Abstract

The broad aim of the paper is to explore the introduction of innovation involving a location technology in an anonymous UK public safety organization. Drawing on Activity Theory and the Social Construction of Technology, the paper describes the multivoicedness within an organization, the tensions and the consensus developed among the stakeholders in various phases of the innovation process to exploit new ideas and bring an innovative technology into service. Innovation is increasingly crucial to the success of law enforcement organizations, whose core business is essentially information management and information use. However, innovation in such organizations tends to be influenced by multiple (obvious and concealed) factors including policies, priorities and personal views towards the introduction of particular new technologies. In addition, much of the Activity Theory literature focuses on the contradictions that produce innovation, despite the fact that such organizations are particularly prone to innovating on the basis of political motive and as such are prone to building consensus, whether agreement or compromise. The paper addresses this gap in the literature by offering an understanding of how dialogues and interactions develop between individuals and how the dynamics of the process of innovation evolve over time. Discourse analysis is performed to study the interactions of actors in a UK constabulary and the mediating tools until contradictions are resolved and ‘closure’ occurs. Addressing the theme of the colloquium, the paper shows the central role of multivoicedness in producing dialectical contradictions and how their resolutions occur in a law enforcement organization. Furthermore, the paper presents how Activity Theory is complemented by the Social Construction of Technology through the notion of ‘closure’ to depict the outcomes of an innovation process.

Introduction

Swanson (1994) argued that innovation is increasingly crucial to the organizations’ success. In law enforcement organizations the role of innovation is even more critical; this is because law enforcement organizations are highly dependent on information as their core business can be regarded essentially as information management and information use.

However, existing innovation research explains relatively little about whether and how services, in general, innovate (Tether 2005), and even less is known about innovation taking place within a public organization context (Albury 2005); a distinctive section of that within the public organization and services context is that of law enforcement organizations. Researchers tend to agree that our understanding of innovation and innovation process has been largely derived from studies of manufacturing (Herbig and Kramer 1993) and services are considered to be non-innovative or simple recipients of technologies (Tether 2005).

This paper will attempt to explain the innovation process around a location technology in a UK law enforcement organization. A location technology is a technology that continuously records and transmits location data. The European Parliament and the Council of the European Union (2002) define the location data as the latitude, longitude and altitude of the user’s terminal equipment, and/or the direction of travel, and/or the level of accuracy of the location data.
information, and/or the identification of the network cell in which the terminal equipment is located at a certain point in time and/or the time the location information was recorded.

**Literature review**

The process of innovation in organizations has been investigated by numerous theories. Traditional perspectives on innovation such as Roger’s (2003) has looked at the diffusion of innovations as a collective process or an authority decision, while Constant (1987) described the evolution of technology through incremental improvement within an existing community of practitioners, which at troublesome times becomes radical innovation. Innovation literature seems to be missing some important facets in the innovation process of complex technologies (Lyytinen and Damsgaard 2001), and usually appears to provide inconclusive results when the context studied does not match the contexts in which the perspectives were developed (Fichman 1992; Gallivan 2001).

Such limitations of the innovation research led to an interest in process research in order to understand how and why innovations developed (Barrett and Walsham 1995). According to Barrett and Walsham (1995), by using the latter approach the researchers may be able to capture the complex organizational processes involved in the implementation of innovations, which was not feasible before. In addition, researchers such as Prasad (1993), DeSanctis and Poole (1994), and Orlikowski and Gash (1994) attempted to examine and explicate the dynamics involved in the process of the introduction of an innovation. They used the concepts of ‘interpretative flexibility’ and ‘technological frame’ to look at the process of innovation (Kline and Pinch 1999), and Bijker and Pinch (1987) and Bijker (1995) looked at technological innovation, as a socially constructed process, in which social groups negotiate different meanings (see also Sproull and Goodman 1990, Kline and Pinch 1999, Wilkins, Swatman and Castleman, 2002). As such, technology is considered to be flexible and open to re-invention (Allen 2000) and its implementation to have unpredictable and variable outcomes (Maniatopoulos 2005).

