Exploring enterprise mobility: Lessons from the field

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Abstract: The mobile phone has received global attention primarily as a personal consumer technology. However, we believe that mobile information technology in general will play a significant role in organisational efforts to innovate current practices and have significant economic impact. Enterprise mobility signals new ways of managing how people work together using mobile information technology and will form an integral part of the efforts to improve the efficiency and effectiveness of information work. This belief is, however, not reflected in the current selection of books and collections exploring the issue of enterprise mobility. The aim of this paper is to highlight some of the key challenges in the application of mobile information technology to improve organisational efficiency. This is accomplished through comparing and contrasting findings from a selection of 11 empirical studies of enterprise mobility with information technology conducted between 2001 and 2007. The paper argues that the debate so far has largely failed to embed glowing accounts for technological potential in a sound discussion of organisational realities. In particular, there has been a lack of balanced accounts of the implicit and explicit trade-offs involved in mobilising the interaction between members of the workforce.

Keywords: Enterprise mobility, empirical studies, critical issues, organisational efficiency

1. Introduction

Mobile technology in general and the mobile phone in particular has fuelled people’s imagination by offering a rich medium for social experimentation (www.mobilelife2007.co.uk). One of the persistent issues in the use of this technology is its ability to support users in breaking down temporal and spatial boundaries, for example between home life and work life. In this sense, one of the persistent means of mobile interaction in organisations is the privately owned mobile phone. However, the challenge to the traditional division between home life and work life is only one of the barriers mobile Information
Technology (IT) require organisations and individuals to negotiate. Mobile IT is increasingly moving up on the lists of important technological concerns for organisations. This is due to the two forces of technological push whereby technological innovation provides opportunities for supporting work, and organisational pull emerging as a response to the pressures to perform and to effectivise information work [72]. This situation of technological push and organisational pull forms a rich substrate in which the technological promises can be cultivated.

When the first mobile phones were commercially introduced in the 1980s, they were only understood to be used in certain fixed locations outside the office, such as the car, a remote office or a building site [1]. What we have witnessed in the past few decades is a global experiment in joint technological sophistication and emerging interaction practices. As a result, it is almost impossible to find a business person who does not carry a mobile phone, and increasingly the phones will have personal computer capabilities, for example supporting email and web access. This technical convergence of a variety of capabilities in handsets and associated telecommunication infrastructures is the result of extensive technical innovation [60]. However, the technical convergence of capabilities must be assessed in the context of everyday use. It is not yet clear to what extent converged handsets will entirely replace diverged ones with easy user-identifiable purposes, such as notebook computer for data-intensive tasks, Blackberry for email, camera for photos and mobile phone for conversations and text messaging.

The distinguishing characteristic of this socio-technical development is the joint forces of the technology being closely associated with the body and the variety of ways it supports remote interaction with others and with informational resources. As with any new technology, organisations need to establish how using mobile technology can lead to improvements in the way work is done.

The aim of this paper is to contribute to the discussion of how mobile information technology can play a role in improving organisational efficiency. As part of a long-term research commitment to the study of enterprise mobility, we have conducted a number of in-depth studies of how organisations and individuals use mobile information technology. The research has been written up in various academic deliverables but we have so far not documented important lessons learnt across these studies. This paper, therefore, asks the question: What are the organisational implications specifically related to the application of mobile information technology across a variety of public and private organisations? This question is explored through cross-analysis and synthesis of results from 11 qualitative research studies conducted between 2001 and 2007. In our exploration we identify six essential aspects of organisational use of mobile information technology and discuss each in distinct Section 6. Brief vignettes and context descriptions from 7 of the 11 studies offer rich examples throughout the paper of the diversity of situations in which mobile IT can be deployed to enable organisational improvements. Due to space limitations all studies have not been included.

The article is structured as follows. Section 2 briefly outlines the research approach across the 11 studies included in the analysis. Section 3 discusses how mobile IT support changes in the way people interact, in terms of allowing work to be conducted anytime and anywhere, as well as supporting situated interaction whilst maintaining essential secondary interaction. Section 4 explores the management of work in terms of support for increased organisational control or individual discretion. Section 5 explores how enterprise mobility relates to choices between support for individual or collective working arrangements. Section 6 investigates the role of technology as being either ubiquitous or opaque to the user. Section 7 promotes the distinction between the use of mobile information technology to cultivate existing organisational practices as opposed to the transformation of these practices. Section 8 discusses how mobile IT can either facilitate encounters between people and information resources or more substantially support and mediate ongoing relationships. Section 9 concludes the paper. Appendices 1–3 present in detail more of the findings across 11 cases and 6 themes.
2. Studying enterprise mobility

LSE’s Mobility Unit (mobility.lse.ac.uk) was established in 2001 and has since conducted a number of qualitative studies of how mobile technologies are used in organisations. The network has around 20 directly involved researchers and has over the years involved more than 50 MSc students. Six PhD dissertations have so far been completed and another six are in the process of completing. Common to the studies conducted within the Mobility Unit at LSE is in-depth qualitative enquiry either through interviews, direct participant observation, work document analysis, focus group discussions, or participation in projects as action researchers. The aim of the empirical efforts has been to inquire into the specifics of how work processes and supporting technologies mutually evolved over time either by investigating the established arrangements or by participating in their initiation. The closeness of mobile information technologies to the body of the user, and the ability of the technology to converge various media, are some of the features that make processes of experimentation and complex appropriation common phenomena.

Although mobile information technology in some cases may stipulate precise work processes and thereby be less open for users engaging in experimentation, there will most often still be some room for manoeuvre as individual seek to meet their specific needs through the technology in their own preferred ways. The increased use of mobile technologies is further fuelled the discussions of technology and business innovation as conversations and networks of influence [20,23,61]. Precisely for this reason, in-depth qualitative methods can serve the valuable purpose of highlighting specific uses in order to understand more fundamental principles. If the technology was quite simple and would only be used for exactly the purposes intended by the designers, macro-perspectives emphasising general trends would be more appropriate.

For this paper, we have chosen a subset of 11 in-depth qualitative studies. Each study sought to investigate the specifics in the challenges of organisational adoption of mobile technology. Table 1 highlights the studies, which contain a variety of decisions, for example modern professionals mostly working on their own in and around Tokyo, Middle-East bankers, Black Cab drivers in London, police officers, health professionals, executives and delivery drivers. For each of the studies, key references are indicated for readers with further interest in studying the details.

Whereas each of the studies applied its own set of theoretical assumptions and associated frameworks to analyse and understand the detailed data collected, this paper will seek to draw out more general themes across these detailed studies. The aim has been to identify key-decisions of specific relevance when seeking to improve organisational performance with mobile information technology. There are of course a range of issues that always will be of interest in any type of technological intervention. As these, however, are discussed extensively elsewhere, they will not be discussed in this paper. As a result, the paper will present a fairly high-level view of very deep analyses in each study. Clearly, given this initial cross-analysis of a large number of individual research studies conducted by a group of people over a six year period, and given that the aim of this effort has been to identify major themes for discussion and not to formulate in-depth theoretical contribution, the result can be characterised as primarily representing richness of worldly realism as opposed to tightness of scientific control [41]. We have tried to draw out issues of general importance and interest to the readership of both academics and decision makers rather than focus on providing specific in-depth academic debates.

