Understanding the role of information systems pilots: evaluation, legitimization and experimentation

David Allen
Business School, Leeds University, Leeds, Yorkshire, United Kingdom., da2@lubs.leeds.ac.uk

Stan Karanasios
Business School, Leeds University, Leeds, Yorkshire, United Kingdom., S.Karanasios@lubs.leeds.ac.uk

Nurain Hassan Ibrahim
Business School, Leeds University, Leeds, Yorkshire, United Kingdom., nurainhassan@yahoo.co.uk

Alistair Norman
Business School, Leeds University, Leeds, Yorkshire, United Kingdom., an@lubs.leeds.ac.uk

Understanding the role of information systems pilots: evaluation, legitimization and experimentation

David K Allen
AIMTech Research Group
University of Leeds
da2@lubs.leeds.ac.uk

Stan Karanasios
AIMTech Research Group
University of Leeds
s.karanasios@leeds.ac.uk

Alistair Norman
AIMTech Research Group
University of Leeds
a.w.t.norman@lubs.leeds.ac.uk

Nurain Hassan Ibrahim
AIMTech Research Group
University of Leeds
busnha@leeds.ac.uk

ABSTRACT

In this paper, we seek to draw attention to the piloting stage of information systems (IS) in organizations. We argue that this stage has been neglected by IS scholars. To illustrate this argument, we draw on previous research and examine and review the pilot process across a number of studies undertaken with police forces in the United Kingdom. The studies reveal a different process of piloting than is outlined in the traditional IS and design literature. The findings indicate that results of the pilot (including laboratory and field measurements) are open to interpretation by organizational actors. We discuss the concept of legitimization of the technology being piloted and its role in the success of the pilot phase.

Keywords

Pilot, mobile, police, information systems.

INTRODUCTION

In this paper, we seek to examine a particular component of the innovation process, namely the process of piloting and, specifically, how the success of a pilot is interpreted. IS and innovation research acknowledges that IT adoption often includes a phase of initial "pilot testing" and that the trialability of an innovation at this stage affects adoption (Swanson 1994), as well as future developments. Although it is a powerful and widely used tool (Pal et al. 2008), there are few studies that explore how pilot testing unfolds and the interaction between actors and the pilot technology (Bansler and Havn 2009). By exploring the work practices of actors as they form initial assessments of the technology and addressing how the properties of the technology are established, we aim to contribute further to the understanding of piloting as a critical phase of the innovation process, and emphasizing its strategic importance.

We examine and review the pilot process across a number of studies illustrating our arguments with reference to a research program undertaken with police forces in the UK (Allen 2011; Allen and Karanasios 2011; Allen and Wilson 2004; Allen et al. 2008; Karanasios et al. 2009). The policing environment provides an interesting context for examining innovation as it is a highly politicised entity not amenable to radical change and particularly, failure and remains an area that has received relatively little enquiry. These pilots have strategic importance in the widespread diffusion of mobile devices in UK policing. While there is a developing literature that focuses on the implementation and use of mobile technologies within police services (Sørensen and Pica 2005; Straus et al. 2010) our aim is to illuminate the generic significance of the pilot and testing

stage in shaping the innovation rather than factors which are specific to the police. The findings discussed in this paper are useful for discussion, reflecting upon the importance of pilots and framing future research.

LITERATURE REVIEW: PILOTING INFORMATION SYSTEMS

In the wider innovation and change literature, piloting during the initial stage of innovation is seen as a significant part of the process (Chan and Hawkins 2012; Peraya et al. 2004), while testing and piloting in the IS field is often viewed as a rather uninteresting and unproblematic process (Gooding et al. 1989). There are few insightful studies on the process and benefits of the pilot stage (Benbya and McKelvey 2006; Wiredu 2007). Piloting has been described as one element in the process of strategic experimentation as part of the innovation process. McKeen and Smith (2007 p. 136), for example, suggest that piloting is preceded by a process of idea generation and proof-of-concept (often undertaken within a laboratory environment) and followed by a transition stage where "*the idea now enters the full system development life-cycle to ensure that the product/service is "industrial strength". Many shortcuts (i.e., "duct tape" solutions) which served well enough for the pilot must now be engineered to meet production standards*".

