From Knowledge Transfer to Situated Innovation

Cultivating spaces for co-operation in innovation and design between academics, user-groups and ICT providers

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Abstract

Innovation systems, 'triple helix', and similar expressions, are used to conceptualise the growing need for more integrated forms of co-operation between academia and other societal actors, such as governmental agencies and industry, in order to produce knowledge relevant for society. However, there is as yet little reported experience from such recent and on-going co-operative projects of how research changes when it becomes involved in practices it is meant to contribute to. In this paper, the authors report about three different research projects where researchers co-operated with governmental agencies and industry around the development of ICT. Evidence from three domains, namely e-government, telecommunications and welfare services, indicates the need for problematising current mainstream understandings of innovation. Innovation, as we see it, is occurring through configurations of designers, developers and domain experts that form constituencies and where scientific knowledge is confronted by requirements, constraints and possibilities of the specific situation. In this context innovation of, or involving, ICT requires a significant amount of imagination, represents a relatively sharp break with established ways of doing things, and requires artful integration of different professional practices, communities, and technologies. We define these creative processes of co-development of work practices, organisations and technology as 'situated innovation'

Introduction

Innovation systems, 'triple helix', and similar expressions, are used to conceptualise the growing need for more integrated forms of co-operation between academia and other societal actors, such as governmental agencies and industry, in order to produce knowledge relevant for society (Gibbons et al.1994). However, there is as yet little reported experience from such recent and on-going co-operative projects of how research changes when it becomes involved in practices it is meant to contribute to. In this paper, the authors report about three different research projects where researchers co-operated with governmental agencies and industry around the development of ICT. Evidence from three domains, namely e-government, tele-communications and welfare services, indicates the need for problematising current mainstream understandings of innovation. Innovation as part of a traditional knowledge transfer process[1] does not capture the dynamics observed in the three cases presented in this paper.

Innovation, as we see it here, is occurring through configurations of designers, developers and domain experts that form constituencies and where scientific knowledge is confronted by

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[1] For example the various processes of innovation that include a relationship between research in academia, firm R&D activity, and product development (c.f. Mansfield, 1961, 1963, Rogers 1962)

requirements, constraints and possibilities of the specific situation. In this context innovation of, or involving, ICT requires a significant amount of imagination, represents a relatively sharp break with established ways of doing things, and requires artful integration of different professional practices, communities, and technologies.

We define these creative processes of co-development of work practices, organisations and technology as 'situated innovation'. In the article, we explore the role researchers can play when co-operating with other actors around such situated innovation. By contributing an outsider perspective as well as methodological and technological knowledge, researchers expand the spaces for innovation, and provoke a more reflective attitude among the involved practitioners. On the other hand, because of the way academic knowledge is adapted, rejected, and provoked in the situation at hand, researchers involved in these co-operative projects develop a deeper understanding of the interplay of work practices, organisations and ICT. To further and accelerate such situated innovation, spaces for co-operation between ICT providers, other practitioners, and researchers, need to be cultivated. We term these spaces 'transformational spaces', which are different types of meetings and workshops in which various participants can share and exchange knowledge and where they can experiment with ideas in technical, organisational and social change (Wessels, 2000).

In the article, we discuss some of the dynamics of such situated innovation in three collaborative projects that focus on ICT.

In the domain of e-government, ICT in front office work is becoming closely integrated with public services on-line. These services, in turn, are becoming more citizen-oriented and integrated across public service sectors, which puts new demands on the front and back office ICT. The e-government project explores the inter- and intra-organisational co-operation over time around continuing design and development of ICT in use in a public service one-stop shop in a town in southern Sweden. Municipal technicians, front and back office workers and technology suppliers are actively involved in this project, while citizens in the municipality are, as yet, only indirectly involved via the one-stop shop personnel, who 'know what people ask for'. The informatics researchers call their approach *participatory research*.

The second project described in the article concerns the co-operation between a telecommunication provider and software engineering researchers in a project that addresses use-oriented development in the design of flexible administrative systems. Also, within this project, in-house software developers co-operate with the business units around the design and development. The researchers, in this case, contributed to the development of a more adaptable system. At the same time, for their own part, they learned more about how the interaction of use context, development practices and technical infrastructure influenced the adaptation of technology and development methods. *Co-operative method development* is the concept used here to describe how software engineering methods can be developed in an evolutionary learning cycle together with the co-operating software practitioners.