The field-studies of mobile IT outlined in Table 1 have been synthesised into distinct aspects of particular relevance for the organisational use of mobile IT. These aspects emerged from discussions of the case studies across industries. We have identified six aspects where the role of mobile information
Table 1
Characterising the 11 selected field studies

<table>
<thead>
<tr>
<th>#</th>
<th>Workers</th>
<th>Year</th>
<th>Location</th>
<th>Method</th>
<th>Extent</th>
<th>Topic</th>
<th>References</th>
</tr>
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<tbody>
<tr>
<td>3</td>
<td>Mobile support centre</td>
<td>2003</td>
<td>Middle-East</td>
<td>Interviews &amp; Support ticket analysis</td>
<td>102 interviews in total for Study 2, 3 and 4 plus 10,000 support tickets analysed</td>
<td>Challenges of running support function for global mobile professionals</td>
<td>(Al-Taitoon and Sørensen, 2004)</td>
</tr>
<tr>
<td>4</td>
<td>Off-premises foreign exchange traders</td>
<td>2004–2005</td>
<td>Middle-East</td>
<td>Interviews &amp; observation</td>
<td>102 interviews in total for Study 2, 3 and 4 plus participant observation of traders</td>
<td>Discretion and control in mobile working for off-premises foreign exchange traders</td>
<td>(Al-Taitoon, 2005, Sørensen and Al-Taitoon, 2008)</td>
</tr>
<tr>
<td>5</td>
<td>London taxi drivers</td>
<td>2004–2007</td>
<td>UK</td>
<td>Interviews &amp; video observation</td>
<td>35 interviews and 14 hours of video-taped observations</td>
<td>The choice of location as core business strategy and the role of mobile technologies in pooling resources and informing individuals</td>
<td>(Elaluf-Calderwood, Forthcoming, Elaluf-Calderwood and Sørensen, 2008, Elaluf-Calderwood and Sørensen, 2006)</td>
</tr>
<tr>
<td>6</td>
<td>Police officers</td>
<td>2002–2006</td>
<td>UK</td>
<td>Observation, interviews &amp; focus group</td>
<td>250+ hours participant observation with 40+ officers and managers, 20+ interviews, 2 focus groups</td>
<td>The rhythms of interaction with mobile information technology by operational police officers</td>
<td>(Pica, 2006, Sørensen and Pica, 2005)</td>
</tr>
<tr>
<td>7</td>
<td>Health professionals</td>
<td>2002–2005</td>
<td>UK</td>
<td>Action research</td>
<td>15+ people participating in project</td>
<td>Supporting situated and remote learning for medical professionals (Perioperative Specialist Practitioners) with mobile information technology</td>
<td>(Wiredu, 2005, Wiredu and Sørensen, 2006)</td>
</tr>
<tr>
<td>8</td>
<td>Security guards</td>
<td>2004–2005</td>
<td>UK</td>
<td>Action research</td>
<td>350 hours of meetings, interviews and observation for Study 8 &amp; 9</td>
<td>Real-life experimentation with RFID (Radio Frequency ID) enabled mobile phone technology supporting new ways of working</td>
<td>(Kietzmann, 2007)</td>
</tr>
<tr>
<td>9</td>
<td>Industrial waste management</td>
<td>2004–2005</td>
<td>UK</td>
<td>Action research</td>
<td>350 hours of meetings, interviews and observation for Study 8 &amp; 9</td>
<td>Real-life experimentation with RFID enabled mobile phone technology supporting new ways of working</td>
<td>(Kietzmann, 2007)</td>
</tr>
<tr>
<td>10</td>
<td>Delivery Drivers</td>
<td>2006–2007</td>
<td>UK</td>
<td>Observation &amp; interviews</td>
<td>50+ people participating in interviews and participant observation</td>
<td>Establishing IT mediated control of work tasks with low degree of discretion through enterprise infrastructure and mobile information technology</td>
<td>(Boateng, Forthcoming)</td>
</tr>
<tr>
<td>11</td>
<td>Professionals</td>
<td>2002</td>
<td>UK, USA</td>
<td>Interviews</td>
<td>16 interviews</td>
<td>Investigation of how mobile information technology still fails to become ubiquitous in the work of professionals</td>
<td>(Sørensen and Gibson, 2008)</td>
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</table>
technology must be subjected to organisational design or experimentation. These six aspects relate in general to the understanding of use, adoption, and impact of services at the individual, team and organisational level according to Lyytinen and Yoo’s [37] taxonomy of research in mobile information technology. In their taxonomy, Lyytinen and Yoo [37] categorises eight major categories of research of mobile information technology. They distinguish between the services and infrastructure levels across individuals, teams, and organisations. In terms of this classification, the six aspects can be understood as follows. (1) Interaction as situated or mediated by technology explores individual level services impact; (2) the management of activities in terms of individual discretion or organisational control, which denotes the possible conflicts between services requirement at different organisational levels; (3) organisation of collaboration as individual or collective work relates to individual and team-level services opportunities with mobile IT; (4) the role of technology in everyday use as ubiquitous or opaque is concerned with individual services use and impact; (5) the organisational opportunities for either cultivation or transformation of existing working practices relates to organisation level services impacts; and (6) the inherent characteristics of the services provided through mobile information technology as either mediating encounters or relationships investigates the IT artifact itself and as such relates more to Lyytinen and Yoo’s [37] infrastructure level category of research issues. Appendix 1, 2 and 3 present more detailed findings.

3. Interaction: Mediated or situated?

This section explores interaction supported by mobile IT in terms of the distinction between on the one hand allowing activities to be carried out independent of time and space though mediating remote connections, and on the other supporting situated activities critically depending on being somewhere specific whilst still maintaining remote access to relevant people and resources.

The first element in this distinction relates to the common argument for mobile IT as a means of removing interactional constraints imposed by temporal and spatial boundaries. Paraphrasing Cairncross [9], not only distance may suffer a sudden death, time may also be a likely victim. The so-called anytime-anywhere hypothesis emphasises the technological promises of fluid interaction patterns unrestricted by the location of participants and by the necessities of synchronised interaction [26,32].

As the second part of the proposition indicates, this is only one possibility. One that is only valid to the extent that work activities indeed are independent of time, place and other situational aspects. From a phenomenological perspective, the situations people find themselves in always matter – how we feel, who we are with, what happened just before etc. [11,59]. From a pragmatic point of view, much of what goes on in organisations also depends critically on who is present, where and when the encounter takes place, and in what context. Activities can be situated, and Suchman [59, p. 48] defines this in terms of: “action taken in the context of particular, concrete circumstances in local interactions with our environment”. Work can be constrained in various ways, for example through the need for certain organisational resources to be available or it may need to be conducted at certain times. Spatial and temporal dependency and independency implies that embedding mobile technology in organisational contexts must consider to what extent the technological promises can be fulfilled in the particular context [66].

For all but a few of the professionals studied, our research has documented work that to some degree is bound by location and time. Police officers (Study 6) engage in incidents when called. Taxi drivers (Study 5) critically rely on understanding exactly where and when to locate customers needing cabs. Delivery drivers (Study 10) and security guards (Study 8) have very little direct control over where they
| Vignette Study 1: | It is 4pm in the afternoon in Japan. Hiro, the CEO of a small company developing various digital services for Internet-enabled mobile phones and television, walks down the main street in Tokyo’s Akihabara district. He is engaged in one of his favourite past-times; to find inspiration for new services through immersing himself in Tokyo street-life. He observes what people do, what they buy and wear. Being in the field of the Japanese consumer is a source of inspiration to Hiro, and he characterises this behaviour as “being analogue” as opposed to surfing the Internet for inspiration. Wandering the streets of Tokyo is an important way for him to get new ideas for his company. The company only employs around a dozen people and he is the hub of most activities. Whilst traversing through Tokyo as a mobile age flaneur he is therefore subjected to a massive amount of requests for interaction through emails and calls to his mobile phone. He uses a phone that was specially customised for him by one of his client companies and it is set up with a complex arrangement of alerts and ring-tones depending on who seeks his attention. (Study 1 in Table 1). |
| Context Study 1: | There is a long tradition of employment in large organisations as the predominant strategy for Japanese professionals. For cultural reasons it is not seen as acceptable for individuals to unsolicitedly engage in promotion of own services. If an individual contractor needs work, the work will largely have to come through requests from others. This is quite contrary to other cultures, such as the North American, where it is seen as quite acceptable to openly offer one’s services [6]. However, both cultures lead to a significant amount of time spent socialising and networking to secure future earnings [25,46]. This implies that work for small organisations and for individual professionals primarily is found through social relations and as direct results of past projects. The trend of increased flexibility for a small proportion of Japanese professionals mirrors developments seen elsewhere with organisations seeking to manage risk by relying on itinerant workers of various kinds [6,34,39]. Through a range of mobile information technologies, the 63 modern professionals studied, managed to create competitive advantage through situating themselves where work was needed at the same time as they could engage with important clients and collaborators whilst away from the office. Most of the people studied were intense notebook and mobile phone users. |

work. Health professionals (Study 7) work where the patients are, waste management workers (Study 9), where the waste is, and bank executives (Study 2) occasionally where the clients are.