Some of the literature reviewed refer to the pilot phase as being undertaken within the laboratory using an experimental research design (c.f., Babar et al. 2006), while others see it as the first live trial of a technology in an organization or "real-world" setting. Equally, piloting is often seen as part of the process of new systems development (invention) rather than deploying a new technology (innovation). The pilots reported in this paper are live trials of the mobile technologies by the police forces in their real world operational environments.

Peraya et al., (2004) suggests that piloting innovation requires (i) the taking into account of an object in its complexity; (ii) the temporal dimension in which the project is grounded and develops; and, (iii) grounding on an approach in the centre of which are the actors, the negotiation and the making explicit of their practices, and how they make explicit to each other their practices. Schwabe and Krcmar (2000) note that pilots serve two key functions: to act as an exemplar of innovation and to test an innovation. In serving as a reference for other interested organizations, pilots can be used to demonstrate the benefit of the technology to end-users and enroll them into the technology development process. Of the two functions, the issue of testing or evaluation has been most intensively researched.

The significant investment in IS coupled with low success rates (Doherty et al. 2011) provides a stark indicator of the need for evaluation and legitimization (Dougherty and Heller 1994) of innovations. It also raises the important issue of validation of a technology in the piloting stage. In the (*ex-post*) evaluation research, evaluation criteria are socially constructed (Bartis and Mitev 2008) and deeply political (Wilson and Howcroft 2005), with different stakeholders having different, and often conflicting, perceptions of IS (Walsham 1993), making them even more difficult to identify and measure (Markus 1983). These factors are also relevant in the pilot phase. Piloting and testing are important because what we know about the technology will have a major influence on how widely it is adopted and what we do with it (MacKenzie 1989). For organizations that fail to properly pilot technology there can be severe problems. Janson (1986) found that where the implementation of a software failed, applying a pilot system for selecting and implementing the software package would have resulted in identifying the causes of these failures.

Pilots can be a useful way for organizations to examine the reaction of end-users as well as the overall fit of the innovation within the environment. Financially and politically, pilots can also be an instructive mechanism for an organization to justify decisions concerning whether to continue or halt investment in a particular innovation. As described by Dougherty and Heller (1994), the product innovation process in large, established, bureaucratic "big old firms" is often illegitimate because its constituent activities "either violate established practice or fall into a vacuum where no shared understandings exist to make them meaningful" (Dougherty et al. 1994). To successfully innovate, therefore, managers must legitimate this process by weaving "activities of product innovation into their institutionalized system of thought and action, not merely change structures or add values" (Dougherty et al. 1994). Therefore, it is unequivocal that much expectation can be placed on the outcomes of a pilot programme.

In the context of policing, these expectations are problematized by political influences, public opinion and government mandates to adopt certain technologies (Ackroyd et al. 1992). Furthermore, police managers are often pressured by the need for quick results, the conviction that new technology can be beneficial and the desire to satisfy public opinion. For example, the case of the Yorkshire Ripper, prompted the development and use of a system, which emerged, in part, from the need of the UK government to be "seen as doing something" (Ackroyd et al. 1992). In other words, with significant ingenuity, any technology can be defended as adequate (MacKenzie 1989) or argued as meeting certain imperatives. It is this area, the perception of the pilots and technology, which generates the most interest in the literature. This is because technological testing is open to challenge, and the validity of the experimental procedure itself can be attacked in many ways (MacKenzie 1989).