The third project, in the area of welfare services, addresses the joining up of services for disabled children in the UK. This project is centred on a Centre for Disabled Children in a city in the North-East of England. The project involves the Local Administration, the local Health Trust, the local University and a technology supplier. *Researched development* emphasises the reflective and reflecting role of a social scientist accompanying and facilitating the cross-organisational change and development processes.

Each of these three projects involves participants from universities, from developers and from user communities. The involved researchers come from different disciplines, thus the approaches differ in objective as well as in theoretical background and research methodology. These differences are not discussed further here. The article focuses instead on the common themes emerging from the projects. These are discussed in sections 3 and 4. The main theme of the article, however, is that there is some evidence to suggest that the innovation of ICT in applied domains is becoming locally situated, especially in complex environments such as the ones we describe.

Three Cases

Case 1: Participatory research

Continuing design of ICT in use was the main focus of the DitA project[2], which ran between April 2000 and December 2002. The ICT we were interested in was the existing technology support for front office work on the one hand, and rapidly evolving public services on-line on the other. To what extent were they being integrated? And how—and by whom—was this integrative design and development being done? These were questions we set out to explore in in-depth case studies at a number of different municipal one-stop shops. The methods we used were mainly qualitative: interviews, workshops, and ethnographic field studies, including video-recording and interaction analysis of front office work practice. Our approach was based on the Scandinavian tradition of participatory design (Ehn 1988, Bjerknes & Bratteteig 1995). We were inspired by its basic democratic ideals, yet aware of the challenges posed to this tradition by the diversity and complexity of on-going technological development as well as by the shifting political, epistemological and ontological contexts of its use (Beck 1996, Ehn and Badham 2002, Dittrich et al 2002).

The DitA project was a combined research and development project funded by the Swedish Agency for Innovation Systems (VINNOVA). The project partners were five municipalities, two software consultancy firms, a call centre, and researchers from Blekinge Institute of Technology. The original plan was to run five projects in parallel, one in each municipality, and to encourage mutual exchange of experiences and design and development ideas between the different projects. For various reasons beyond the control or influence of the joint R&D project, only two of the initial five projects were fully carried through.

Our design focus eventually led to studies of work practices beyond the front office. We found design-oriented communication and cooperation between front and back office personnel, between front office personnel and municipal technicians, between front office personnel and the rest of the municipal organisation, and between front office personnel/local designers and various software providers. The number of different software providers involved in supplying municipal technology support for front office work and public services on-line surprised us. Ten years ago, most municipalities in Sweden were using software from one or two large software providers who had specialized on administrative systems for the public sector. Now we found applications from 15-20 different companies up and running on municipal intranets, many of them integrated as part of the municipal services offered to the public via the Internet.

We found small local software companies who had developed a culture of continuing design in use as part of their customer relationship management, and who considered it an important and selling quality of their product.

In the discussion in this paper, we draw mainly on experiences from one of the case studies in the DitA project, involving a one-stop shop in a small municipality in southern Sweden. Here, we carried out what we have come to refer to as participatory research (Enden 1981) in a longitudinal case study that lasted for two and a half years. Field studies were initially carried out in the front office of the one-stop shop, with observations mainly focused on technology in use at the front desk. Later they came to include work practice studies at a small software company that provided one of the more frequently used applications in the one-stop shop. The longitudinal nature of the case study, in combination with our focus on design in use, thus allowed for exploring on-going long-term co-operation between users and technology suppliers as well as between local web-designers and other municipal employees.

During the study, we became more and more aware of the multitude of different design-oriented activities going on here. For years, the front office team has had a say in choosing what applications to buy to support their own work, and recent development has lead to them gaining a more official status in the organisation as local designers of the municipality's intranet. In contacts with the providers of software in use, they have grown accustomed to voicing their own problems, needs and requirements in problem-solving terms aimed at accomplishing specific improvements in next versions of the software. The software provider whose work practices were studied had found ways to take care of this type of feedback from customers and incorporate it in their product as co-constructive version management as well as customer relationship management (Hansson 2002). They had successfully developed both software and a growing stock of customers from all over Scandinavia in a specific niche, which was by now being further defined and developed by the customers and software providers in collaboration, in the very use of their software. It seemed like an excellent example of participatory design, in the sense user driven software development. It might even qualify as a miniature version of an innovation system. But where were the researchers in this picture?

