TECHNOLOGICAL INNOVATION IN LEARNING SETTINGS: POWER AND POLITICS IN 'LIVING LABS'

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ABSTRACT

This paper explores technological innovation in a learning setting known as a 'living lab'. Living labs are a relatively new methodological approach to action-oriented, developmental research, which embeds novel technologies in real world settings and aspires to reveal learning through the ongoing conversations and debates between participants. Social and organisational dynamics are important features of living labs and previous research has suggested that continuous sense-making and negotiation are key features of them. In this paper, we draw on a comparative analysis of four living labs to suggest that power and politics are also key features of the learning process.

KEYWORDS: power, politics, innovation, living labs, learning, technology

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1. INTRODUCTION

'Living labs' are a relatively new methodological approach to action-oriented, developmental research, promoted by the European Research Area, which embeds novel technologies in real world settings and aspires to reveal learning through the ongoing conversations and debates between participants (Katzy and Klein 2008). Living labs correspond to what Von Hippel (2005) describes as 'democratised innovation', where unstable, prototypical technology is adapted and employed by users whose own innovations are then adopted by producers and incorporated into subsequent versions in an iterative, learning process.

While earlier research focused primarily on technological issues (e.g. Abowd 1999; Eriksson et al. 2006; Følstad 2008; Intille et al. 2006), attention is now being paid to social and organisational dynamics in living labs. For example, Frössler et al (2007) use a social network perspective as a theoretical framework to provide insights into the different kinds of inter-firm partnerships in living labs and their evolving objectives. Drawing on insights from communities of practice literature (Brown and Duguid 1991; Huysman and Wulf 2005; Wenger 1998) and data from one living lab, they argue that continuous sense-making and negotiation are key features of the living labs and that knowledge brokers have an important role in stabilising the network.

While accepting the importance of knowledge brokers, continual sense-making and negotiation in living labs, in this paper we argue that the theoretical model does not provide for an account of the power relations embedded within these learning environments (Contu and Willmott 2003; Foucault 1980; Knights and Murray 1994). Drawing on Foucault's work on power/knowledge (Foucault 1977; Foucault 1980; Foucault 1982) we argue that sense-making and negotiation should be understood as political processes. We illustrate this theoretical framework by drawing on empirical data from a comparative, interpretive, longitudinal study of four living labs, run in different countries and focusing on e-government innovations in four different industries. The cases demonstrate the political manoeuvrings required to initialise, shape and sustain the living labs, as well as highlighting the complicated balancing act required in an open-ended learning environment.

The contributions of this paper are threefold. First, we investigate a novel research method that attempts to foster innovation through real-life, learning settings. Second, we extend one of the theoretical models used to understand living labs, arguing that power and politics are an inherent feature of these learning settings. Whereas economic-rationalistic or technical/rational research on innovation posits innovation as rational and progressive, we argue that learning in innovation settings is based on compromise. Finally, we extend the empirical analysis; whereas previous research has focused on one living lab, we offer a comparative analysis based on longitudinal, interpretive research conducted in four living labs.

2. LITERATURE REVIEW

The predominant theoretical approach for researching information technology (IT) innovation can be characterised as following an economic-rationalistic (Fichman 2004) or technical/rational (Avgerou and McGrath 2007) model. That is to say that the majority of this research treats innovation as progressive, human decision-making as rational and knowledge as a commodity that can be accumulated. Such a functionalist approach operates on an implicit assumption that IT innovation is an apolitical process, with little recognition that power relations and organisational politics are an inescapable feature of technological change (Knights and Murray 1994). Although power and politics feature intermittently as topics in IT research (for a review, see: Willcocks 2006), studies of IT innovation have, by and large, neglected Foucault's work on power/knowledge. This is noteworthy on two points. Firstly, Foucault's work has had a significant impact on the IS community's cognate disciplines (Willcocks 2006) and secondly, given that political clashes are a constant feature of IT innovation (Avgerou and McGrath 2007), it is unusual that they are not an explicit focus of innovation research. In what follows, we offer an overview of Foucault's writings on regimes of truth and suggest why such an approach is useful for discussing IT innovation and living labs.