In terms of research conducted within law enforcement organizations, the innovation literature is rather small. There are few studies such as Chen et al. (2003) and Nunn (1994) that have examined the benefits experienced from the introduction of an application to two Police Departments and from mobile digital terminals in police forces covering three cities in the USA, respectively. Substantial part of the literature, instead of looking closely at the innovation process and the intra-organizational dialogues developed, focused on the practical challenges law enforcements are expected to face (e.g., modernisation of the police (Loveday 2005)) and the effects of innovations in law enforcement organization (e.g. Gimber 2007). As a result, the process of innovation within such organizations, the interactions among actors, and the contradictions taking place during that process have not been comprehensively examined at a micro-level. This is despite the fact a) that law enforcement organizations are anticipated to be keen on introducing technological innovations since they are highly dependent on information with their core business being information management and information use, and b) despite that all of them are expected to (but often do not) innovate in the same pace although they operate under very similar (both legal and operational) framework.

**The Social Construction of Technology**

The Social Construction of Technology has been used numerous times to investigate the social shaping of technology (Kline and Pinch, 1999). It was developed by W. Bijker and T. Pinch
(Bijker, 1995, Bijker and Pinch, 1987) and was one of the theoretical approaches bearing upon the social shaping of technology (Kline and Pinch, 1999).

SCOT’s focal point is on “interpretative flexibility”, which refers to how ‘relevant social groups’ – or different groups of people involved in the development of a technological artefact (Kline and Pinch, 1999) – develop diverse understanding of the technological artefact by assigning different meanings to it (Bijker and Pinch, 1987, Sproull and Goodman, 1990, Wilkins et al., 2002, Wong, 2004). SCOT suggests, the same technological artefact can mean different things to different groups of individuals (Kline and Pinch, 1999), and these different perceptions are the result of these groups’ interactions and negotiations of the meanings attributed to a particular artefact. The dynamics among the groups involved in the innovation process are continuous and so interpretative flexibility is regularly observed. However, there are points when one artefact becomes the dominant form of the technology, others ceasing to exist and the dominant artefact develops an increasing degree of stabilization within one and possibly more relevant social groups (Bijker, 1995). This is when interpretative flexibility ceases and ‘closure’ occurs. This is a repetitive process and interpretative flexibility may reappear at a later stage (Kline and Pinch, 1999). Although SCOT has been refined and developed over the last decade (Kline and Pinch, 1999), part of the innovation literature argues that SCOT has weaknesses that need to be addressed by those employing it. For instance, Kline and Pinch (1999) argue that SCOT deals mainly with the design stage of innovations and says little about the social structure within which technological development takes place and that it does not demonstrate how closure is achieved through their interactions during the innovation process.

Activity Theory

Activity Theory is adopted as the main framework for this paper. Originating in the fields of developmental psychology and educational research (Leont’ev, 1978; Vygotsky, 1978), Activity Theory has been used in work design (Engeström, 2000) and human-computer interaction studies (Kaptelinin & Nardi, 2006). Cultural-Historical Activity Theory is a realist framework of collective consciousness for the analysis of standardized, habitual work-related behaviour.

Activity Theory has its foundation in the Soviet cultural historical school of psychology that was founded by L. Vygotsky during the beginning of the 20th century (Miettinen, 1999, Bourguin and Derycke, 2000). The central point of Activity Theory is an activity system where action is mediated; this draws on the idea that cultural means or artefacts – mental constructs or physical entities – operate in a mediating role between human agents and the object. These cultural means or artefacts can be either signs or tools that are internalized by individuals when participating in common activities with others (Vygotsky, 1986, Miettinen, 1999). Activity Theory also addresses the importance of analyzing the interactions between rules (the explicit and implicit regulations, norms and conventions that constrain actions and interactions within the activity system), community (which contains the individuals and groups who share the same object) and the division of labour (the horizontal division of tasks between the members of the community and the vertical division of power and status) (Engeström, 1987). Thus, the activity systems can also be examined at the macro level of the collective and the community rather than the micro level of the individual actor functioning with tools (Daniels, 2001).

Activity Theory is not a ‘theory’ in a typical way; Activity Theory can better be considered as a framework that provides conceptual tools for tackling many of the theoretical and methodological challenges (Engeström, Miettinen and Punamäki, 1999). Activity Theory provides a conceptual model for explaining different levels of activity and the interaction that
emerge. Along these lines, Engeström (1993) argued that Activity Theory is a conceptual tool that should be adapted to the context of the study (Karanasios et al., 2009).