The researchers involved in the DitA project came from different disciplines and research traditions: software engineering and computer science, human work science and informatics, and techno-science studies. We shared an interest in and a vision of working with participatory design of technology and services in the public sector. We found that participatory design was already, in some sense, going on out there 'in the wild' (Dittrich et al 2002). This shifted the role of the researchers, and forced us to reconsider what part we might play in relation to such on-going, user driven design. If this is participatory design, and it is going on out there without researchers driving it, then what does it actually mean to do participatory *research*? Are there lessons to be learned from the pragmatic way in which the software provider is managing the customer relationship as part of a continuing design process in the example above? And from how, concurrently, the front office personnel have developed their role in the municipality as local co-designers of services and technology, both in this specific niche, and concerning the municipal intranet and Internet design in general?

In discussing dynamics of innovation at this level, in this case, *diffusion* is not the first word that comes to mind[3]. What appears to be evolving here is a web of new design practices in what could be defined as a *space for situated innovation*, a space that is being deliberately cultivated from both sides of the supplier/customer relationship. We researchers developed a metaphorical sketch, or simple 'figure of thought', in order to conceptualise this space and the working relationships of technology production and use (Suchman 1994) we thought we could see within it. The figure proved to be useful for initiating and carrying on open-ended discussions about design co-operation, both with practitioners and with other researchers. In the project co-operation, it came to support a reflective dialogue, in close touch with actual work practice experience, between the project participants. This was repeatedly illustrated during project workshops, when one person or another would get up, go over to the white-board, and point at some specific place in the figure, indicating that 'this' was what they were talking about. Perhaps this was the biggest difference we made, in a project where we felt more like observers of on-going user driven design than participatory design researchers according to the Scandinavian tradition. By observing, sketching and pointing to on-going design interactions and relationships, and talking about them with those involved, we have hopefully broadened the scope of the space for situated innovation.

The citizens' role in this design partnership is as yet undefined. So far, citizens have been represented indirectly, by the front office personnel, who 'know what people ask for'. However, as citizens become more active in making demands on public services offered on and off line, this appears to be one of the areas where methods from participatory design could be more deliberately applied in reflective dialogue between public service providers and various citizen groups. As researchers, we plan to explore further the possibility of increased citizen participation in future collaboration between municipalities and other public service agencies, software providers and the university.

Participatory research, then, as we have begun to use the concept, is based on a Scandinavian tradition of participatory design, but goes beyond the traditional delimitations of a specific technology development project, and thus puts new demands on already established methods and techniques of participatory design, and challenges traditional dichotomies such as user/designer. It also changes the role of the researcher in the co-operation.

Case 2: Co-operative method development

Flexible and adaptable software was the subject of a co-operative research project from January 2000 until December 2001 between computer scientists from Blekinge Institute of Technology, the IT unit of Europolitan, now Vodafone Sweden, and a small software provider. The research was sponsored by the Swedish Knowledge Foundation[4]. Sponsoring from that funding organisation requires industrial counter financing, in form of financial support, material or, as in our case, project participation by the industrial partner.

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[3] Although you might argue that, from a more detached point of view, it could be seen as diffusion of ICT within the municipal organisation, taking this point of view at close range causes a blind spot concerning the very dynamics of situated innovation we wish to focus and explore, effectively laming the local actors in a 'view from nowhere' (Suchman 1994) framework we are attempting to avoid.

[4] See http://www.kks.se/aboutus/

The small software provider was interested in exploring the requirements for further developing a flexible database management system for a general market. Within Vodafone, we co-operated with a project group around the design and development of a business application. Providing mobile communication is a competitive and rapidly changing business. New types of services are invented and have to be implemented. This, plus the lack of standard systems supporting the telecom industry, puts high requirements on the IT systems and the development of them.