Foucault's view of power as an endemic network of force relations (Foucault 1977, 1990) marks a break from other conceptions of power because he rejects the concept of power as agency (Clegg 1989). Power, for Foucault, is 'the name that one attributes to a complex strategical situation in a particular society' (Foucault 1990: 93). Power is not an external force that imposes itself on people and neither can one exist outside of power. It is a network of 'force relations' that are innate, local, continuously reproduce themselves and are endemic in all social relationships; one can neither control nor escape these power relationships because 'power is exercised rather than possessed' (Foucault 1977: 26). In a later essay he argues that 'power *is* "always already there", that one is never "outside" it, that there are no "margins" for those who break with the system to gambol in' (Foucault 1980: 141, original emphasis).

Power relations produce regimes of truth, which in turn reinforce the power effects. Foucault defines a regime of truth as 'a system of ordered procedures for the production, regulation, distribution, circulation and operation of statements' (Foucault 1980: 133). Unlike positivist concepts of knowledge which seek incremental gains in knowledge through 'careful testing of scientific propositions' (Gergen 2001: 152), in terms of regimes of truth, knowledge is neither value-free nor capable of increasing incrementally. Rather, it is inextricably bound up with power relationships and the constitution of reality. Knowledge must be continually produced and reproduced through discursive practices:

> It is a question of what *governs* statements, and the way in which they *govern* each other so as to constitute a set of propositions which are scientifically acceptable, and hence capable of being verified or falsified by scientific procedures (Foucault 1980: 112, original emphasis).

In other words, there is a 'close relationship between claims to knowledge and cultural power' (Gergen 2001: 28). Thus, one has to investigate the 'rules of formation of statements which are accepted as scientifically true' (Foucault 1980: 112) because for truth claims to become widely accepted, they must be co-opted, accepted and normalised, a process which necessitates exercises of power.

Expanding Foucault's description of regimes of truth into IT research, Grint and Woogar (1997) argue that technology does not have one true, transparent meaning; neither does it have independent effects. They are concerned with investigating the 'particular regime of

truth which surrounds, upholds, impales and represents technology' (Grint and Woolgar 1997: 32), arguing that technical artefacts can be understood as texts that must be interpreted; meaning is constructed from the multiple interpretations and representations of a technology, with the most persuasive, or forceful, interpretation emerging as the dominant, commonly accepted meaning.

As outlined in the introduction, 'living labs' are an action-oriented developmental research methodology, which embed novel technologies in real world settings and aspire to reveal learning through the ongoing conversations and debates between participants. Embedded power relations are a feature of these learning environments (Contu and Willmott 2003; Foucault 1980; Knights and Murray 1994), given that living labs comprise of multiple stakeholders and actors, multiple inter-firm partnerships and fluid, evolving goals. While previous research in this area highlighted the importance of knowledge brokers, continual sense-making and negotiation in a living lab (Frössler et al. 2007), the question of how particular innovations come to be produced, accepted and normalised has not been addressed. It would seem, therefore, that the link between truth claims and exercises of power are particularly relevant when researching technological innovation in learning settings.

3. METHODOLOGY
3.1 Methodological underpinnings

The case studies presented here are part of an EU-funded research program. Four living labs provide real-life settings in which innovative eCustoms solutions are developed and their broader influence on diffusion and adoption is investigated. These living labs focus on different domains (beer, paper, food and pharmaceutical) and take place in different countries (Netherland, Finland, Denmark, and Ireland and Germany). In this paper, we follow a comparative case study method (Walsham 1995) where we investigate the four living labs from the point of view of power and learning. The case studies are conducted in an interpretative tradition (Klein and Myers 1999; Markus and Robey 1988; Walsham 1993). Interpretive studies are "aimed at producing an understanding of the context of the information system, and the process whereby the information system influences and is influenced by the context" (Walsham, 1993, p. 4-5). A broad assumption of the study is that there is no such thing as value-free research (Berger and Luckmann 1991). As researchers of, and participants in, the funded project, we are aware of the tendency towards 'privileging of the consciousness of the researcher' (Knights 1992: 515). Thus, in focusing on issues of power/knowledge in living labs, we are conscious of the interrelationship between truth claims, inter-subjectivity and exercises of power and our own roles in constructing and reinforcing specific regimes of truth.