Drawing on Activity Theory (Wertsch 1991, Engeström Miettinen, & Punamäki 1999), we aim to explore how multiple (obvious and concealed) factors including policies, priorities and personal views towards the introduction of particular new technologies generate multivoicedness within an organization. This multivoicedness might produce tensions or might conclude to consensus; it is this ending that determines whether there will be a decision to move forward by the relevant stakeholders and an innovative technology is brought in service. The main analytical tool of cultural historical activity theory we adopt is the triangular diagram of an activity system developed by Engestrom (1987). Following the key principles of Activity theory, we look at a) the active role of the subject, b) the mediating role of an artefact on the relationship of the subject with the object, and c) the interaction of all the activity system elements with each other (Hasu and Engeström, 2000).

Researchers such as Blackler et al. (1999) and Daniels (2001) suggest that this model looks at the activity from the point of a goal-directed subject and its actions, but it also brings into focus the interrelations between the individual subject, the activity in which the subject is engaged and the social structure within which the activity takes place. In this way, emphasis is given to the structure of the social world, the conflictual nature of social practice (conflicts between the various interacting systems of activity, as well as between the old and new forms of activity), and the process of social transformation (see also Engeström, 1987). By focusing on the social structure within the activity takes place, this framework simultaneously addresses one weakness of SCOT.

Figure 1: The meditational structure of an activity system.

Furthermore, Engeström (2001) advocates that the principles of historicity and the central role of contradictions can be the main sources of change and innovation. ‘Historicity’ means that activity systems are shaped over extended periods of time and their problems and potentials can only be understood against their own history, which needs in turn “to be studied as local history of the activity and its objects and as history of the theoretical ideas and tools that have shaped the
activity” (Engeström, 2001). Historically accumulating structural tensions within activity systems are developed into contradictions, which often take place when a new element from the outside (for instance, a new technology or a new object) is introduced into an activity system. This introduction can lead to an aggravated contradiction where the existing elements (for example, the rules or the division of labour) collide with the newly introduced element. According to Engeström (2001), such contradictions generate disturbances and conflicts, but also innovative attempts to change the activity. However, we argue that it is when ‘closure’ occurs (as suggested by SCOT) that innovation does take place at last as a consensus is reached and a technological innovation is accepted by the members of the activity system.

The case
The police service in the UK is carried out by 45 Police Forces, which report regularly to an independent Police Authority. There is little direct national guidance on the management of the Forces. The main tasks of the Police Authority are to set policing targets, to monitor performance, and to be accountable for the management of the overall police budget. Each Force follows the Authority’s guidance and operates in ways compliant with the Authority’s goals. This translates into a multiplicity of approaches towards investment in new technologies among the different police Forces in the UK.

The case we have chosen to analyze focuses on the introduction of innovation involving a location technology in an anonymous UK public safety organization. Due to confidentiality and anonymity grounds, more information about the organization cannot be provided. However, we note that at the time of the data collection, the constabulary we investigate was seen as a strategic Force in the UK in terms of operational activities and partly in terms of its size (i.e. number of employees). The Force at an organizational level aimed at maintaining performance and thus on meeting the performance targets set by the senior management of the Force and which were generally in line with the framework suggested by the Home Office. As a result, innovation was regarded as being promoted in a fairly limited way through staff suggestion and recognition schemes.

Also, such is the nature of the law enforcement organization we have chosen to study that the contradictions among the components of the activity systems (rules, community, and the division of labour) arise at multiple levels as multiple (obvious and concealed) factors including government policies, organization priorities and personal views towards the introduction of an innovation exist. Typical decision making (based on organizational hierarchy) becomes flimsy when it comes down to a new technology as lower ranks expect to be involved in the decision making process as the potential users of the innovation. Ultimately, they engage sometimes positively and sometimes in a negative way so that eventually a consensus is reached (or not) across hierarchical levels and organizational roles. The innovation process involves taking into account the historicity, perceptions and preconceptions based on the personal and organizational experiences gathered to that point.

