory and Technological Innovation*, 3(4), 46–59. doi:10.4018/jantti.2011100105
- MacKenzie, D., & Wajcman, J. (Eds.). (1985). *The social shaping of technology: How the refrigerator got its hum*. Milton Keynes, UK: Open University Press.
- Manning, K., Wong, L., & Tatnall, A. (2010). Aspects of e-learning in a university. *International Journal of Actor-Network Theory and Technological Innovation*, 2(4), 43–52. doi:10.4018/jantti.2010100105
- Mulcahy, D. (2011). Performativity in practice: An actor-network account of professional teaching standards. *International Journal of Actor-Network Theory and Technological Innovation*, 3(2), 1–16. doi:10.4018/jantti.2011040101
- Muniesa, F. (2011). Is a stock exchange a computer solution? Explicitness, algorithms and the arizona stock exchange. *International Journal of Actor-Network Theory and Technological Innovation*, 3(1), 1–15. doi:10.4018/jantti.2011010101
- Naidoo, T. R. (2010). A socio-technical account of an internet-based self-service technology implementation: Why call-centres sometimes ‘prevail’ in a multi-channel context? *International Journal of Actor-Network Theory and Technological Innovation*, 2(2), 15–34. doi:10.4018/jantti.2010040102
- Priyatma, J. E., & Mohamed, Z. A. (2011). Opening the black box of leadership in the successful development of local e-government initiative in a developing country. *International Journal of Actor-Network Theory and Technological Innovation*, 3(3), 1–20. doi:10.4018/jantti.2011070101
- Quinlan, A., Quinlan, E., & Nelson, D. (2011). Performing actor-network theory in the post-secondary classroom. *International Journal of Actor-Network Theory and Technological Innovation*, 3(4), 1–10. doi:10.4018/jantti.2011100101
- Rayna, T., Striukova, L., & Landau, S. (2009). Crossing the chasm or being crossed out: The case of digital audio players. *International Journal of Actor-Network Theory and Technological Innovation*, 1(3), 36–54. doi:10.4018/jantti.2009070103
- Rimpiläinen, S. (2011). Knowledge in networks – Knowing in transactions? *International Journal of Actor-Network Theory and Technological Innovation*, 3(2), 46–56. doi:10.4018/jantti.2011040104
- Rogers, E. M. (1995). *Diffusion of innovations*. New York, NY: The Free Press.
- Rogers, E. M. (2003). *Diffusion of innovations*. New York, NY: The Free Press.



- Rowan, L., & Bigum, C. (2009). What's your problem? ANT reflections on a research project studying girls enrolment in information technology subjects in postcompulsory education. *International Journal of Actor-Network Theory and Technological Innovation*, 1(4), 1–15. doi:10.4018/jantti.2009062301
- Tatnall, A. (2009). Information systems, technology adoption and innovation translation. *International Journal of Actor-Network Theory and Technological Innovation*, 1(1), 59–74. doi:10.4018/jantti.2009010104
- Tatnall, A. (2009). Innovation translation and innovation diffusion: A comparison of two different approaches to theorising technological innovation. *International Journal of Actor-Network Theory and Technological Innovation*, 1(2), 67–74. doi:10.4018/jantti.2009040105
- Tatnall, A. (2010). On actors, networks, hybrids, black boxes and contesting programming languages. *International Journal of Actor-Network Theory and Technological Innovation*, 2(4), 10–20. doi:10.4018/jantti.2010100102
- Tatnall, A. (2011). *Information systems research, technological innovation and actor-network theory*. Melbourne, Australia: Heidelberg Press.
- Tscholl, M., Patel, U., & Carmichael, P. (2011). (Un)locating learning: Agents of change in case-based learning. *International Journal of Actor-Network Theory and Technological Innovation*, 3(2), 17–31. doi:10.4018/jantti.2011040102
- Tummons, J. (2009). Higher education in further education in England: An actor-network ethnography. *International Journal of Actor-Network Theory and Technological Innovation*, 1(3), 55–69. doi:10.4018/jantti.2009070104
- Tummons, J. (2011). Deconstructing professionalism: An actor-network critique of professional standards for teachers in the UK lifelong learning sector. *International Journal of Actor-Network Theory and Technological Innovation*, 3(4), 22–31. doi:10.4018/jantti.2011100103
- Uden, L., & Francis, J. (2009). Actor-network theory for service innovation. *International Journal of Actor-Network Theory and Technological Innovation*, 1(1), 23–44. doi:10.4018/jantti.2009010102
- Underwood, J., & Tabak, E. (2011). Making information systems material through blackboxing: Allies, translation and due process. *International Journal of Actor-Network Theory and Technological Innovation*, 3(1), 16–26. doi:10.4018/jantti.2011010102
- Wickramasinghe, N., & Bali, R. (2009). The S'ANT imperative for realizing the vision of healthcare network centric operations. *International Journal of Actor-Network Theory and Technological Innovation*, 1(1), 45–58. doi:10.4018/jantti.2009010103
- Wickramasinghe, N., Bali, R., & Goldberg, S. (2009). The S'ANT approach to facilitate a superior chronic disease self-management model. *International Journal of Actor-Network Theory and Technological Innovation*, 1(4), 21–34. doi:10.4018/jantti.2009062302
- Wickramasinghe, N., Tatnall, A., & Bali, R. (2010). Using actor-network theory to facilitate a superior understanding of knowledge creation and knowledge transfer. *International Journal of Actor-Network Theory and Technological Innovation*, 2(4), 30–42. doi:10.4018/jantti.2010100104
- Zammar, N. (2010). Social network services: The science of building and maintaining online communities, a perspective from actor-network theory. *International Journal of Actor-Network Theory and Technological Innovation*, 2(2), 54–62. doi:10.4018/jantti.2010040104