Mobile IT supports people engaging in rich situated interaction whilst remaining in touch with other remote contexts for their work. Even in cases where work tasks are purely informational and in principle can be conducted at anytime and anywhere, resolving mutual interdependencies still critically rely on engaging Inter-personal relationships. This makes face-to-face interaction much more effective for many situations, compared with mediated interaction – distance does matter as mediated interaction can not simply replace co-present socialisation and interaction [5,47,73].

Turning the argument around from one based on what technology can offer, namely boundary free interaction, to one emphasising what people desire, then the issue becomes much more complex. Viewed entirely from an individual point of view, the technology provides distinct opportunities for individual choice of who to interact with and from where. However, as all interaction is deeply situated in social and organisational practices, there will very seldom be an entirely free range of opportunities ahead but rather complex socially negotiated norms guiding the individual [12]. The choices are conditioned by traditions, power relations between initiator and recipient, practical concerns, the need to use organisational resources in the decision making etc.

It might be a more constructive view for the organisation to consider how the interactional context of its members can be viewed as an organisational resource of strategic importance and not merely a phenomenon accidental to practical information management constraints or individual preferences. Mobile IT implies the increased ability of organisational members to engage in mediated interaction in places of organisational importance whilst remaining in touch with necessary interactional contexts. Our study of Arabian banking executives illustrates this well (Study 2). Bank executives would frequently find themselves engaging in negotiations with high-end clients about the services rendered and the client’s financial arrangements with the bank. These negotiations would most often happen at the client’s site somewhere in the World. The bank executives would have direct access via Virtual Private Network (VPN) connections from their PDA’s to the bank’s internal systems in order to obtain up-to-date information about exactly how significant the client’s involvement at that time was with the bank.
Obtaining this data provided essential information for the bank executives to get a good position for the tough negotiations with the client and allowed these to be done at the client’s own location.

The distinction between situated and mediated interaction can be further qualified in distinguishing between two types of mediated interaction – local mobility and remote working. Global virtual teams or traditional telecommuters engage in remote working either across continents or from a home-office. Activities can, however, also be conducted through locally mobile working within a restricted domain [36]. Whilst the locally working person may elude fixed location, he or she will be assumed to remain within close proximity, for example in a neighbouring building. Here, the defining characteristic is the ability to contact an individual through a pager, mobile phone, tannoy system or by other means and as a result summon this person. Doctors and nurses engaged in healthcare work are a good example of local working. Study 7 illustrated how constant engaging in activities to serve the purpose of a remote quality assurance easily got in the way of this kind of working. Remote workers will be working from fixed office arrangements and will therefore typically be available through ordinary desktop communications channels such as email and telephone. Mobile working is, characterised by the combination of local mobility and remote distribution, and marks a significant increase in complexity. The mobile worker is potentially neither able to quickly be summoned, nor is he or she possible to pin down at fixed remote locations. Taxi drivers, lorry drivers, and travelling sales people are all examples of work that traditionally has been mobile seen from the perspective of others who collaborate with these.

Summarising, mobile IT support the fluidisation of time and space by offering easy mediated interaction anytime and anywhere. However, by offering mobile access to people and resources supporting work activities, the technology also makes it possible to enrich activities that inherently are situated.

4. Management: Control or discretion?

In terms of the management of work activities within the organisation, this has traditionally been conducted through combining direct observation with various systems of remote control [71]. Mobile IT supports connections between remotely distributed organisational actors and can place direct access to the corporate infrastructure in the palm of their hands. The introduction of mobile IT will therefore influence the possibilities for management of remote and mobile activities. Zuboff [74] broadly characterises the effects of IT in terms of the distinction between the use of information technology as means of automating work processes and thereby driving discretion out of work, as opposed to informing work by providing rich information allowing for discretionary localised and contextualised decisions. We, therefore characterise the support for management of work through mobile IT in terms of the distinction between technology providing means for control as opposed to opportunities for increased individual discretion in decisions.

The underlying assumption of process automation is the viability of characterising work in terms of business processes that can be made explicit, negotiated, and subjected to re-design. However, some work domains, for example top-executives, professionals, and artists, are not expected to be subjected to this kind of formalisation. Here, the individual or small group of collaborators are perceived to exclusively exercise professional judgement and discretion in their decision making [55].

The literature contains extensive discussions of employee empowerment and self-organisation. While Malone [38] proposes that the cost of communication has brought the opportunities of large-scale decentralised organisations closer, Argyris [4] argues that organisations in fact do not increasingly empower their employees. Conger and Kanungo [13] argue that there is a lack of understanding of what constitutes empowerment and how it can be promoted in organisations. Courpasson [14] points out the importance
Vignette Study 6: In the South of England, two police officers, John and Mary, are driving at high speed towards a domestic disturbance incident mid-morning. Whilst driving to the incident they are heavily engaged in two important tasks. One is to ensure that they arrive as fast and as safe as possible. The other is to ensure that they have as much information about the incident they very soon will be attending. They drive at high speed with the loud siren and blue blinking lights through a small town. They are in constant touch with the control room and arrange for a range of information about the incident and past incidents at the same address to be streamed from the control room to a small computer in the patrol vehicle. This enables one officer to read this information out to her colleague driving and they discuss the situation ahead trying to form a good idea of what risks may be involved and how to prioritise their effort. As they arrive at the scene, they stay in constant touch with the control room. Mary calls the neighbour reporting the incident from her mobile phone to get further information. (Study 6 in Table 1).

Context Study 6: The two-way radio system was first time used outside the military by the Chicago Police Force in the 1930s Prohibition period of emerging organised crime [1]. Since then, police forces across the World have embraced mobile voice and data-services as means of collecting intelligence, distributing information to officers in the field and for co-ordination of efforts. Most mobile IT is therefore naturally not organisationally transformative but rather finds its own place in the mobile ecosystem within the limited space of the police vehicle or on the police officers’ person. Mobile IT serves an essential purpose when operational police officers engage in incidents, or rather before and during engagement. The situation ahead is often characterised by a high degree of uncertainty and the technology allows officers to draw upon mobile data and interaction with control room and others in their assessment of the risk ahead. A core consideration with time- and safety-critical work is the rhythms of interaction with technology and the right-time, right-job attitude to technology as opposed to the view that the technology is ubiquitously available and needed anytime, anywhere. Police officers need to actively engage with the incident and not stare into screens.

of distinguishing between operational empowerment in the the decentralised delegation of activities and the centralisation of power to set the boundaries for these activities. Kirkman and Rosen [31] study 111 teams and suggest team empowerment as a way of conceptualising the issues. We have in our studies seen a broad range of management practices from closely controlled activities to work performed exercising extensive discretion.

The independent Tokyo professionals in Study 1, the bank executives in Study 2, and the London taxi drivers in Study 5 are all examples of domains with a high degree of individual discretion [2,17,25]. The security guards in Study 8 and delivery drivers in Study 10 are examples of work with a very low degree of individual discretion where work is largely sought and stipulated in detail by procedures and supportive information technology. The highly managed work of, for example, security guards (Study 8), can be further improved by using mobile IT to speed up communication between mobile security guards and centralised management. Furthermore, the technology strengthen relationships between the physical environment and the information tasks through RFID technology automating the recording of positions converged with mobile phone technology automating the transmission of location-data [30]. We have also (in Study 10) seen how organisational infrastructures in detail organising mobile tasks centrally can support the management of mobile work activities [7].