Methodology
The data collection followed a coherent protocol, which was based on the components of the Activity Theory. Based on a general pattern for investigation over time emerging from a range of Activity Theory studies (e.g., Hasu and Engeström, 2000, Jarzabkowski, 2003, Nardi, 1996), data collection was conducted over two years through a combination of semi-structured interviews, document analysis (organizational and governmental documents) and observation in the field.
Meetings, project-related documents, plans, press releases and other proprietary sources were analyzed to understand the reasoning behind activities and decisions, the people involved, and the people affected (Engeström 1996).

Interviews were conducted with individuals from all hierarchical levels of the organizations that were directly involved in the introduction of the technological innovation. Each interview lasted from 50 to 85 minutes, during which thorough notes of gestures were taken. The interviews were digitally-recorded and transcribed verbatim in order to be coded with a software and then be analyzed. An individual served initially as the liaison and contact person, who provided further interview subjects that had been involved in the introduction and implementation of the technology. Besides these initial interviews, potential interviewees were identified through the “snowballing” technique that Aaker and Day (1986) advocate and which is commonly used in ethnographic field studies of organizations (Gallivan, 2001). In particular, each interviewee was asked to point out other individuals that were involved in the innovation process and who could be potential interviewees (independently of their perspective). At the end of each interview, participants were asked to provide their demographic data as well as to comment on any other aspect they thought it would be relevant to the study but had not already been raised through the discussion. That action was performed in order to make sure the researcher did not omit any other important issues. The total number of participants seems to be small in comparison with the overall size of the organization (in number of members of staff); however, a “saturation” point was reached where responders were recommending individuals who had already been interviewed or, in a couple of cases, individuals that had left the organization and the persons replacing them had no involvement in the innovation process examined.

Data were collected in line with procedures informed by previous Activity Theory studies (e.g. Hasu and Engeström, 2000) and by following Yin’s (2003) guidelines about case study research. Initial data were analyzed based on inductive analytical methods suggested by Miles and Huberman (1994) to identify themes and repeated patterns regarding the process of innovation in the law enforcement organization investigated and its progression.

Adopting Activity Theory for conducting our research has clear methodological implications that can be summarized in three main principles (Engeström 1996). An activity system is taken as the unit of analysis, thus we focus on and articulate the interactions that evolve within the UK police force during the innovation process. The activity system and its components can be understood historically, thus we track back the dialectical interactions of people before the beginning of the innovation process, when the first idea for the introduction of a location technology was declared and members of the organization engaged for the first time and employed a number of mediating tools. Internal contradictions of the activity system can be analyzed as the source of disruption, innovation, and ‘closures’ can point to stages where consensus was reached and the innovation process moved on. Accordingly, we consider the dialogues between relevant stakeholders, management and non-management individuals, and across ranks. The role of mediating tools (i.e. in-person interaction, basic information technology tools and enterprise knowledge management systems) in influencing individuals’ involvement to the innovation process is also explored, in a context where access is usually very restrictive and where the boundaries between disagreement and disobedience are blurred.
Analysis of Data

Although the senior management of the Force was seen as genuinely interested in the new ideas and frequently endeavoring to promote innovation through its actions, the introduction of the location technology we examine was not set up as a distinct project by itself. In fact, it was a spin-off project of a previous project and became possible when the department of finance informed the team that a technology project was within the budget even after its full deployment. Following that, the Project Manager took advantage of the opportunity and agreed with the Director of IS (subject) to use the remaining funds for a location technology that would function over the existing equipment.

“The Project Manager was aware I wanted to do this, and the project manager also wanted to get more benefit out of <the existing equipment>. I think we just agreed between us we spent the budget now...” (Director of IS)

Since it was not a planned project, neither of them had an idea what its introduction would involve in terms of human resources and time for his department, and how the new technology could benefit the Force. The Project Manager formed a user requirement document that could answer partially this, yet it was still generic. In order to develop the user requirement into a comprehensive document, which could then be proposed to the senior management for approval, visits to other Police Forces, businesses, and specified exhibitions were made to understand better how similar technologies were used in daily operations.

“...we tried to find out what other people had done; other Forces, other organizations. We tried to find out what the RAC were doing.” (Director of IS)

As the ideas were communicated with members of staff from the IS department and other individuals from the middle levels of the Force’s hierarchy, the Project Manager and the Director of IS came across multiple views on how the technology could benefit the Force. Different roles had a different take. This assisted the Director of IS to form a user requirement that would be relevant to the Force’s operations and would justify the purchase of the technology. On other hand, it started becoming apparent that such a technology would need to satisfy all different roles if it was to be routinely used.