Technologies in the pilot phase, or as explained by Sterling (1995), the "goofy prototype" phase, are seen as rarely working well due to their experimental nature. This stage is also open to a range of factors such as the interpretive flexibility of stakeholders. That is, what is measured, and how it is interpreted by the different relevant groups. Therefore, while testing and piloting may be critical, the knowledge that testing generates, may be problematic (MacKenzie 1989). For instance, Bijker (1992) deconstructed the experiment of a UK National Health Service (NHS) clinical system and found that there were unusual circumstances surrounding the test (re-organization of the NHS) that prevented legitimate extrapolation of results to normal use conditions. In this case, unsuccessful results were being ameliorated by the argument of the impact of the re-organization and thus actors argued that the system had all the right ingredients to succeed. At the same time, while there is a strong demand for controlled tests with careful monitoring and detailed information gathering, these are precisely the opposite conditions of a live scenario (MacKenzie 1989).

More recently, Cornelissen (2011) discussed the use of analogies and metaphors as core processes for framing changes when evaluating and legitimating them. These analogies and metaphors serve to make the changes familiar and legitimate to the eyes of stakeholders. An understanding of how these processes can affect the outcome of the pilot phase could, therefore be crucial. Despite their consequences on innovation management and funding, these underlying issues are often not discussed, and remain omitted from contemporary IS research.

RESEARCH SETTING AND METHODS

The research is based on studies of three UK police forces that ran pilot implementations of mobile technologies. The research approach taken in these studies was of Action Research (Kock et al. 2008) where the research team attempted to develop "theory-in-practice based knowledge that is truly usable for IS practitioners" (Simonsen 2009 p.116). In these studies we blended both qualitative and quantitative approaches by working in partnership with internal police service data analysts and officers in a process of co-production. The approach to piloting observed was, however, one which was embedded in pre-existing organizational processes 'assumed as a norm' and not influenced by the research team. In this paper the three sites will be referred to as Northern Force, Southern Force and Urban Force.

Northern Force polices a large county area in the UK. The Force is regarded as a technology leader among UK Police Forces. They were early adopters of information and communication technologies (ICT) and, partly as a result of the lack of suitable commercially available systems; they have developed a very strong team in ICT. They ran a Mobile Data Pilot using PDAs. At the time of study the pilot had not been closed and this investigation was a snapshot of the implementation with data gathered over a limited (three month) time period.

Southern Force polices a southern county area. The Force had established a project to look at the totality of changing the Force systems and processes, which took a systematic approach of marrying technological development to business processes. There were a few small pilots but these were limited in scope and scale while other major developments were being completed. Southern Force's pilot of PDAs, supports a set of processes that represent an evolution from earlier projects and is intended to inform future adoption and diffusion. Nonetheless, it has formed the basis of a larger and wider roll out.

Urban Force is responsible for a large city that has extremes of both wealth and deprivation. It is a large, well-resourced organization with a high-profile. They were involved in technology trials investigating the potential of mobile data as a means of delivering improvements in front line policing. An initial proof-of-concept provided neighborhood patrol officers with the opportunity to experiment with e-mail capable PDAs in one division of the force.

Using the empirical results from the studies described above, we illustrate factors that pattern the pilot phase, focus on different types of measurements and the influences. The data we draw upon in the studies is summarized in Table 1.

Force	**Summary of data collected**
Urban	Qualitative data provided by the force on officer activity and system use. Baseline observation and semi-structured interviews with users of the technology. Data was collected before, immediately after live issue, at an interim point some three weeks later, and then as a final data collection exercise a month after the interim data collection.
Northern	Qualitative data both supplied directly by the Force and collected from interview and observation. Quantitative data was primarily drawn from in-Force data collection from existing systems and from specific requests and work by the Project Team.

Southern	Qualitative data both supplied directly by the Force and collected from interview and observation. Quantitative data was lead by the Force and was been drawn from existing systems and specific requests and from work by the Project Team.

Table 1: Summary of data collection

DATA AND FINDINGS

In each pilot, the device to be trialed had been developed in a partnership between a mobile technology device manufacturer, a mobile network provider and a specialist software development house. The hardware and interface design were developed for a commercial market and had already been taken through a development cycle by the device manufacturer. The software applications were (largely) developed from existing applications (either in-house or provided by an external vendor). The combination of software, hardware and communications network had been through initial proof-of-concept trials where the individual components of the system and the combination of the different components had been tested in a laboratory environment.