It is, however, dangerous to assume that a particular type of work does not rely on individual discretion on a daily basis. Emerging contingencies may occur and dealt with but never reported elsewhere in the system. The formalised model collectively assumed may in fact not be an appropriate formalisation of what goes on. Localised improvisation and subtle changes to the way work is done may have altered the reality of how work is done but not the formalised assumption held about it. Schmidt [52] reports from a manufacturing study where a Kanban implementation, supposedly entirely automating the flow of parts in an assembly line, was subjected to frequent discretionary decisions explicitly breaking the principles of the formal process in order for the system as a whole to deal with emerging constraints. Kietzmann [30] documents how industrial waste management drivers (Study 9) found it problematic that management would get detailed information about the movement of waste barrels and would use this information incorrectly to derive implications for further decisions as they did not have a full overviews of local constraints. Boateng [7] shows how delivery drivers use their initiation, judgment and negotiation
The discussion of organisational or managerial control versus individual discretion relates to the more general concern of emerging changes to organisational arrangements in terms of centralisation.
versus decentralisation. Malone [38] argues that organisational forms largely depend on the cost of communicating. He argues that hierarchical and centralised communication through vertical command-and-control management is a necessity when there is a high cost associated with interaction in large organisational forms. This, Malone argues, changes when the cost of communicating drops and as a result will allow for large-scale co-ordination of activities in networks emerging through horizontal cultivation of relationships. Much has been written about shifts from hierarchical to networked organisations, and this debate is quite often based on the wrong premises that networked interrelations can occur disassociated from established structural arrangements of traditions, power, influence etc. [29]. Courpasson [14] argues that some contemporary organisational forms show the characteristics of horizontal operational co-ordination of activities in networks along with centralised control over the tactical and strategic issues of resource allocation and agenda formation. For the off-premises foreign exchange traders in Study 4 the trade-offs between organisational control to ensure proper documentation of trading versus the need for discretion features prominently. The primary mechanism to ensure this balance was the careful vetting of which pit-traders would be granted the coveted status of membership of the exclusive group of off-premises traders.

5. Collaboration: Individual or collective?

| Vignette Study 5: | It is early Tuesday morning and Ray has just begun working. He is one of the 40,000 licensed London Black Cab drivers. Ray has decided to start early today as he need to pick up his teenage daughter from school in the afternoon and take her to an appointment with their doctor. As he drives down Oxford Street towards Marble Arch one of his three mobile phones starts ringing. This particular phone is exclusively used for a service automatically locating an available cab nearest to the location of the caller’s mobile phone. The driver answers and within five minutes the passenger is picked up at Notting Hill Gate. As he drops the passenger off in front of The Houses of Parliament one of his colleagues calls and informs him that due to a problem with one of the local train lines there is a need for a number of cabs to replace the train for a few hours. As it is good money, Ray decides to accept and sets off to the station. (Study 5 in Table 1). |
| Context Study 5: | London Black Cab drivers have been around for 420 years and since 1851 been certified according to a strict set of exams, “The Knowledge”, ensuring the driver knows over 300 routes in inner London. Drivers tend to own their own cab and work has always been conducted in a highly independent manner with each driver deciding how and when to work. This is an archetypical example of choice of work context as a strategic concern and after studying for 3-4 years for The Knowledge, drivers typically spend several years learning how to position themselves to be profitable. The mobile phone serves as a natural tool for drivers to get in touch with the rest of the world whilst driving. Colleagues may inform them about particularly profitable work or essential traffic situations. One of the computer-cab systems automatically links the nearest cab to the calling customer’s mobile phone location. Competitive pressure from minicab companies without license to pick up at ranks or in the street makes closer collaboration through centralised computer dispatch systems a viable option for the independent Black Cab drivers to pool their resources. They thereby will appear as an organised unit and not individuals, but this also is associated with major discussions about the relative merits of joining the different organisations in terms of fairness of job allocation and requirements to choose a certain number of jobs from the company each month. |

Mobile IT is often associated with single-user technology, for example, the mobile phone and the notebook computer. These allow the user to maintain occasional connections with other people or information resources when the resolution of mutual interdependencies are needed. Mobile IT can therefore support increased individualisation of work activities. At the same time, mobile IT also lowers the barrier for interaction across spatial and temporal barriers and therefore makes collective efforts possible where they before were not. Interestingly, the introduction of mobile IT can shift activities in both directions between these two types.

As one of the primary reasons for people working together is to negotiate their mutual interdependencies in their collaboration, an obvious concern regarding mobile information technology is to what extent it
can support engaging in such negotiations. In this sense the technology can remove many boundaries to rapidly collaborating [53]. This may, for example, imply that organisational actors who previously did not have opportunities to directly negotiate their mutual interdependencies with mobile information technology can be presented with multiple means of interacting directly.

The London Black Cab drivers (Study 5) provide a clear-cut example of how mobile information technology can support an increased collectivisation of work. Individual taxi drivers owning their cab have traditionally decided entirely themselves where, when and for how long they work. Each cab is generally an independently owned business unit serving the purpose of driving people and things from A to B. Black cab drivers have traditionally engaged in the exchange of experiences and tips either when waiting at taxi ranks or when meeting for coffee or lunch, much in the same way as the engineers studied by Orr [48] exchanging important knowledge about the profession and not in a highly detailed and operative manner [19]. However, the mobile phone has made it possible for emerging and changing communities of Black Cab drivers to weave networks of mutual interdependencies, in a similar manner to the geographically situated ephemeral organisation described by Lanzara [33]. When, for example, a train operator needed many cabs to transport stranded passengers, drivers would call others to alert them of available jobs. Also, as many cab drivers will be spending some part of their working time chatting with colleagues, this would also offer opportunities of sharing a common awareness of not only emerging business opportunities but also of traffic conditions.

More fundamentally, London Black Cab drivers face competitive pressures from minicab companies who can only interact with their customers through the customer requesting their services in the minicab office, by telephone or through the Internet. As a result of this pressure, drivers increasingly join organisations facilitating the pooling of individual Black Cab resources by providing automatic, semiautomatic or manual dispatch services. This signifies not only increased opportunities for individual drivers to interact with each other but the creation of organisation where there previous was none or very little. This re-intermediation is largely dependent upon the combination of computer-cab systems and mobile phones linking the cab to the central infrastructure of the dispatch organisation.

In the case of mobile work in industrial waste management (Study 9), the introduction of stronger automated links between the work done and the systems used to monitor work implied a much smaller level of granularity in the discussions of work tasks and thereby made work more collaborative between those who worked locally, and those who managed the work remotely. This is similar to the example documented by Ciborra [10] of the product development Lotus Notes discussion groups, which in turn were read by top-executives situated remotely. As in the waste management case, this ability to remotely observe detailed work decisions led to conflict.

There was ample conflict in the health professional case (Study 7), and it was mainly related to the organisational disagreement about what working together actually meant and the relative importance of one collaborative context as opposed to another. For the local hospital where the health professionals engaged in daily training, this was the main place of collaboration. However, the responsibility for the learning process resided in London, where students would participate in one-week sessions every nine weeks throughout a year. The ability of those responsible for the learning to centrally be able to monitor progress was deemed essential for the outcome of the project. The immediately situated concerns would frequently conflict with the demand for close documentation of the learning process imposed from London. This conflict between local and remote collaboration formed the main cause of conflict in the failure of the PDA system [68,70].

However, the use of mobile information technology can not only relate to increased collaboration. It can also be part of the opposite phenomenon of increased individualisation or segmentation of work.
Many organisations seek to manage the complexity of their business by focusing on core issues and sub-contracting or outsourcing other aspects. This relates to a variety of organisational trade-offs between managing work through social control or through economic exchange with the acquisition of commodified knowledge embedded in a product being mainly social control and the internalisation of knowledge through ongoing employment of experts [51]. Packaging of knowledge, outsourcing of activities, and sub-contracting all seek to cut or contractualise some of the mutual interdependencies within organisations and replacing them with temporary relationships or with negotiated specific contributions by individuals [6,62,67].