The implementation of a location technology involved front-line officers being watched regularly by their in-line superiors and the Command and Control staff. That could raise anxiety and tensions within the Force’s employees and the senior management would probably disapprove the purchase of the technology. The Director of IS also spoke to the Police Federation and the Professional Standard Department to make sure they comply with regulations about privacy rights. Beneficially, the Police Federation’s opinion was that the Force had the right to know where its employees were while on duty and to ask what they were doing during that time. All this was fed to an ‘ideal’ user requirement, which then was conveyed to the senior management of the organization. Previously though, the Director’s actions became known to a group of senior officers from every division in the Force to ask for feedback and get their support. When the ‘ideal’ user requirement was submitted for approval to the senior management, a positive outcome of the decision was still doubtful.
“We very much had to take a gamble that ‘these are the potential benefits, we haven’t been able to prove them yet but we want you to trust us and buy this new technology now.’” (Project Manager)

Tensions were observed as some member of the senior management requested their ideas also to be taken into account. This made the process slightly more complicated and it took sufficient time and effort to “make a case” and soothe the differences of the various opinions. Yet, senior management was persuaded to agree on the purchase of the new system and to “give their blessing to… go ahead and manage it on behalf of the Force”. As a result, GPS chips and all the necessary equipment were installed.

However, the technology could not be switched on because it needed to be configured prior to its use. Up to that point, the IT staff was unfamiliar with the configuration and they did not have any spare time due to their workload. The Director of IS searched online and discovered supporting material and configurations. He aimed to maintain the support already gained by senior management and so he had to also include many of their requirements to what a location technology ought to be.

“There was one critical piece of technical documentation that we used, that came from the Internet… It was my assistant developers here who… I obtained the research paper for him, the publication; and he sat down over the weekend and done it. He came back in and did the maths to do the conversion and then sent people out with radios and me with a device, and he tested his software until he got the software device and the radio to coincide on the map… and we knew we cracked it.” (Director of IS)

Even then, the Director of IS and the Project Manager decided not to fully implement the technology as ‘silver’ commanders’ (middle-high management staff) had not been involved, which was a potential risk for the technology’s ‘failure’. For this reason, trials took place at a few large scale operations such as big concerts and street carnivals as well as in part of the Force’s daily operations on a motorway section. The feedback provided the Director of IS and the Project Manager with plenty of comments; the ‘meaningful’ were taken into account and some others, although unnecessary, “had to” be taken into account to reconfigure the system – that was mainly because of the silver commanders’ rank and subsequently power within the organization. As such, the ‘ideal’ user requirement was somewhat diluted.

Following that, the Director of IS also encouraged front-line officers to provide feedback and comments. The main reason was to further inform the ‘ideal’ user requirement; but he also aimed to gather information in order to justify the purchase of the technology and to demonstrate this investment’s usefulness and value to organization. Clearly, it became impossible to incorporate many of the suggestions. They were often diverse and some of them required considerable amount of time and funds in order to be materialized.

“We’re still in the process of “we’ll make a change, they look at it, they feedback”. People keep knocking on the door and saying “I wish it did this”, “wouldn’t it be great if I could see...?” and then we work out whether we can do it” (Director of IS).

At the time of our last observation, the system was still not entirely operational due to configuration issues. In addition, the Project Manager raised his concerns about the Force’s
capacity and its ability or not to deal with all the data traffic that the use of the location technology would cause.

The following diagram briefly presents the series of events observed during the study in a chronological order. Many of the stages appear as distinct and separate periods and in a sequential order, yet this is only for practical purposes. There was an overlapping for most of the stages as well as reiterations.

Object and motivation

The object of the innovation activity was to introduce and implement a location technology into the Force based on the creation of a perception of a complete, precise and flawless, an ‘ideal’ user requirement (object). The motivation behind this reaches all operational, organizational and individual levels as the object incorporated all the requirements suggested by the senior and middle management as well as those suggested by potential users. In other words, the object can be regarded as the subject’s attempt to achieve the ideal. Ultimately, the object of the activity would bring a better use of the organization’s existing resources, which forms the motivation of the activity system.