The co-operation was successful. Vodafone's IT unit developed a more flexible application than the predecessor of the application. The involved practitioners developed competence in how to design for flexibility and technical possibilities. We researchers learned more about the deployment of technical possibilities under industrial conditions. Criteria from use, development and technical contexts influence the evaluation of design solutions. (Lindeberg & Diestelkamp 2001) This puts into question the traditional scientific concept of design. Instead of focusing on the sole designer and his 'design from nowhere', 'artful integration' (Suchman 1994) of different contexts becomes a more appropriate way of conceptualising how design takes place in this industrial setting. (Dittrich & Lindeberg 2003)

The IT unit co-operates closely with the business units around the development of new software supporting the development of services and business practices. (Dittrich & Lindeberg submitted) Project teams consist of members of the business units that will work with the software and developers. The project is co-owned. Users get compensated for their contribution through a reduction of their normal tasks. Tasks in the project are distributed according to competence. In the project the users took part in the formulation of the requirements and the initial design, contributed to the evolutionary analysis and design, gave feed back on early prototypes, formulated the test cases for the acceptance tests, and tested the system accordingly. When needed, the project consulted experts from other units of the organisation. The researchers contributed to this design constituency with their technical know how and reflective attitude.

During the co-operation, a set of difficulties in this kind of co-operation became visible: Research and industrial software development practice have different rationales. Software development practice is measured according to whether it provides good software in an efficient way. Researchers are measured according to the number of publications they produce. To get published, they have to follow the standards of the scientific community regarding rigour of empirical work and argumentation. They have to relate to a scientific discourse that might, or might not, be relevant for the involved practitioners.

The rhythm of research and development differs. Research publications take between one and two years from the first formulation of the idea to the printed form. The empirical research articles are based on prolongs this period. Only part of the results of the co-operation has been published during the project time, and there are still articles under construction. Software

projects may take time to get started. The work tends to get intense during implementation[5], and it has to be finished before the software is taken into use.

To get different rationales and timelines to work together, mutual respect and flexibility on both sides are required. The IT unit applies a rather flexible project model, mainly in order to accommodate the co-operation between business units and the IT unit described above. This flexibility allowed the project to take in the evolving results of the co-operative research. The researchers applied an empirical approach, combining participatory observation, and qualitative interviews and document analysis with more active involvement in form of workshops around techniques and concepts to design and implement flexible systems, jointly supervised student projects that explored specific techniques, participation in the design and implementation. This allowed for adjusting the empirical work to the rationale of the development project. Regular coordination meetings and close contact between project team and researchers helped to co-ordinate research and development practices to become fruitful for each other.

Empirical research in the context of an engineering discipline – and in all three projects we take up in this article – changes character, as the researcher is interested in and expected by all involved parties to contribute to improving and developing the practices that are subject to the research.[6] The researchers become part of the situation in a different way than in traditional social science research. The relationship to the people involved, the perspectives we bring to bear in trying to understand the software development practice, and the basis for our proposals for improvements, turn out to influence what we are able to see, and therefore what kind of results we can produce. The relationship between researcher and research subject(s) – otherwise discussed as ethical issues – becomes a methodological problem. How can such empirical research prove anything?

Reflecting our own experiences, we developed a constructive approach: Observation of practice, workshops and implementation of methodological innovation build a learning cycle that allows for a reflected change of software development practice and gives the researchers feed back regarding the usefulness and applicability of methods. Theoretical findings – how software development with a specific rational like use orientation can be successfully supported – are developed in dialog with a specific practice that shows the potentials, but also the limitations, of the methodological inventions. In our case, neither the academic results around 'Design for Change' nor the improvement of practice at the IT unit, or the design of the system, could have been achieved independently.

Case 3: Researched-development
This section of the paper discuses the work of an Economic and Physical Science Research Council funded research project (a 3-year project) called Advanced Multi- Agency Service

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[5] In software engineering, *implementation* is usually understood as the coding process (programming work) concerning what has been specified in the software design process, not as the process of fitting a software system in to a use environment.

[6] See (Dittrich 2002) for a more in-depth discussion of the epistemological problems of research in co-operation with industrial practice.

Environments in the UK (AMASE).[7]

The emergence of networked configurations of services for the provision of welfare poses a challenge to the role of new information and communication technologies. They are perceived by some to offer the potential for faster, simultaneous and interactive communication and increasingly seen as a key mechanism through which such new forms of public service might be more effectively enabled. Bellamy and Taylor (1998: 14 - 18), however, emphasize the 'ambiguity' of these technologies and the role of institutional factors in shaping the technology in use. This poses new and challenging issues in terms of the relationship between 'system designers' and 'users'. System designers now have added levels of complexity developing systems that enable communication across organisational boundaries as well as the public access to services. Whilst 'users' which and who include multiple organisations, stakeholders and citizens cannot be assumed to co-operate in a complementary fashion. This dynamic raises questions with regards to the effectiveness of the methods that have been developed in attempts to involve the user, including citizens – in some sense and by some means – in the process of system design and innovation. The AMASE research team came to the conclusion that this could be best achieved by using a process called *researched development*. This means that researchers, designers, policy makers and practitioners develop a design constituency in which research findings, industrial wisdom, and practitioner and policy makers' perspectives are discussed and fed into the design of new systems and practices.