Modern project-workers, who do work on a contractual basis as opposed to continuing employment can, for example, spend a significant proportion of their time networking with others in order to ensure future involvement in projects [46]. We clearly found this in the study of Tokyo professionals (Study 1), especially since Japanese culture frowns upon direct solicitation of own services. Barley and Kunda [6] show how software developers use recruitment agencies as the organisational arrangement ensuring a steady stream of project engagements with clients. Although the Tokyo professionals in Study 1 often would be engaged in collaboration with others, work would most often be project based and in some cases highly individual by consisting of clearly separated modules or services. Mobile information technology supported this individualisation of work as channels by which work could be negotiated and where the work results could be disseminated.

In the case of off-premises foreign exchange traders (Study 4), their work had two distinct collaborative modalities. During the day they engaged in individual, but closely co-ordinated, trading in a stationary organisational setting. This had before been conducted as three-shift trading following the opening hours of the exchanges in Japan, Europe and USA, but trading outside normal working hours had been replaced by a selective group of trusted traders engaging in off-premises trading in their own time. As they in effect worked when off work, it was not feasible to impose the traditional requirements of collaborating and this resulted in off-premises trading largely being individual activities, which in certain situations selectively by the traders themselves could be subject to negotiation, for example off-trading limits [2,54]. Mobile information technology directly made this modality possible through the Reuters SmartWatch with market access to data and the mobile phone for documenting trades to an answer-machine for back-office processing the following day. An intermediary mode of operation had seen traders engage in trading from their desk-based PC at home, but this was equally inconvenient as three-shift trading as they were bound to their desk for trading.

6. Technology: Ubiquitous or opaque?

Not only is each mobile IT terminal normally used by one individual, the mobile phone and notebook computer being obvious examples, it also come attached with the assumption that it will disappear for the user and become an ubiquitous part of their everyday activities. This was first formulated by Weiser [64, 65]. However, mobile IT can for a range of reasons easily turn into an opaque element demanding attention and generally being in the way of getting work done [56].

Mobile information technology is most often personal and it is always possible to physically take parts of it along as opposed to pervasive technology, which may or may not be mobile. Ubiquitous technology can be defined as the combination of technological mobility and pervasiveness, i.e., the ability of the technology to relate to its surroundings. Although most mobile technologies are exactly only that, and not particularly pervasive, the combined socio-technical relation can produce ubiquitous behaviour, for example the social use of the mobile phone as a location-based service. Although a mobile phone has
quite precise information about where it is located through the cell it is registered in, this information is not normally used by its owner. However, the frequent SMS messages or brief telephone conversations stating; “I am on my way”; “I’m stuck in traffic on the motorway 10 miles away”; or “please wave so I can see you”, are all examples of how we can make the mobile phone ubiquitous simply because it for most people in the developed world is an individual device carried along with money and keys. As some mobile technologies, such as the mobile phone, elegantly have managed to find itself a place on or near our bodies, and others still are reserved a less close role, such as the notebook computer, it is interesting to explore the possibilities of mobile technologies becoming an ubiquitous part of work. However, just by being carried around close to our bodies does not necessarily always make a technology ubiquitously move into the background as a taken-for-granted resource. As some of the professionals in Study 11 argued, mobile technologies in general, and the mobile phone in particular, can become opaque and demanding attention, for example with the mobile phone when it has run out of battery or if someone is calling when the receiver of the call is busy concentrating on other important matters [28,35,56].

Vignette Study 7: Yin used to be a nurse, and she was very good at her job so she decided to do further specialist training for even more challenging work with patients as a specialist practitioner assisting surgeons. This involves on-the-job training for one year at the hospital she works. This morning she is following surgeons doing rounds. An essential part of her theoretical learning and practical training is done at one-week sessions every six weeks in London. Here, the main co-ordinator of the programme is keen to follow and record the progress of each of the 16 participants when they are back home. This is essential for both providing feedback on the learning and for documenting progress to ensure subsequent certification. The students are therefore provided with a personal digital assistant (PDA) with proprietary software to record conduct and outcome of each session back at their respective hospitals. Yin finds this very difficult to accomplish as the PDA constantly seems to get in the way of learning and working. The PDA, however, comes in very handy for her own personal information management and she also uses its built-in medical dictionaries frequently. (Study 7 in Table 1).

Context Study 7: The purpose of the PDA-based system, which reported to a centralised database in London was to ensure that situated learning by each of the medical professionals based around the country could be documented and subjected to assessment by the person responsible. The aim of documenting work-integrated learning at the place of work and centrally monitor and verify this did not succeed. This went far beyond the usability problems of having PDA interaction artificially interjected in situated hospital work. The conflicts between the localised control of the participants at their hospitals and the desire for centralised influence and control through the technology from the central London-based learning-centre presented a significant barrier for using the mobile technology effectively. The aims for strong local control over activities locally clashed in territorial dispute with the attempts to exercise equally strong remote control from the central learning centre. As a result, the only useful aspects of the PDA was the individual use of medical dictionaries and the personal information management functionality.

We are still far from realising the much promoted techno-optimistic vision of all matters of ubiquitous technologies like utilities of the 21st Century disappearing from our direct attention and unnoticeable becoming unconstrained resources for our immediate consumption [16,45,56,64]. The question is indeed if we ever will realise this vision, and if we do, whether or not it will be desirable. The extent to which mobile phones, for example, are constant subjects of conversation, adjustments, attention etc is a sign of the importance the users lend to this technology. It represents a means to be contacted by others and through which to reach them. The underlying 2 or 3G wireless infrastructure may only enter the user’s awareness when there is no signal, much similar to other utilities such as water and electricity.

The traditional view of how information technology relates to organisational actions is one of large systems delivering a set of fairly standardised services which together forms sufficient and homogeneous support for the IT aspects of decisions [43]. The ways in which heterogeneous information services are combined and the variety of approaches adopted by individuals, indicate the need for reconsidering the role of information services in organisations. With advanced options of exporting data from one application and importing them into another is just one aspect of the ease by which users can seek their own individualised means of managing information through their selected portfolio of services and
applications. Mobile services are no different and will play an increasingly important role in supporting the management of information and decision making. Modern professionals will have email at home, on their mobile phone, at the office, or indeed often anywhere with an Internet connection. The mobile phone will probably be able to download, display and maybe even support editing of attachments. So, for just the simple task of reading email, replying to them and editing sent attachments, the modern professional will have a range of options available and will often be able to combine these according to personal preferences or the situation they may find themselves in. For example, the instant availability of mobile email may lead to much more frequent checking of email [44].

In our studies we generally found that closeness of the technology to the body of the user promoted an interactive process of individual adaptation allowing the user and technology to mutually adapt. In the case of Study 4, the off-premises trading worked well because being an off-premises trader signalled status within the organisation, and because the organisation did not impose itself on the trader through the technology but instead allowed a natural flow of using the technology to support the primary tasks at hand. The London Black Cab drivers in Study 5 were experts in selecting and appropriating technology that would directly support their main task of locating customers, but also support drivers in maintaining essential social links to friends and family while driving around the streets of London. Aspects of the systems, such as the fairness of the principles they implemented for allocating jobs to drivers were of significant importance and therefore discussed intensely. For the health professionals in Study 7, using the PDA system was throughout at odds with the specific requirements of the work context and although they managed to make individual use of some features, the technology seemed to remain opaque and problematic throughout [69]. For the security guards in Study 8, the RFID-enabled mobile phone quickly became a natural part of their work as it easily replaced the existing electronic reader. The operational police officers in Study 6 displayed, due to the extreme nature of their work, very interesting mobile technology use patterns, where there were significant variation or rhythms of interaction with the technology depending on the circumstances and on how intensively they were required to engage with the physical world of citizens embroiled in incidents [49,57].