Subject

The Director of IS and the Project Manager as they led the introduction and implementation of the AVLS/APLS in the Force, and directed the IT Department accordingly in order to configure,
test and reconfigure the new technology. As such, the subject consists of the Director of IS and the Project Manager. The Director of IS not have a police background, which means that his knowledge of the police operations and of the issues developing in front-line policing derives from the interaction with the Force’s employees (either front-line officers or senior managers with strong operational police background) and occasionally with employees from other Forces.

Community
The community of this activity system comprises of the collection of the individuals and organizations that the Director of IS interacted with. That includes the Project Manager’s team, the senior management of the Force, the technology suppliers as well as all the members of staff in the Force that commented on the possible uses of the technology, contributed their own requirements, and provided feedback after the technology’s trials. The interaction between the community and the Director of IS (and the Project Manager in part) essentially informed the final user requirement.

“We had people in the IT Department, couple of developers, some people from Command and Control Team; lots of people from the communications section; people handling all the 999 calls and the deployment; it’s quite a wide spread, fairly loose group of people all putting in their thoughts, their requirements, their ideas…” (Director of IS)

Mediating artifacts
The following conceptual and physical tools mediated the interactions between the subject and the community of the system: oral communication, numerous tests of the new technology, exchange of written and electronic documents, the network communications used, emails, meetings, and visits to other Police Forces and exhibitions. These mediating artifacts contributed to the formation of the user requirement and played a significant role for the Director of IS to understand what specifications would make his user requirement an ‘ideal’ one.

Rules/Norms
The Director of IS tended to shift between typical (obvious) and informal (concealed) rules. Sometimes he acted slightly outside the rules and ‘manoeuvre’ in order to achieve his aim. For instance, he had to demonstrate in advance the benefits of the new technology but, because he did not have any evidence of actual benefits, the business case relied mainly on his general motivation. In other occasions, he followed strictly those regulations that are strongly encouraged by the Force, the government (e.g., the Home Office), and relevant trade associations. As a result, the Director of IS consulted the Police Federation and the Professional Standards Department of his Force in order to make sure that the new technology abided by the regulations about privacy rights and employees liberties.

Division of Labour
This collection of individuals and organizations are defined by their division of labour and shared norms and expectations. Specifically, the division of labour runs vertically since tasks are distributed up and down divisions of power. Although the activity was largely centred on the Director of IS and the Project Manager and the object of a user requirement, the refinement of the user requirement would not have been possible without the contribution of the IT department, of senior management, and of front-line officers. Most of the actions by the Director
of IS were directed towards maintaining a balance between advancing on the implementation technology and preserving the endorsement gained by senior management. In other words, the focus was on maintaining a stable relationship with the senior management in order to be able to go ahead with the introduction of the new location technology as he sensed.

The activity system described above can be illustrated in the form of the following diagram (Figure 2).

**FIGURE 2**

![Diagram](image_url)

**Discussion and contribution**

In summary, we describe the multivoicedness within an anonymous UK public safety organization. We note the evident historicity in the decision making of the organization as well as the tensions and the consensus developed among the stakeholders in various phases of the innovation process to exploit new ideas and bring an innovative technology in service. Meetings, project-related documents, plans, press releases and other proprietary sources were analyzed to understand the reasoning behind activities and decisions, the people involved, and the people affected (Engeström 1996). While Activity Theory focuses on the contradictions that produce innovation, we embrace also the instances where closure occurred as law enforcement organizations are particularly prone to innovating on the basis of political motive and as such are prone to building consensus, whether agreement or compromise.

Our paper contributes to the literature on Cultural-Historical Activity Theory as it shows how dialogues and interactions develop between individuals and how the dynamics of the process of innovation evolve over time. In addition, the paper presents the central role of multivoicedness in producing dialectical contradictions and how their resolutions occur in a law enforcement organization. Finally, the paper argues that Activity Theory can be complemented
by the Social Construction of Technology through the notion of ‘closure’ to depict the outcomes of an innovation process.

The paper is still under progress so the data that has been presented is somewhat limited. The study will continue to explore how the examined innovation process forms a new cultural historical context for the organization and individuals in relation to further introductions of technologies in the organization.

References


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