Furthermore, financial benefits of the technology were more difficult to establish. Nonetheless, this is what holds the attention of policy makers, especially given the large amounts of government funding allocated to mobile devices. However, while some benefit areas could be represented in financial gains, it was not possible for all areas, and this is an area that should be treated with caution. In some cases the forces and the government body agreed on a basis for calculation and figures. In one case, this amounted to a saving of £7.7 million per annum. This was a non-cashable efficiency gain based on the ability of officers to complete administrative work on the beat, which would have kept officers in the station, reducing visibility and public reassurance.

Other savings were measured in terms of improvements in police officer safety. In one case, this was evident through reducing attacks on police officers, while the technology could reduce the cost of absence due to illness or injury by over £7,000 per month. In other cases, the use of the pilot technology reduced the demand for voice communications (i.e. relying on the radio to contact the control room using costly spectrum). Such efficiency savings in administration in one case could allow jobs to be redeployed. To provide this number of additional staff by additional employment would cost in the order of £625,000. Nonetheless, during the pilots, we observed two areas of testing and measurement which we describe as "live" and "operational", and which particularly inform our arguments.

Live tests

Live tests, where the technology is tested in a controlled laboratory setting, were undertaken in all three sites. Northern Force provides an exemplar of this, where the time taken using the piloted technology (PDA) in a given scenario was compared with using traditional radio, pen and notepad methods. The results provide empirical evidence of the advantages of the technology. The results indicate that the PDA offered time advantages over the extant process. For instance, the results of three scenarios conducted in a laboratory setting are displayed in Table 1. Nonetheless, while these tests examine the efficacy of the technology, it was recognized that these do not replicate the real conditions of using the technology on the beat. These 'live' tests occurred both in parallel with and at the start of the pilot process.

Scenario	**Total time taken on PDA**	**Total time taken using paper notebook**
Scenario one: Fixed penalty ticket	8.35min	8.44min
Scenario two: Two vehicle road crash with casualty and pedestrian witness	30.00min	27.43min*
Scenario three: Domestic assault	57.46min	70min

Table 2: Laboratory test results from Northern Force

*While the traditional method was faster, the process was not complete and still required some processing of data.

Operational measurements

These refer to measurements in the operational environment. In the cases we examined, there was some consistency concerning the areas of operational measurement. However, this is not evidence of a successful pilot. At the same time, the approach used to assess each item varied (see table Table 2). Some measurements were qualitative relying on observations, interviews. Others where more quantitative, relying on questionnaires, economic analysis and comparison of figures against baseline data. Some items in the table were measured using both qualitative and quantitative analysis.

Measure	Southern Force	Northern Force	Urban Force
Visibility	X	X	X
Time out of station	X	X	X
Productivity	X		
Access to Force and National applications	X		
Public confidence in individual officers and Police	X	X	X
Detections	X		
Officer safety	X	X	X
Process time for transactions supported by the PDA	X		
Accurate form completion	X		
Completeness of data	X		
Airwave radio use	X	X	X
Load on control room staff	X		X
Back office process	X		X
Data quality of information received by officers		X	
Data quality of information input		X	
Ability to identify individuals		X	
Officer confidence		X	
Community contact, victim and witness support		X	
Mileage		X	
Smoothing of peaks and troughs in work			X

Table 3: Example of operation benefits

It is worth noting here that, before the technology was taken to pilot, it had significant organizational support and was perceived as being robust and fitting a particular work context. The view of those involved in the pilot was that it is a precursor to implementation, where 'tweaks' to the system may occur but major changes would be unlikely. As observed, the development and implementation of a technology is open to the interpretation of the results of the pilot. It is therefore important to not only examine what is measured, but also, how it is interpreted. The result of any test, need not, on its own, be held to determine, the workability of a technology, as different interpretations can be and are offered (Pinch et al. 1992). We explore how these interpretations are legitimized through the use of language in the discussion section.