Rather than over emphasising the challenges of making mobile technologies ubiquitously disappear in the background, it is perhaps more constructive to conceptualise mobile IT at work similar to the extreme case of the police. This makes the ability of rapidly shifting the attention from the technology to the situation or from one technology to another according to the rhythms of work much more essential. The success of the mobile phone so far is perhaps based on this criterion that the technology should be easily engaged and disengaged. This perspective of engagement and disengagement also emphasises the importance of not only using the technology but also to make it disappear in order to engage with the world around. This relates back to the initial issue of mediated or situated interaction, and the crucial role of engaging with others when it really matters. For all organisations the lessons learnt from studying the police can be valuable in terms of augmenting situations with mobile services as opposed to replacing them. The bank executives in Study 2 illustrated this very well with the entire emphasis being on intense negotiations with the client, but with relevant information for these negotiations being available when needed.

7. Organisation: Cultivate or transform?

Mobile IT can offer organisational support for the gradual cultivation of existing working practices and through this for example enable efficiency gains and increased flexibility. However, mobile IT also
Vignette Study 8: Late at night in an industrial estate in the outskirts of Manchester, the security guard Sandeep is doing his nightly round at an electronics warehouse. At each check-point he waves his mobile phone, which contains a built-in RFID (Radio Frequency Identification) reader over a tag mounted on the wall and a message is automatically sent to a central server to update his whereabouts. This is not a lot different from the previous systems where a torch-like tag reader would record each check-point. However, this would only allow data to be uploaded to the system once Sandeep was back in the office after a whole shift. Instead, the database is now immediately updated. Sandeep does not mind too much that he is a bit tighter observed as he already was so before, even if it was not in real time. (Study 8 in Table 1).

Context Study 8: The system above was part of a set of four extensive real-life experiments with RFID-reader mobile phones used to render work more effective through real-time updates within central systems of mobile work activities. The RFID reader mobile phone here enforced existing working arrangements and cultivated real-time updating of guard positioning allowing for a range of management practices operating at a finer level of granularity. As work already was characterised by a low degree of individual discretion, the technology was not seen as radically changing the conditions for work. The experiments also highlighted the added complexity of formulating systems requirements for technologies that are not only close to the human body but also directly links the physical and virtual world. Whereas end-users in other cases may be easier to circumvent, the complexity of RFID-enabling individual work processes implies the need to involve end-users and thereby also drawing them in as a significant stake-holder.

has the potential of being a disruptive technology [8] supporting a transformation of the way decisions are made, innovation carried out or services delivered.

From both an organisational and a technology vendor point of view, the aim will often be to seek to transform the organisation of work to make it more effective, innovative, profitable or whatever criterion is sought after. However, the straight-forward business cases for significant investments in mobile IT is often difficult to identify as the transformation hinges as much upon a business transformation as on technological change. Zuboff and Maxmin [75] argue that market demands from customers for increasingly individualised support will result in a demand for business transformation. Malone [38] argues from the perspective of the dropping communication costs that such scenario is practically feasible. However, these studies do not consider mobile IT and it is still somewhat unclear what role this technology can play in business transformation.

In our studies we mostly saw mobile IT supporting the step-wise cultivation of existing working practices, which is probably typical for many technologies as radical changes may only look appealing in business case texts and on spreadsheets with estimated gains or savings, but not at the coal-face of work. Furthermore, the closeness of the user and technology is in itself an experimental setting that in most cases will be needed in order to fully understand how the technology may provide transformative effects. The intensity of the human-technology relationship when the technology is constantly carried along and cared for is one that sets new issues on the innovation agenda. The user becomes an integral element in shaping the innovation and real life experimentation can be the only means by which the consequences of the innovation can be understood as the relationship between body, technology and work process becomes more and more intense [23,30].

In terms of the transformative capabilities of mobile information technology, these must be seen in the greater perspective of the overall business objectives and the role of information technology herein. Whereas the traditional role of the organisational information system was to automate back-office processes, current information technologies seek to support the organisation in for example relating to customers and business partners. The multi-faceted challenges to contemporary organisations include the ability to listen comprehensively to what products and services customers and other stake-holders desire, and to go beyond listening to also engaging various constituencies in collaborative efforts. These types of efforts are only commercially feasible through intensive use of information technology as both support for and replacement of human activities [55]. Mobile technologies will by definition follow organisational actors where they may go and as such represent the new information management boundary of the organisation. The ability of the bank in both Study 2 and 4 to extend its information services boundary
beyond the walls of the organisation provided potentially transformative effects. Similarly, the ability of the police offers to gain information before and during incidents can both help protect citizens and the officers as it greatly helps transform operational uncertainties into assessed risks.

If organisations aim at softening the boundaries to customers and associates in order to better understand and involve these stake-holders, then one of the primary means may just be mobile IT. If Internet users are keen to helping companies supporting customers with deep technical questions about its products through posting their knowledge on discussion forums, some of this energy may in different forms be harnessed and adopted to the context of mobile technology use. Already now it is possible to study the phenomenon of micro-blogging, which often is done in a combined stationary and mobile manner – Twitter.com and Jaiku.com are two good examples of this. The technological convergence of various services from stationary to mobile technologies will provide interesting platforms to innovate from, for example the recent development of an affordable 3G mobile phone with Skype functionality, or the integration of GPS receivers, contact-less payment cards or general RFID readers in mobile phones.

More and more organisations understand that reaching customers on their mobile phone, if done the right way, a much stronger relationship than the one cultivated through a personal computer as it will allow much more direct access. Delivery drivers (Study 10), police officers (Study 6) and modern professionals (Studies 1, 2, and 11) alike have all experienced the importance of getting access to each other and to vital organisational resources when interacting with people at the edges of the organisation. When an airline company allows its customers to check-in from a mobile phone (for example SAS mobile check-in), it gains effectiveness in the traditional manner information technology often does, by the customer doing some, if not all, of the work [58]. However, for the customer this is not necessarily a bad idea assuming it is sufficiently simple to do. For regular customers with an account set up, it is even possible to buy ticket and check-in in one simple operation. The potential for transformation if the right conditions are present is significant as the example of the M-PESA project in Kenya where the lack of general access to banking combined with the widespread diffusion of mobile phones provided fertile soil for a mobile phone based electronic money system [24].

8. Services: Encounters or relationships?

Mobile IT can provide two different categories of information service. The first kind is comprised of information services offering technologically mediated encounters, and the second kind mediate ongoing relationships [43]. Zuboff and Maxmin [75] argue that the 21st Century is to be one characterised by individualised consumption of experiences and support more than merely the consumption of mass-produced goods. They see as one of the essential prerequisites the ability for organisations to engage in a relationship economy as opposed to the traditional transaction economy. A key element to engaging with customers and organisational partners will therefore be the ability to mediate customer relationships through information services [43]. The distinction between services offering encounters versus those mediating relationships relates to discussions of; The differences between algorithmic codification (encounters) and interactivity (relationships) [21,42,63]; the distinction between encounters and relationships in the provision of services [15,22]; and the economic development of market forces towards a relationship- as opposed to a transaction economy [75].

When a mobile phone is used for short voice calls, to send an SMS message, or for mobile email, then the phone mostly mediates encounters as any ongoing relationship is entirely managed by the people engaged in the interaction. If a series of phone conversations for participants amounts to an interesting
relationship, then this is entirely constructed amongst the actors. The phone will only mediate a relationship to the extent it contains the memory of names and numbers in the log or address book. Recent services, for example on the iPhone of representing ongoing SMS messages between people as though they were instant messaging discussions will more significantly mediate the relationship [43].

Comprehensive support for mobile collaboration requires additional services supporting mutual adjustment and recording of distributed decisions beyond merely allowing people to do so themselves through instant connections. Mobile collaboration support will require support for ongoing discussions, easy sharing of workspaces, coordination of mobile activities, and establishing mutual awareness through the technology [43,63].