3.2 Method of data collection

Data were collected from different sources in order to gain a comprehensive picture of the cases. The authors of this paper were actively involved in one or more of living labs and they collected rich pool of data during the living lab duration (the duration of each living lab was between 18 and 24 months). More specifically, data was collected through participation in meetings, brainstorming and working sessions, individual interviews with living lab participants, observations and document analysis. Texts reviewed ranged from internal project reports, policy documents issued by national tax administration or EU

concerning eCustoms developments, sector-specific documents for the specific domain investigated in each living lab, white papers and reports concerning the innovative technologies used in the living labs, to mention only a few. The majority of the field research was carried out in the period January 2006- December 2008, however additional data is still being collected. A large part of the general meetings and formal interviews were recorded. Due to the large number of meetings and recorded material, these were only partially transcribed. Meeting notes or reports have been sent out to participants for verification and clarification purposes. Initial analysis began as the data was being gathered (Silverman 2000; Wolcott 1994). Following Watson's (1994) image of research as a craft, analysing the data was an iterative process that involved developing and discarding themes through numerous discussions and rewrites.

4. DATA PRESENTATION

4.1 Living Lab One (LL-1)[2]

Living Lab One (LL-1) was conducted in parallel with Living Lab Two (LL-2). In LL-1, the goal was to develop innovative IT-enabled solutions which would allow small and medium size companies (SMEs) to establish electronic communication with a large multinational company (ScanCo) for their commercial transactions. A core argument in LL-1 was that if all the commercial processes starting from ordering to invoicing are conducted electronically, this information can then be reused for interactions with the authorities for procedures such as import, export and can allow for trade simplification.

The initiation of LL-1was done by a regional innovation institute (InnovIns). While for the other living labs the pilot companies were selected at a later stage and were included as sub-contractors, in LL-1 the commitment of ScanCo was secured in advance and ScanCo was an official project partner. The parties that remained to be sub-contracted for a later stage were the SMEs that were going to participate in the pilot. In addition to ScanCo, InnovIns ensured the involvement of the government authorities and a Scandinavian Bank as part of the official partners in the project.

Despite initial commitments, LL-1 encountered difficulties once it started. Due to internal reorganizations, ScanCo shifted their priorities and LL-1 was no longer high on their agenda which made the communication with ScanCo difficult. Moreover, representatives of Government Tax and Customs remained sceptical about what LL-1 would actually achieve. They remained as observers but as they did not see clear benefits for their organization, their input and energy invested in the project remained limited. The same was true for the Scandinavian bank, which was rarely represented to meetings, showed little interests and subsequently withdrew as a partner from the project. In that respect, while gaining initial interest was relatively easy to achieve, little efforts were spent on understanding the real interest of the parties involved, which subsequently resulted to loss of commitment.

LL-1 was the only living lab that did not have a university partner involved in the initiation and management of the process. Although InnovIns was responsible for the management of LL-1, it still had commercial interests and as such was not able to provide fully neutral

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[2] All names are pseudonyms.

grounds for discussions. It also had to rely on expertise from foreign universities. These parties were supposed to carry out major project tasks related to problem analysis, redesign and evaluation but the geographical distances did not allow for building good relationships with the companies and establishing frequent interactions.

Two technology providers were involved in LL-1. As they pursued different commercial interests, tensions between them arose at certain stages in the project. Without a neutral partner to balance the interests, we saw power struggles and shift of leadership from one technology provider to the other.

Nevertheless, at the end of the project, LL-1 managed to produce a very interesting demonstrator and is the only living lab in the project which addresses problems related to SMEs. And while at the beginning they were not able to formulate the LL-1 core message with the key objectives of EU, at the end of the project, with the help of the foreign university partners they were able to come up with a strong message for both businesses and government.

4.2 Living Lab Two (LL-2)

The goal of LL-2 was to develop innovative IT-enabled solutions for export of excise goods such as alcohol. LL-2 aimed to demonstrate that if a company can prove, by using innovative IT, that is in control of its supply chain operations, it can receive significant trade simplifications by the government in return.