To achieve this, one pilot in the AMASE project, namely the joining up of services for disabled children, developed Sloper's (1999) concept of researched development, using qualitative methodologies in the context of a broad design constituency. There are three main dimensions in this process:

1. Developing an appropriate theoretical framework that addresses the multiple structures of meaning involved in public service redesign and one which facilitates participation by all the stakeholder groups.

2. Using different methodologies in relation to the welfare system, which in the case of North East City Children's Services involves researching access to services, practices of multi-agency working and policy-making processes.

3. Developing a design constituency that can encompass many perspectives and one in which all can participate

1. Theoretical Framework

The concern with the formation of intentions and the emergence of meaning by agents as they are creating change and in that process being changed themselves means that the AMASE

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[7] This multi-disciplinary project sets out to establish whether a more rigorous approach to designing and specifying organisational and information system architecture is able to ameliorate some of the severe difficulties of integrating the information and communications systems needed to support the planning and delivery of integrated public services. This involves addressing the integration of services in relation to multi-mode access to services from the perspectives of citizens as well as practitioners and policy makers (see http://www.csr.ncl.ac.uk/emods/)

project needs to address the constitution of meaning in the innovation process. In theoretical terms, this demands an approach that can address meaning and action. To this end an interpretivist approach has been adopted and we have based our methodology on the works of cultural anthropologists Geertz, Burke, Turner and Pfaffenberger. This theoretical perspective places AMASE away from the conventional 'hard' as well as some 'soft' system approaches (Dahlbom 2001). [8] Our theoretical approach allows us to explore the co-shaping of intentions and co-construction of information systems in the development of integrated services. It addresses the reflexivity of action as agents are transforming the ways they work and it encompasses the various perspectives of agents and agencies as they move towards multi-agency working. It also acknowledges the meanings of the agents involved and the ways in which their respective cultures enable them to be creative and reflexive in the processes of change. Finally, our definition of technology enables us to understand the 'thinking through' and the 'discursive aspects' in the design of an information system as it is produced within these sets of social relationships

2. Multiple methods and research relationships

Given the context of the research problem and our theoretical approach, we have designed a multi-faceted research design based on qualitative methods. Also given the complexity of the research problematic, AMASE is a multidisciplinary project with researchers from computer sciences, social sciences and management studies. Our approach is one of researched development (Sloper, 1999), and we are working *with* members of our pilots as they are in the process of change. The approach is inductive and interactive (Hobbs 1988) and is conducted reflexively (Hammersley and Atkinson 1983). Furthermore, the reflexivity of being a 'stranger' or 'marginal stranger' in relation to a pilot maintains an intellectual distance for each researcher, thereby creating a space for the analytical work of the researcher in the research process (Hammersley and Atkinson 1983: 102).

This general approach is taken up throughout all aspects of our research design. The actual design of the research is built around the *planning, practice*, and *access* aspects of developing integrated services. We are using different qualitative methods in each of these areas, and we feed back the research in different ways to members of the Children's Services Group, including research reports and presentations, workshops, feeding research into applying for funding, and models of communication as an 'architectural discourse'. The use of models is to try to 'improve the discourse' in the ways in which managers, practitioners and citizens

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[8] To summarise these approaches, Geertz (1973) addresses the ways in which meaning emerges through social action and is understood through culture's symbolic forms. Turner in particular is concerned with processes, and uses the concept of drama and action as reflexive to address change and transformation. Burke (1989), in the manner of Turner (1987) and Geertz, argues that the grammar of motives is not merely a pattern for describing events, it constitutes the symbolic forms through which experience is constituted. Cultures, in these senses, are not simple reflections of material realities; they are shapers of such realities. Burke argues from a deep-seated pluralism, there is more than one meaning, one possible interpretation, and/or one possible structure. It is precisely multiple meanings in the conflict and contrast of perspectives that gives rise to transformations. Pfaffenberger addresses the relations of production through which technologies emerge, and the emergence of the meanings of technology through its use (c.f. Wittgenstein) as he argues that technology is 'humanised nature' which stresses that technology is fundamentally a social phenomenon.

understand and can articulate their needs in relation to an information and communication system.