DISCUSSION

McKeen and Smith (2007) describe the pilot stage as being followed by a transition stage and preceded by a proof-of-concept. It is suggested that the pilot may generate 'duct-tape' solutions which are not 'industrial strength', which are then improved in a transition stage. In all three cases, the proof-of-concept stage seems to be much more developed than described

and the transition stage seems to be incorporated within the pilot. The relatively conservative approach to piloting within the three organizations provides a contrast with the approach described by McKeen and Smith (2007). This approach perhaps reflects the nature of work undertaken by high reliability organizations' (Young 2011) such as police forces where failure of systems piloted could lead to catastrophic consequences.

Equally the distinction made between proof-of-concept and pilot stages in terms of laboratory vs. field trials seems less clear. In the cases that we observed the technology was placed in the laboratory environment for testing both at the start of the pilot and during the pilot (as seen in Table 2). These tests were focused on specific applications and on quantitative testing against objective criteria (such as time taken to undertake a particular procedure).

However, as shown in Table 3, in terms of the operational measurements, the research demonstrates that the pilots focused more on features of the operational environment, than on the technology itself. At the same time, there were some areas of congruency of measurements across the three organizations. The technology "fit" or appropriateness was demonstrated, therefore, in both the laboratory setting and in the operational sense. The language of the operational measurements is also of interest because it draws on the discourse and norms of the police force rather than technological or economic terminology. Discrepancies in the range of measurements are also instructive as some items are measured whilst others are not. We observed that what is measured often depends on the context, the scope of the technology and the objectives of the force.

However, there are political elements as well. For instance, "increased detections" may seem like an obvious unit of measurement, and one that is easily measured. But this measurement is also predisposed to a range of extraneous factors such as major events that may impact on the number of arrests (such as a riot). In some cases, double-crewed teams of officers would consist of one user of the pilot technology (i.e. mobile device) and one non-user, further contaminating the potential for clear measure of detections. Furthermore, it is also dependent on the nature of the police force, because some police forces are statistics based, meaning that they measure output based on number of detections. This is an ambiguous measurement, as arresting citizens for a minor infringement does not necessarily signify an increase in public safety or efficiency. On the other hand, other police forces may rely on "time to solve a crime" as a measurement of efficiency.

Other measurements appear less acquiescent to evaluate, such as "police officer safety", especially given that its determination is based on observations and opinions of the officers. Nevertheless, in an environment where perceived officer safety is important, it stands as a valid measurement for the justification of the technology. Quantitatively, officer safety can in principle be measured by number of attacks on the officer. However, this can be construed, because the devices allow officers to identify criminals with greater ease. In other words, the greater the number of criminals identified, the more likely an attack. This shows that the data extrapolated is open to a range of different interpretations which may be used by stakeholders to legitimize the technology..

In our study, from the stage of conception, technologies needed to be legitimized, in order for them to progress to the position of testing. The legitimization process involved negotiating for initial funding within the force (Ackroyd et al. 1992). Legitimization of change involves the use of analogies or metaphors (Cornelissen et al. 2011; Dougherty et al. 1994). As core processes of framing, these make the change appear familiar and legitimate in the eyes of stakeholders (Cornelissen et al. 2011). This is important in the context of the public sector, and especially the police, where misused and wasted funding is viewed critically. The legitimization process involves "selling the technology" and moving beyond conceptual and design stages into establishing an artifact that can be adapted and measured under controlled and "live" conditions.

In the legitimization process, technologies are often made available through texts, and the meaning given to a technology though such texts varies from one context to another (Pinch et al. 1992). For change to be accepted as legitimate, it has to be framed in a persuasive manner that is "culturally familiar to stakeholders" and "captures salient and related aspects of the change" (Cornelissen et al. 2011). This is crucial in the pilot phase and the language used can often influence the decision to proceed or abstain. If mobile technology was presented from the perspective of a mechanism to reduce costs by decreasing police officer numbers it is likely to meet hostility. On the other hand, if the technology is marketed through the language of efficiency, accountability, and increased visibility, then it is more likely to resonate with the public sector decision makers.