The initiation and the subsequent management of LL-2 were done by a dedicated university partner (NatUni A). LL-2 comprised of a core team, which in addition to the NatUni A included the following partners: ExciseCo (a multinational company, manufacturer of excise products), Government Tax and Customs (GTC), and a technology provider (TechnoProv 1). Apart from the core team, several other parties were also involved. These additional actors included a Sea Carrier, Foreign Government Tax and Customs (FGTC), a second technology provider and a number of other universities. A key figure in the initiation of the LL-2 was a professor from NatUniA, who drew on his personal and institutional relationships to involve GTC and TechnoProv1. The involvement of ExciseCo, however was a more difficult task and the company's involvement was finally secured via GTC. It took time to convince ExciseCo to join the project and while it finally agreed to join, ExciseCo made it clear from the beginning that the participation was done purely to maintain good relationships with GTC; ExciseCo explicitly expressed its scepticisms of what the project can achieve.

Throughout the whole duration, the project had a friendly atmosphere. The member of the core team enjoyed a close physical proximity, which allowed for frequent interaction. The core team possessed most of the expertise to carry out the project tasks and the limited input required from the supporting partners allowed for a limited coordination complexity.

During the initial phases, as well as throughout the whole project duration the NatUni played a key role in aligning the interests of the different parties involved. Moreover, significant efforts were spent to ensure that the concerns of ExciseCo were taken seriously in the redesign. With the development of the project, the partners remained committed and

at the end of the project they were very pleased with the results. Even ExciseCo, which entered the project with a lot of scepticism expressed that it was very enthusiastic about the outcomes and saw benefits in possible future applications.

4.3 Living Lab Three (LL-3)

Living Lab Three (LL-3) is co-ordinated by two university partners. Unlike the other living labs, the initial stages of LL-3 were difficult because there was no ready-made network of industry and government contacts that could be used to help gain access and set up the living lab network. The university partners were therefore forced to build a network from scratch.

A significant help in building the network was that LL-3 had a strong central message; counterfeit drugs have been recognised as a serious public health risk. Thus, supply chain security and control are key issues for the pharmaceutical industry. The question then is how to enhance the security and control of complex pharmaceutical supply chains, while also reducing administrative red tape and facilitating trade. Although these technical building blocks are in place, the pharmaceutical sector has yet to produce a co-ordinated response to the stringent compliance issues and the threat posed by counterfeit drugs. No single player can solve the problem. What is needed is an industry-wide, inter-organisational approach, involving the co-ordinated action of a large number of stakeholders, including industry, governmental and third party representatives.

Using this central message about the need for a co-ordinated approach to counterfeit drugs, the university partners engaged in an 18 month campaign that sought to discuss anti-counterfeit initiatives with a range of interested parties that included pharmaceutical companies, pharmacies, trade organisations, government agencies, patient groups and other special interest groups. At the end of this process, there was a broad network of interested parties in place, although an industry partner had yet to sign up to LL-3.

The next phase of LL-3 involved getting a large, multinational pharmaceutical company (known as PharmaCo) involved in the project. During intensive discussions, the university partners made the radical decision to split LL-3 into two complementary parts: one LL would investigate anti-counterfeit, while the second was to examine cold chain shipments. This unusual step was in response to industry concerns raised by PharmaCo and it is in keeping with the philosophy of living labs, namely, to evolve and learn in real life settings. Since deciding to conduct two complementary pilot projects, the core project team has begun to expand and has been drawing in expertise from other areas of the project.

4.4 Living Lab Four (LL-4)

Setting up Living Lab Four (LL-4) was a relatively fast, uncomplicated process. One of the university partners acted as a knowledge broker by drawing on his professional contacts to generate interest and commitment to the project. A major player in the food sector (FoodCo) signed up to the project, as did the relevant tax and customs agencies. Furthermore, the living lab had an existing business problem to investigate, namely, examine milk subsidies. LL-4 began with a great deal of excitement and enthusiasm. Given

that it was one of the last living labs to start, the general feeling was that it could build on existing learning in previous labs and would easily be 'the best lab'.

Despite the initial enthusiasm, LL-4 quickly ran in to difficulties. Firstly, the EU cancelled milk subsidies, meaning that the project's *raison d'être* had disappeared. In the months that followed, the partners engaged in substantial discussions about a new topic for the living lab. It was eventually decided to focus on control and competitiveness of the food supply chain by demonstrating how it is possible to increase security in the export of food / dairy products while simultaneously decreasing the administrative burden for exporting companies.