As an example, the reason police officers from Study 6 never disengaging their shoulder-mounted radio during incidents was that they through this kept an ongoing conversation with the control room, who could offer information and support [57]. Taxi drivers in Study 5 using a computer-cab system need some form of information service allowing them to update their recorded whereabouts in a central database at the dispatch office in order to be given jobs near where they are. The off-premises foreign exchange traders in Study 4 used a fairly simple set of information services, but the essential Reuters SmartWatch allowed an ongoing updating of the latest market information and the ways the traders set up this relationship was essential for their performance. In the mobile support centre in Study 3, the way in which the support staff managed their interaction with globally roaming bankers was through a support ticketing system – a type of CRM system – mediating the discussions of the status of submitted requests. The health professionals in Study 7 attempted to engage in a complex relationship between remote learners and a central responsible through an advanced database system being updated by each learner from their PDAs. This did, however not work and it demonstrates the complexity of establishing mobile mediated relationships. Such relationships must be constantly nurtured according to changing needs and preferences. On the other hand if too much time and effort must go into this nurturing then this may be deemed unfeasible.

9. Conclusion

We have in this paper attempted to provide some initial answer in forms of a categorisation to the question of: What are the organisational implications specifically related to the application of mobile information technology across a variety of public and private organisations? This was accomplished by analysing the results from a collection of 11 fieldstudies of mobile information technology use. As a result, six different challenges of seeking to gain organisational efficiency through mobile information technology there explored. The main results are summarised in Table 2 and Appendix 1–3 offers more detailed findings. The six themes unfold a complex set of relevant decisions when introducing mobile IT into an organisation and the following questions: (1) Should mobile IT through mediating remote interaction replace situated interaction or be used to make the context of situated interaction an organisational resource?; (2) Should mobile IT support increased organisational control of decisions or should it promote decentralised application of individual discretion in decision making?; (3) Should the technology strengthen mutual interdpendencies between people within the organisation and with associated partners or should it make more individualised working easier to implement?; (4) How is the technology percieved in the context of everyday activities – as ubiquitous support residing in the background and out of focus, or as an opaque reminder of itself?; (5) Should the mobile IT help the organisation engage in a transformation of existing working practices or will it support the cultivation of
<table>
<thead>
<tr>
<th>Theme</th>
<th>Question</th>
<th>Characteristics</th>
<th>Examples</th>
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<tbody>
<tr>
<td>Interaction</td>
<td>Mediate or Situate?</td>
<td>Mobile IT can both mediate remote interaction and thereby allow people to collaborate across temporal and spatial barriers – the traditional “anytime–anywhere” argument. However, mobile IT can also support situated interaction where the primary aim is being somewhere at some point, whilst remaining in touch with relevant people and information sources.</td>
<td>Off-premises traders in Study 4 could trade anytime and anywhere outside normal working hours through mediated relationship with the financial market. Hiro in Study 1 could immerse himself in Tokyo’s everyday street life for inspiration whilst remaining in touch with his organisation. The senior bank executives in Study 2 likewise engaged in client negotiations and at the same time accessed essential data for the negotiation through their mobile IT.</td>
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<tr>
<td>Management</td>
<td>Control or Discretion?</td>
<td>Mobile IT support the management of work in terms of providing means for control for example through providing direct connections between people, and with corporate systems of control. Mobile IT can, however, also provide opportunities for increased individual discretion in decisions as they have access to relevant information and can implement decentralised decisions.</td>
<td>In several of the studies, the key issue was that of managing mobile working through mobile IT strengthening control, for example, Study 7, 8, 9 and 10, where both the health professionals in Study 7 and the waste management workers in Study 9 experienced negative aspects of increased control through mobile IT. The off-premises traders in Study 4 was each day subjected to organisational control and for the sake of offering some sort of normality when they kept trading after normal working hours, the system was mostly designed to offer support for discretionary decisions.</td>
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<tr>
<td>Collaboration</td>
<td>Individual or Collective?</td>
<td>Mobile IT can offer individual support for activities carried out alone, for example through offering access to information or occasional connections with colleagues or customers. Mobile IT can, however, also support distributed collective efforts. Interestingly, the introduction of mobile IT can shift activities between these two types.</td>
<td>For the off-premises traders in Study 4, the main idea was to allow highly individual working after-hours with intermittent discussions on mobile phone. For the cab drivers in Study 5, the purpose was the opposite, namely to allow highly individualised cab drivers to pool resources and compete as an organisational unit through mobile IT supporting collective response to customer demand for cab rides.</td>
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<tr>
<td>Technology</td>
<td>Ubiquitous or Opaque?</td>
<td>Much discussion of mobile IT centres on its ability to become an ubiquitous part of the user’s activities. However, the technology can for a range of reasons also become an opaque element demanding attention.</td>
<td>For the police officers in Study 6 the main criteria for most mobile IT was to not only be ubiquitous, but at critical times to disappear entirely. The police radio was the only mobile IT close to ubiquitous. For most of the professionals in Study 11, mobile IT often would become opaque and subject of problems, such as issues when attempting establishing network connections or batteries running out. For the health professionals in Study 7, mobile IT was entirely opaque when attempted used to record learning</td>
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<td>Organisation</td>
<td>Cultivate or Transform?</td>
<td>Mobile IT can support the organisation in cultivating existing practices and thereby, for example, obtain better, faster or more flexible decisions. Mobile IT can, however, also serve as one of the means of transforming the way decisions are made, innovation carried out or services delivered.</td>
<td>The security company in Study 8 experienced an incremental cultivation of existing arrangements when experimenting with RFID-enabled mobile phones as a means of recording security guard patrolling. For the bank in Study 4, the application of Mobile IT was an essential part of transforming the bank’s 24-hours trading capabilities in a way that was both cost-effective, organisationally feasible, and acceptable to the individual traders. For cab drivers in Study 5, transformation with mobile IT was essential to establish coordinated organisational response.</td>
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Mobile IT can amplify the ability to rapidly establish technology mediated encounters. Mobile IT can, however, also provide support through mediating ongoing relationships.

For professionals in Studies 1, 2 and 11, mobile IT was mostly supporting technologically mediated encounters supporting flexible information retrieval and decision-making. Remaining Studies 3, 4, 5, 6, 7, 8, 9, and 10 all displayed elements of mobile IT mediating a relationship – although this did not always go smoothly.

Table 3
Essential design choice of supporting encounters or mediating relationships

<table>
<thead>
<tr>
<th>Type</th>
<th>Metaphor</th>
<th>Examples</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
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<tbody>
<tr>
<td>Encounter</td>
<td>Communication Tool</td>
<td>Mobile voice calls, mobile email, mobile instant messaging, SMS messages</td>
<td>Amplifies connections in encounters, Light-weight and flexible, Initially easy adoption</td>
<td>Only scaleable through social conventions, Whilst flexible in establishing communication, it essentially adds to the burden of managing interdependencies through interaction</td>
</tr>
<tr>
<td>Relationship</td>
<td>Business Process</td>
<td>Coordination systems, project plans, mobile workflow management systems, radio contact to dispatch centre, etc</td>
<td>Amplifies collaboration in ongoing relationships and hereby reduces the complexity of negotiating interdependencies, Scaleability designed into the service as it reduces the complexity of negotiating interaction</td>
<td>Extensive and inflexible, Difficult initial adoption as it relies critically on people accepting the implied modelling of the business process</td>
</tr>
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</table>
these practices?; and (6) Should the mobile technology support encounters between users and between users and informational resources, or should it mediate ongoing relationships?

Clearly, there are no straightforward answers to these six questions, but rather in each specific situation of intended organisational innovation with mobile IT, each aspect must be considered carefully and subjected to ongoing experimentation. One of the characteristics of enterprise mobility is the increased reliance on localised innovation, individual ways of appropriating the technology and the need for organisational experimentation to investigate how to yield most benefit from the technology.