This is a particularly important issue, and despite the level of interest surrounding mobile devices in policing, economic terms like "cost-cutting" and "reduction of staff" were not used to legitimize the action of the pilots. Rather, less audible objectives were set such as increasing public reassurance by increasing the amount of time officers spent on the beat, efficacy in major incidents and operational efficiencies. This sets the scene where, rather than investigate financial gains, the pilots were interested in operational and public benefits. An important component of the legitimization process was that the forces were required to gain funding in order to support pilots involving a formal relationship between police forces and the government bodies.

CONCLUSION

Piloting of IS is a key element of the innovation and implementation processes. However, it is also one which is neglected in IS research. This research suggests a different process from the one described in the literature; one where a more robust technology is piloted (closer to the end product) and one which is not followed by a transition stage to full implementation, but (if successful) is seen as a first roll out of the system. Equally we also point to the importance of laboratory (or live) tests before and during the pilot not just within the proof-of-concept stage. While much of the research focuses on the significance of pilots in the evaluation process our work also illuminates the importance of the pilot as a mechanism for demonstration and legitimization. Given the paucity of research on this topic, it is unclear whether our findings are applicable more generally, or whether they only reflect the nature of the technology (mobile solutions) and the nature of the environment in which the technology is being deployed (i.e., high reliability organizations where systems failure could have catastrophic consequences). It is clear that there is a need for further research on this topic to explore these questions.

REFERENCES

1. Ackroyd, S., Harper, R., Hughes, J.A., Shapiro, D., and Soothill, K. *New technology and practical police work : the social context of technical innovation* Open University Press, Buckingham [England]; Philadelphia, 1992.

2. Allen, D.K. "Information Behaviour and Decision Making in Time Constrained Practice: A Dual-Processing Perspective " *Journal of the American Society for Information Science and Technology* (62:11) 2011, pp 2165-2181

3. Allen, D.K., and Karanasios, S. "Critical Factors and Patterns in the Innovation Process," *Policing : a journal of policy and practice* (5:1) 2011, pp 87-97.

4. Allen, D.K., and Wilson , T.D. " Action, interaction and the role of ambiguity in the introduction of mobile information systems in a UK police force. ," Mobile Information Systems: IFIP TC8 Working Conference on Mobile Information Systems Springer: New York, 2004, pp. 15-37.

5. Allen, D.K., Wilson, T.D., Norman, A.W.T., and Knight, C. "Information on the move: the use of mobile information systems by UK police forces " *Information Research* (13:4) 2008, p Paper 378.

6. Babar, M.A., Kitchenham, B., Zhu, L., Gorton, I., and Jeffery, R. "An empirical study of groupware support for distributed software architecture evaluation process," *Journal of Systems and Software* (79:7) 2006, pp 912-925.

7. Bansler, J.P., and Havn, E.C. "Pilot Implementation of Health Information Systems: Issues and Challenges," in: *Fifteenth Americas Conference on Information Systems*, San Francisco, California 2009.

8. Bartis, E., and Mitev, N. "A multiple narrative approach to information systems failure: a successful system that failed," *European Journal of Information Systems* (17:2) 2008, pp 112-124.

9. Benbya, H., and McKelvey, B. "Toward a complexity theory of information systems development," *Information Technology & People* (19:1) 2006, pp 12-34.

10. Chan, E.S.W., and Hawkins, R. "Application of EMSs in a hotel context: A case study," *International Journal of Hospitality Management* (31:2) 2012, pp 405-418.

11. Cornelissen, J.P., Holt, R., and Zundel, M. "The Role of Analogy and Metaphor in the Framing and Legitimization of Strategic Change," *Organization Studies* (32:12), December 1, 2011 2011, pp 1701-1716.

12. Doherty, N.F., Ashurst, C., and Peppard, J. "Factors affecting the successful realisation of benefits from systems development projects: findings from three case studies," *Journal of Information Technology*) 2011.

13. Dougherty, D., and Heller, T. "The illegitimacy of successful product innovation in established firms," *Organization Science* (5:2), May 1994, pp 200-218.