While scoping the new topic for LL-4, the initial network ties began to weaken. The energy and enthusiasm which characterised the kick-off meetings was gradually placed by torpor and a sense of ennui. The initial knowledge broker, FoodCo and tax managers, who had been very active in the initial stages, were gradually replaced by more operational level personnel and this slowed down the scoping discussions because decision makers were not present all the time. Furthermore, the university, industry and government partners all experienced turnover in key personnel, meaning that existing relationships, practices and knowledge about the project lacked stability.

After 18 months, the project reached a turning point when key decision makers had an emergency meeting where the scope and objectives of the FLL were discussed and finally agreed. Since then, LL-4 has been making progress, albeit with significantly reduced technological objectives.

5. CASE ANALYSIS
This section provides an analysis of the four living labs from the point of view of power. We focus specifically on power issues with respect how the living labs were initiated and subsequently managed and on key events from the lifespan of the living lab, where power issues become particularly visible.

5.1 Living Lab One (LL-1)

LL-1 had a good start, as InovIns had managed to secure the formal commitment of key players such as ScanCo, Government Tax and Customs and Scandinavian Bank. Nevertheless, as it became evident later in the project, formal commitment was not sufficient. Limited efforts were spent on understanding the different regimes of truth of the key partners involved and how these evolve over time. ScanCo was undergoing internal reorganization and InovIns was not able to align the new priorities of ScanCo with the goals of LL-1. Limited efforts were spent to understand the regimes of truth of the government and banking partners and to engage them in creating a common discourse that would be beneficial for all the parties involved. As a result, LL-1 suffered from lack of commitment of the business parties in the follow-up stages and even formal withdrawal of partners.

The lack of shared regime of truth in LL-1 was visible also in the communication with the university partners. The goal and direction of LL-1 remained unclear and often participants were not able to see how the focus on integrating the business side of the supply chain

would benefit for improving the interactions between business and government and bringing trade simplifications. Only at the final stages of the project, with a lot of efforts from the university partners, was InnovIns able to come up with a clear message of how LL-1 was able to address some of the fundamental questions asked in the project and this was helpful for established a shared understanding among the participants.

A clash between different regimes of truth was visible in two other aspects of LL-1, i.e. the view on how dissemination should be done, as well as the involvement of the two different technology providers.

With respect to the technology providers, it was obvious that they pursued different commercial interests and they participated in LL-1 to a large extent as competitors. One of the technology providers was a big multinational, well established company that wanted to use the opportunity of LL-1 to generate extra publicity. The other was a small start-up company which wanted to get established on the market through its innovative software technology. These different interests and regimes of truth brought a lot of turbulence in the project and InnovIns was not able to balance the forces and utilize them to the best benefits of LL-1. This resulted in a lot of struggles and shift of leadership from a technology provider's point of view and focus throughout the different phases of the project.

With respect to dissemination, the InnovIns, as well as the two technology providers were attempting to make quick commercial wins and they were therefore willing to engage in large scale dissemination activities without having clear message, tangible results and proper audience. This approach was heavily criticized by the university partners, who felt that thorough preparation was needed in they wanted to have a real impact. While at the end a compromise was achieved and LL-1 was allowed to proceed with the immediate dissemination activities, this resulted in a complete failure and the activities were stopped at that stage.

Despite of the difficulties, at the end LL-1 was able to produce interesting results. With the help of the university partners it was able to formulate a strong value proposition towards the SMEs and is now involved in the overall project dissemination activities.

5.2 Living Lab Two (LL-2)

Different sources of power were used for the initiation of LL-2. In this process the professor from NatUni built onhis power of status, as well as personal and institutional relationships to engage the government and the technology provider. The use of power was also very much visible in the involvement of ExciseCo, where ExciseCo agreed to join the project, primarily in order to keep the good relationships with the government.

During the initiation stage, but even more so during the subsequent stages of LL-2, the NatUni played a key role in helping to elicit the different regimes of truths of the parties involved. Significant efforts of NatUni were spent on mediating and translating between the actors and in searching for grounds for establishing a common regime of truth, which is acceptable and perceived as beneficial by all the parties involved. This was crucial for sustaining commitment and was especially important for the pilot stage, where actors had to invest significant own resources for development of the technical infrastructure

(TechnoPorv1), for making people and containers available for the pilot (ExciseCo) and for setting up teams to do the controls according to the redesign procedures (GTC).