To be more specific, the access part of the work involved a survey of practitioners who were in the process of joining up services for disabled children, focus groups with parents of disabled children, and in depth interviews with managers of services for children (see Wessels and Bagnall, 2002). To address the practice aspect of joining up services, a researcher conducted ethnography of the centre for disabled children. The researcher spent one year in the centre and with staff there, mostly in the role of an observer. However, once a month she reported back to the development group at the centre (GIAG – Give It A Go group), where her observations and analysis were discussed in relation to making decisions about development plans (see Wessels and Adam 2002). In relation to the planning process, two researchers conducted a series of 8 workshops with the Children's Planning Group (one per month), and they continued to sit in on the monthly Planning meetings over the following remaining years[9] (see Vaughan, 2001). Part of this process also involved the researchers interviewing the 12 Chairs of the Children's Needs Groups. Through this process, the researchers have access to decision-makers, and those who have access to resource allocation processes, which are important aspects in the process of innovation.

This research design means that the research team as well as the practitioners and policy makers involved in the development process start to understand the broad environment of service redesign in the public sector. Research conducted in one dimension of service provision therefore informs research from the other dimensions. To achieve this, all the research participants need to be aware of the nature of research, and trust the research process. Participants take part in validation workshops so that the participants can comment on the research results. This process is necessary in several ways, first anonymity and confidentiality is difficult to achieve in this type of approach, therefore, research participants have to feel that they own the information about their work and they need to feel protected from unfair criticism. Secondly, the exchange of information needs to be discussed by participants so that all those involved in the development process understand the conclusions that have been made. Third, as the participants recognise, very often their voices do not get heard in the development process. Participants comment from several perspectives:

1. Managers say that they do not fully understand the problems that the practitioners' face, nor can they keep up with changes in policy.

2. Practitioners express the need for research about their practice to go to policy makers so that practice can inform policy about change to services.

3. Parents argue that their opinions are rarely fed into service redesign. This group says that they often get consulted about welfare provision, but rarely see any change in services that match their comments.

Furthermore, each of these dimensions of the research is conducted within different but related sets of relationships. Thus, for example, the work on access involves parents, practitioners and a development worker. The work on practice involves practitioners at the Centre, their associates in other welfare agencies, and the managers of the centre. The research on planning

involves Senior Management, Directors of Services and managers of services. There is the possibility that it may be difficult to manage all these relationships, but because each participant is aware that the research is facilitating development, and everyone is committed to improving services, relationships are not difficult to manage. Very often participants contest the debates, but a satisfactory agreement for everyone is always reached. It is from these types of discussions in the various groups and between groups that awareness is raised of the issue of the design of systems to support service change. This awareness then needs to be taken a step further into the design process, and this is where the notion of the design constituency emerges in the research and development, or innovation process is materialised.

3. The Design Constituency

The development of the Design Constituency evolves from the relationships built up in the research design and in the process of doing the research, which is embedded within research relationships. The constituency is formed through informal agreement and the goodwill of those who are involved in change and development of public services. Most are involved in the research in some way and wish to see that the research contributes to concrete change in service provision, improves the quality of services and generates efficiencies in services. It is at this point that innovation may be facilitated through the dynamics of informed participants from all positions of service redesign and ICT design. It is not only the participation of a variety of users that may facilitate innovation. It is also the factor that the participants can articulate their ideas in ways that translate technological and service discourses and transcend boundaries through their involvement in the above mentioned research process.

A further significant factor is that Senior Management and Directors of Services take part too, and as they have access to resource allocation processes, they can start to provide the resources needed for innovation. The academic researchers and ICT designers are part of this group, and the group as a whole produces development plans. The intelligence and information gained in the whole 'researched development' process produces innovation that emerges from a grounded consensus of what is needed and one that is creative by being informed by the multiple perspectives inherent in public service welfare provision. A further strength of this approach is that innovation is constantly being monitored and evaluated as it develops, thereby helping to ensure that the innovation is producing the desired outcomes. This robustness of approach is also yielding benefits in relation to funding, as the AMASE team and the Children's Services group have just won funding of £350,000 for further system development.