14. Gooding, D., Pinch, T.J., and Schaffer, S. *The Uses of experiment : studies in the natural sciences* Cambridge University Press, Cambridge, 1989, pp. xvii,481p.

15. Janson, M. "Applying a pilot system and prototyping approach to systems development and implementation," *Information & Management* (10:4) 1986, pp 209-216.

16. Karanasios, S., Allen, D., and Vardaxoglou, G. "Innovation in UK Law Enforcement: The Emergence of Mobile Data," Americas Conference on Information Systems San Francisco, USA, 2009.

17. Kock, N., Gallivan, M.J., and DeLuca, D. "Furthering Information Systems Action Research: A Post-Positivist Synthesis of Four Dialectics " *Journal of the Association for Information Systems* (9:2) 2008, pp 48-72.

18. MacKenzie, D. "From Kwajalein to Armageddon? Testing and the social construction of missle accuracy," in: *The Uses of experiment: studies in the natural sciences,* D. Gooding, T.J. Pinch and S. Schaffer (eds.), Cambridge University Press, Cambridge, 1989, pp. 409-438.

19. Markus, M.L. "Power, politics and MIS implementation," *Communications of the ACM* (26:6) 1983, pp 430-444.

20. McKeen, J.D., and Smith, H.A. "Developments in Practice XXV: Strategic Experimentation with IT," *Communications of the Association for Information Systems* (19:8) 2007, pp 132-141.

21. Pal, R., Sengupta, A., and Bose, I. "Role of Pilot Study in Assessing Viability of New Technology Projects: The Case of RFID in Parking Operations," *Communications of the Association for Information Systems* (23:15) 2008, pp 257-276.

22. Peraya, D., Jaccaz, B., Masiello, I., Armitage, S., and Yip, H. "Analysing, Sustaining and Piloting Innovation: A "ASPI" Model," Networked Learning Conference 2004, Lancaster, UK, 2004.

23. Pinch, T., Ashmore, M., and Mulkay, M. "Technology, testing, text: clinical budgeting in the U.K National Health Service," in: *Shaping Technology/Building Society: Studies in SocioTechnical Change,* B. Wiebe E and J. Law (eds.), MIT Press, Cambridge, Mass ; London, 1992, pp. 265-289.

24. Schwabe, G., and Krcmar, H. "Piloting Socio-Technical Innovation," in: *ECIS 2000*, 2000, p. Paper 27.

25. Simonsen, J. "A Concern for Engaged Scholarship: The challenges for action research projects," *Scandinavian Journal of Information Systems* (21:2) 2009, pp 111-128.

26. Sørensen, C., and Pica, D. "Tales from the police: Rhythms of interaction with mobile technologies," *Information and Organization* (15:2) 2005, pp 125-149.

27. Sterling, B. "The hacker crackdown: evolution of the US telephone network," in: *Information Technology and Society: A Reader,* N.W. Heap and Open University. (eds.), Sage in association with the Open University, London, 1995, pp. 33-40.

28. Straus, S., Bikson, T., Balkovich, E., and Pane, J. "Mobile Technology and Action Teams: Assessing BlackBerry Use in Law Enforcement Units," *Computer Supported Cooperative Work (CSCW)* (19:1) 2010, pp 45-71.

29. Swanson, E.B. "Information systems innovation among organisations," *Management Science* (40:9) 1994, pp 1069-1092.

30. Walsham, G. *Interpreting information systems in organizations* Wiley, Chichester, UK., 1993.

31. Wilson, M., and Howcroft, D. "Power, politics and persuasion in IS evaluation: a focus on 'relevant social groups'," *The Journal of Strategic Information Systems* (14:1) 2005, pp 17-43.

32. Wiredu, G.O. "User appropriation of mobile technologies: Motives, conditions and design properties," *Information and Organization* (17:2) 2007, pp 110-129.

33. Young, B. "Leadership and high-reliability organizations: why banks fail," *The Journal of Operational Risk* (6:4) 2011, pp 67-87.