As ExciseCo was very sceptical about LL-2 at the beginning, NatUni in close collaboration with GTC spent significant efforts to make sure that the concerns of ExciseCo (both legislative and operational) were well understood and taken into account. The green light for proceeding with the pilot was given only after ExciseCo confirmed that it saw real benefits in the proposed redesign. In addition, numerous activities were undertaken by NatUni and GTC to reach out to the legislators and to show ExciseCo that LL-2 pursued a real impact in practice.

The two technology providers in LL-2 had clearly different regimes of truth, however big clashes were not observed. TechnoPorv1 was in the lead in LL-2 and participated from the beginning. The second technology provider joined at a very late stage, bringing its own interests and concerns. These different regimes of truth, however, were mediated by NatUni and a compromise was negotiated.

After the evaluation stage, all the LL-2 participants were happy with the results. What was surprising was that ExciseCo, who was very sceptical at the beginning, ended up being very enthusiastic about the outcomes at the end of the project. The LL-2 participants are now engaging in collective action for bringing LL-2 ideas to practice. They are planning very careful their dissemination strategy and how to use the power of their knowledge and experience through LL-2 proof of concept to bring real change.

5.3 Living Lab Three (LL-3)

The issue of counterfeit drugs has become an increasingly popular topic of investigation in print journalism. The initiators of LL-3, however, discovered that counterfeit borders on being an invisible topic within the industry; although everyone is aware of the seriousness of the problem and have invested heavily in bespoke anti-counterfeit solutions, there has not been a co-ordinated response to the problem. Moreover, spokespersons and agencies were wary of over-publicising the threat of counterfeit drugs for fear of creating public panic. Thus, in trying to start up LL-3, whose aim was to create a co-ordinated response to the threat of counterfeit drugs, the partners had to overcome barriers of suspicion between rival pharmaceutical companies, a proliferation of industry initiatives and a wide array of interest groups who were often campaigning at opposite ends of the spectrum and were moulding the anti-counterfeit discourse to suit their message.

Moreover, multiple discourses exist in the pharmaceutical industry, including public health, (self) regulation and intellectual property rights, meaning that the pharmaceutical industry is both highly regulated and subject to rigorous confidentiality agreements. Therefore, although the two university partners had institutional 'credibility', they were nonetheless powerless players in this network without industry contacts. In order to build the LL-3 case, they undertook a prolonged (18 month) series of community-building meetings with a wide range of stakeholders. While LL-3 is still in the early stages of piloting, this helped the team to elaborate an understanding of the issues and concerns of the stakeholders, as well as identifying industry needs.

5.4 Living Lab Four (LL-4)

LL-4 is of interest because it demonstrates the 'exercise of power' and political manoeuvrings in living labs. Firstly, LL-4 originally came into being because a member of the university core team was able to draw on his reputation and contacts to generate interest in and commitment to the project; as a highly successful, famous academic, he had high level access to government and industry leaders. Later on in the process, however, when the high level decision-makers were replaced by operational staff, a power vacuum developed. Daily project management was deputised to the operational staff and decision-making shifted to a consensus model. When the milk subsidies were abolished, this had a number of implications. Different partners within the project group tried to push for their preferred scoping topic and this presented a confused, disarrayed image to FoodCo and the tax and customs agencies.

A second element of the analysis is that LL-4 was caught between several conflicting regimes of truth. On the one hand, there was the discourse of eGovernment, which continues to have the strong message that modernisation of government services through use of ICT is both necessary and inevitable. The project, in its exploration of 'intelligent' e-Customs innovation is part of this regime of truth. A second, complementary power/knowledge truth regime is the modernisation of the public service, via neo-liberal discourses of enterprise (Doolin 2002). Part of this agenda included automating tax and customs services, amalgamating services and reducing the workforce. A direct outcome of this is that tax and customs agency staff routinely responded to the question 'how do you think we could use technology to improve the service?' by replying that 'our system is the best in the world. It doesn't need to change'. The researchers were initially sceptical of this response ('could their system really be that good?' 'they are very proud of their systems'), but further interviews revealed a deep fear among operational staff that further technological efficiencies would result in further job cuts.