Summary

The development of multi-agency service provision in the UK has led to the concept of researched-development, which means that research is continually feeding into the design process, both informing and evaluating the ongoing development. The process involves academic researchers, policy-makers, practitioners and technology providers contributing to what becomes a design and innovation team, which is situated in a locally specified domain of innovation.

Dynamics of situated innovation

Looking at the three cases, none of them can be described as developing an instance of first practical use or commodification of inventions based on scientific results. Participatory Design, an important part of the scientific background in the first project, provides a well understood set of methods and procedures that has been developed based on empirical projects. (Elden 1981, Ehn 1988, Bjerkenes and Bratteteig 1995) Mainly through the co-operation with the municipality, the theoretic understanding of where participatory design takes place is challenged and expanded. This brings with it the need to explore how the methods might have to be adapted to support a sustainable co-operation around design and interlacing of a diversity of design activities (Dittrich et al 2002). At the telecommunication provider, software practitioners and researchers explored together the usability of technical possibilities to develop flexible software and the situational specificities that influenced the design and the evaluation of different solutions. The co-operation with the health care practitioners not only resulted in the re-design of services, and the design of supporting organisational and technical solutions, it also contributed to the improvement of development methods and techniques, as well as a better understanding of the co-development of service provision, work practices and technical infrastructure. In each case, scientific knowledge met with a complex practice and generated improvement, innovative design and organisational change on the one hand, and new theoretical knowledge on the other. Innovation takes place in two dimensions, the change of practice developing and deploying software, and the furthering of scientific insight.

American Pragmatism and other critical approaches (Dewey 1910, Dewey 1916, Berger & Luckmann 1966) have argued the connectedness of theory and practice for quite some time. How is it that this connection comes to bear so clearly in the context of design and deployment of ICTs? Computer technology is more malleable than many other technologies. Design – in the form of interpretation and adaptation – tends to invade usage (Dittrich et al 2002). Use-related qualities of computer applications are therefore highly situational. This means that the successful deployment of computer applications – and therefore their development – is dependent on the concrete situation at hand. Research that addresses development and deployment of ICT has to take this situational character into account. Empirical research that both applies and develops theoretical understanding may be the most important resource for understanding the located and emerging organisational change when introducing ICTs.

The interplay of work practices and organisation on the one hand, and ICT on the other, is highly situational. This interplay requires design methodologies that take this situational character into account. Multi practical design constituencies, interlacing of design and use, and a reflective development of evolving work practices, concerning organisation as well as technology, have been observable in all three cases. Understanding such complex processes means to understand how different situational factors affect development and use of the technology. Research to further such understanding, and to develop means to support such situated design processes, has to get involved in the situation at hand and both contribute to and learn from it. What we call situated innovation, situational adaptation, rejection and provocation of theoretical knowledge, both contributes to the involved practice and is necessary for the academic production of knowledge furthering the development and deployment of ICT.

This kind of research changes the traditional roles of researchers and practitioners in the co-operation. We academics got involved in the situation, taking part and influencing with our academic knowledge as well as with our way of seeing, the practice we observed. In all three cases, the researchers broadened the design space with their contributions, opening up for new possibilities and different ways of acting. Practitioners – be it providers or users of ICT – are not only research subjects, but become actively involved in the research by evaluating and adapting what the researchers can provide to the situation at hand. This forces practitioners into a more reflective stance, which in itself accelerates the innovative processes.

As fruitful as the co-operation between different professional practitioners and researchers is, it is not necessarily an easy achievement as the software development, the everyday-work practice of the organisation, and the research practice each have different objectives and different rhythms. To co-operate requires knowledge of and acceptance for each other's constraints and success criteria. It requires flexibility to adjust one's own practice, and to take in contributions and provocations from the other practices. Besides flexibility and mutual respect, the cultivation of spaces where different professional practitioners and researchers co-operate around the design of ICT requires commitment and the development of reliable relationships. The current structure and regulations of research funding, contractual relationships between ICT providers and customers, and organisational unawareness regarding the change dynamics originating in the deployment of technology, can provide serious obstacles for situated innovation.

Implications for Research in Situated Innovation contexts

What would these three cases have looked like if researchers had not been involved in them? For one thing, they would not have been seen as 'cases'. They would not have been used as examples of situated innovation in an academic conference paper, and thus you would never have read about them. More importantly, they would not have been seen as 'cases' by the people involved in them, and would not have resulted in reflective process development to the extent we argue they did through researcher participation.

Certainly, in the project concerning the joining up of services for disabled children, the researchers were, to a considerable degree, officially as well as practically, involved in defining and driving the processes they were at the same time observing and taking part in. In this case, the researchers actually seem to have created the space for situated innovation. This is also true, though to a somewhat lesser degree, in the telecommunication provider case. In the one-stop shop case, the researchers found themselves discovering and observing design practices that were already there when they arrived on the scene. Yet in all three cases, the researchers made a difference by being there. Such research co-operation in located innovation as we have observed in the three projects described here, introduces a different degree of reflexivity in the change processes. This in turn blurs the boundaries between invention, design, development, requirements and use, and helps to integrate social and technical innovation. Research becomes part of the development process, and, through this presence and participation on the scene of practical action, is challenging some deep-rooted academic traditions:

- The role of the researcher is no longer one of a detached observer, watching 'from nowhere', nor is it the partial position of an action researcher that researches on behalf of a funding organisation. Situated innovation requires an outside view that mirrors

practices and developments, yet this outside view of the situation influences the various involved understandings of it, and thus affects further development. Research practices in such contexts have to reflect this point, and research theories have to not only take it into account but also adjust to it and encompass it.

- With the involvement of the researchers, ethical questions are raised in a different way. When the researcher takes part in the development, the ethics of the research is no longer mainly a question regarding the use of research results, but becomes an issue of the research process. Ethical issues need to be considered throughout the process as well as concerning both research results and other outcomes of the co-operation.

- The close co-operation in situated innovation requires the co-ordination of different interests and different temporal dynamics. Strategies, politics and planning in relation to different organisations and cultures have to be related. This requires mutual respect and flexibility between the involved parties and individuals.
  For researchers involved in situated innovation, the role of researcher in short-term development projects is constantly being re-established in action. The fast-paced interactive rhythm of co-operation in a joint project needs to be deliberately and continually counterbalanced by the slow, reflective rhythm of research, and by networking with a broader international research community within one's own discipline and research area. Paradoxically, this need to establish and uphold a strong professional identity and integrity, which is made more obvious by the risk of being addressed as a consultant, at the same time opens new spaces and opportunities for making research contributions towards local and regional innovation more valuable, more valued and more tangible.

- Situated innovation challenges some of the traditional boundaries of academic disciplines. Research in such contexts can take place within one discipline but often demands an interdisciplinary if not multi-disciplinary approach from within academia. We have used simple metaphorical 'figures of thought', in trying to increase reflexivity concerning working relationships (our own and others), manage multi-perspectives, and also broaden the space for situated innovation in the projects we have taken part in.

Conclusion

In concluding this article, we argue that in some cases innovation is in the process of being re-positioned. As our paper shows, these contexts of innovation are being formed through locally situated design constituencies, which are comprised of academic researchers, practitioners and ICT providers. This development, we argue, is creating spaces that are locally situated within domains of innovation that are context specific. It is within these spaces that different interests, knowledge and expertise meet, often with a focus on practical action: academics, practitioners and ICT providers discuss and debate issues of design and use in ways that stretch their traditional work and research practices. In relation to the innovation of ICT, the work facilitated in these spaces generates imaginative changes to ICT and its continuous design in use that are both 'fit for purpose' and 'timely' in contemporary rapid innovation cycles.

This process raises new issues for research and for innovation. These include the issue of generalising from particular contexts of situated innovation, and one suggestion that emerges from this early work is that this kind of research and development generates methodologies

alongside products so that product and development processes can be finely tailored. We also suggest that in these new forms of situated innovation, the roles and relationships of research need to be clarified within respective design constituencies to maintain the rigour and ethical considerations of academic research. This in turn will help to foster trust in the research and development process by maintaining the reflective and reflexive role for academics, which distances itself from the more local and political considerations and dynamics. We also recommend that this approach to innovation develop ways of maintaining and developing organisational and stakeholder intelligence within collaborative constituencies, so that the development process can be sustained when academic partners are no longer so closely involved.

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