6. DISCUSSION AND CONCLUSIONS

This paper foregrounds the importance of power and politics for understanding the process of technological innovation. We began by suggesting that what can be termed 'economic/rationalistic' (Fichman 2004) approaches to IT innovation operates on an implicit assumption that IT innovation is an apolitical process, where innovation is treated as progressive, human decision-making as rational and knowledge as a commodity that can be accumulated. There is little recognition that political clashes are a constant feature of IT innovation and technological change (Avgerou and McGrath 2007; Knights and Murray 1994). All four living labs offer empirical evidence to support these claims. For example, LL-4 was caught between conflicting regimes of truth which equated technological innovation with modernisation of government services, on the one hand, and on the other, with loss of employment due to increased automation. LL-2 and LL-3 offer comparative examples of power relationships in establishing living labs. LL-2 could draw on institutional resources (Government, academic) to persuade ExciseCo to join the project, but in the case of LL-3, no such resources were available, meaning that the project team

were constantly attending to stakeholders' interests in an attempt to generate and sustain interest in the project. Following Foucault's argument that power does not have any inherent qualities (Clegg 1989), a comparison between the living labs suggests that political manoeuvrings can have both positive and negative outcomes. For example, while there were clashes of interest and communication difficulties in LL-1, the pilot produced an SME-focused demonstrator that is regarded as a success within its target group.

Another contribution is that the paper addresses the lack of empirical research (Følstad 2008) in methods and procedures for living labs. The project deals with innovation in a multiple stakeholder environment. Therefore, understanding the drivers of collaboration and conflict, of collective action and mutual blockades is an important feature of the research agenda. Through a series of interpretive, longitudinal studies of each living lab, lasting between 18 and 24 months, this study draws on a rich data set and attempts to examine 'technological innovation' in a critical light, again highlighting the argument that political clashes are a constant feature of IT innovation (Avgerou and McGrath 2007). However, while our roles as both researchers and participants in the project allow us ease of access to empirical data, we are aware of the need to reflect on our roles in constructing the 'truth' of the project. In exposing the conflicts and agenda-driven activities in living labs, we are aware that this story is in itself an exercise of power and it crafts (Watson 1994) the stories of the living labs in a fashion that might not be recognised, or agreed upon, by other participants.

The main contribution of the paper is in the area of technological innovation in learning settings. While previous research in this area highlighted the importance of knowledge brokers, continual sense-making and negotiation in each living lab (Frössler et al. 2007), the question of how particular innovations come to be produced, accepted and normalised has not been addressed. Living labs are a relatively new methodological approach predicated on the concept of fostering technological innovation through real-life learning settings. As outlined in the introduction, learning is revealed through the ongoing, iterative conversations and debates between participants. In this study, we suggest that embedded power relations are a feature of these learning environments (Contu and Willmott 2003; Foucault 1980; Knights and Murray 1994), given that living labs comprise of multiple stakeholders and actors, multiple inter-firm partnerships and fluid, evolving goals. It would seem, therefore, that the link between truth claims and exercises of power are particularly relevant when researching technological innovation in learning settings.

In the case studies, we outlined examples of political manoeuvrings, clashes and open conflict between partners. Yet in all cases, the living labs concluded, or are on course to conclude, successfully. We must then ask, did learning occur in the living labs and, if so, how did it occur. Firstly, following Contu and Willmott (2003), the cases show that learning environments are highly political. Participants produce, reproduce and struggle with multiple regimes of truth. Participants also struggle with scarce resources, which delimit the conditions of possibility (Knights and Murray 1994) for learning-based innovation to occur. Furthermore, with no fixed goals in a living lab, the learning outcome must be negotiated and is subject to constant ongoing revision, as more is learnt about the situated innovation. We suggest, then, that *compromise* is a key feature of learning in a living lab setting and, hence, that technological innovation is based on compromise. For example, in LL-2, participants had to negotiate towards a set of shared objectives, goals and

definition of value. Similarly, in LL-3, participants had to alter their original project scope in order to align the project with industry-wide interests. In contrast, for much of LL-4, participants were unable to agree on a mutually-acceptable project scope and the constant negotiations and sense-making meant that the project quickly ran behind schedule.

If compromise is a feature of learning in living labs, we should ask whether living labs are a useful methodology. Living labs acknowledge that messiness and political clashes are a recurring feature of technological innovation. Rather than ignoring these, living labs acknowledge that it is through the messiness that you understand the real needs of industry and users. Thus, technological innovation is not divorced from practical needs, meaning that potentially it has a better chance of adoption after the pilot stages.

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