The main contribution of this paper is to highlight six essential discussions of enterprise mobility consequences. This expands our theoretical knowledge about the possible consequences of enterprise mobility and sensitisate managers to the key questions they need to ask in their organisation when considering implementing mobile IT. Whereas much previous research has focused on technological opportunities, this research is based on organisational realities from the 11 case studies. The practical examples presented in the vignettes and discussed in the analysis can also provide management with tangible examples of enterprise mobility placed in a theoretical context.

The obvious first consequence of the analysis presented in this paper is that there is far from a simple linear relationship between the introduction of mobile IT and the consequences in terms of increased organisational agility through enterprise mobility. Specific mobile IT can have different consequences in different settings and the analysis exactly points out that the pressure points relate to how interaction is organised, how work is managed, how collaboration is designed, how technology is assimilated, the organisational strategy for change, and the sophistication of information services.

In all of this, the application of human discretion, as opposed to the reliance on mobile IT for the control of mobile activities, is clearly one of the key issues as this was found to be one of the key differentiators in terms of the approach to support work activities. Distinguishing between work where individual discretion is essential, and work where this is not the case, will clearly be a key-decision preceding any investment in mobile IT. In general, the distinction between mobile services supporting encounters and ones mediating relationships, offers an excellent lens through which we can discover essential archetypes of technological and organisational configurations (see Table 3 for overview).

Typically support for professional activities, such as in Studies 1, 2, 4, 5, 6 (mostly), 7, and 11 involves support for light-weight encounters through mobile phones, email, Instant Messaging and video conferencing. Here, enterprise mobility is mostly concerned with providing an open-ended light-weight platform of tools allowing individuals to exercise their discretion by essentially adopting the tools they see an immediate use for and reject those they do not [50]. The research, in particular through Studies 8, 9 and 10, saw examples of enterprise mobility where work largely was conducted according to a strictly controlled business process, and where mobile IT would stipulate and mediate the business process, and through this control the performance of mobile working. We did, however, also see clear examples where a combination of these two situations was present. In Study 5, highly independent black cab work was under transformation to introduce interdependencies formalised in dispatch systems and associated regulation enabling changes in organisational capabilities. Conversely, in the case of the police officers in Study 6, the formalised systems primarily served the purpose of providing officers with as much support in the field as possible. The increased availability of information streamed to data terminals facilitated a better foundation on which to base discretionary decisions. As illustrated in Table 3, the advantages of providing encounters are the disadvantages of mediating relationships with mobile IT and vice versa. One of the primary challenges in applying enterprise mobility is to get the balance right between the provision of discretion and the management of work through the technology.

The main challenges of determining the right enterprise mobility strategy for an organisation is to relate the available mobile IT to the overall purpose of the work conducted and determine a risk-profile, for
example, in terms of how radical the organisational changes should be, how closely the business process should be aligned to the mobile IT, and how the mobile IT will not only enable more fluid interaction between users but also how it can support each of them in managing their day-to-day interaction when they experience it in abundance.

One of the reasons good business cases for enterprise mobility are difficult to establish is that such business cases are not needed for providing CxO’s with mobile email and they are relatively easy to establish for incrementally strengthening the control of routine tasks with little discretion. However, the largest group of organisational members are in situations much similar to the police officers, namely bestowed a high degree of individual discretion, but at the same time subjected to organisational control mechanisms enforcing standardisation of behaviour.

Seen in the light of increased emphasis on service delivery as opposed to product manufacturing, it is clear that developments will favour automation of what can sensibly be automated, supplemented with self-service of all aspects suitable for this approach. What is left will critically require the application of discretion. The combination of automated services, customers managing own profiles, and a high degree of discretion to solve exceptions, will be a challenge for most organisations. The application of enterprise mobility viewed in this light implies an emphasis on bringing this discretion in touch with customers when they need it – situating interaction. It also implies that although enterprise mobility is an essential part of increasing the scientific management of information workers, the challenge will be to establish support for discretion and not foremost of control.

Although substantial research has gone into our work since 2001, there is still much to do and there are still many open practical and theoretical questions in relation to the business case for enterprise mobility. As with many other technologies, mobile IT both provides the promise of radical change and of cementing sub-optimal working arrangements further through embedding them into new technological systems.
### Appendix 1 – Study 1–4: Summary of themes characterizing enterprise mobility challenges

<table>
<thead>
<tr>
<th>#</th>
<th>Workers</th>
<th>Interaction</th>
<th>Management</th>
<th>Collaboration</th>
<th>Technology</th>
<th>Organisation</th>
<th>Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Professionals</td>
<td>Some work situated other independent of context. IT used to both maintain secondary interaction and to conduct context independent work</td>
<td>IT use generally concerned with mediating participant discretion</td>
<td>Mobile IT makes it easier to engage in distributed collaboration</td>
<td>Very close relationships between professionals and technology and mobile IT generally becomes an integral and ubiquitous part of work</td>
<td>In most cases, mobile IT allowed for the radical organisational arrangement of individual professionals managing all aspects of their work as opposed to being part of large corporation</td>
<td>Mobile IT mostly supported encounters through email and mobile phone access as well as Internet searches</td>
</tr>
<tr>
<td>2</td>
<td>Bank executives</td>
<td>Critical negotiations highly situated. IT augment available information</td>
<td>Work characterised by a high degree of discretion and IT provides a platform to support decisions</td>
<td>Work highly collaborative and IT supports increased remote collaboration between executives and their colleagues</td>
<td>As mobile technology with relative ease can be produced and removed from negotiations, it displays itself in a quite ubiquitous manner</td>
<td>Mobile IT presented a cultivation of existing organisational arrangements</td>
<td>Mobile IT mostly supported encounters through mobile access to corporate databases, email and colleagues</td>
</tr>
<tr>
<td>3</td>
<td>Mobile support centre</td>
<td>IT enabled mediated remote support for mobile users</td>
<td>IT supports the streamlining and management of a complex distributed support process</td>
<td>IT enhances the opportunities for resolving technical issues in a collaborative fashion</td>
<td>IT supports mobile workers when they have problems with their IT and the system therefore presents itself as an opaque element in addressing these problems</td>
<td>Mobile IT transformed the organisation of the support function</td>
<td>The support system mediated a relationship between bank employees needing support and the central support function</td>
</tr>
<tr>
<td>4</td>
<td>Off-premises foreign exchange traders</td>
<td>Off-premises work not situated. IT enable trading independent of situation</td>
<td>IT critically allows for extensive discretion during off-premises trading as traders technically are off work</td>
<td>Mobile IT allows individualisation of off-premises trading with selective negotiations of mutual interdependencies</td>
<td>Mobile technology generally functions in an ubiquitous manner and supports the parallel conduct of private life and off-premises trading</td>
<td>Mobile IT critical to the transformation of 24-hour trading into the combination of day-trading and off-premises trading</td>
<td>Mobile IT supported ongoing relationship between the money market and the traders, as well as encounters between traders internally</td>
</tr>
</tbody>
</table>
### Appendix 2 – Study 5–8: Summary of themes characterizing enterprise mobility challenges

<table>
<thead>
<tr>
<th>#</th>
<th>Workers</th>
<th>Interaction</th>
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<th>Collaboration</th>
<th>Technology</th>
<th>Organisation</th>
<th>Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>London taxi drivers</td>
<td>Work situated and independent. IT supports stronger dependencies for allocation of jobs</td>
<td>IT exists in a setting of extreme individual discretion so individual offers of jobs can be accepted or rejected</td>
<td>Mobile IT supports establishing mutual interdependencies where work before was conducted highly independently</td>
<td>Mobile IT is an integral and ubiquitous part of the cab cockpit</td>
<td>Mobile IT critical element in the transformation from highly independent taxi work to organised interdependencies</td>
<td>Mobile IT established ongoing relationships between cab drivers and the dispatch office as well as encounters amongst drivers</td>
</tr>
<tr>
<td>6</td>
<td>Police officers</td>
<td>Work situated and IT mediate ongoing relationships between control room, colleagues and information resources.</td>
<td>A high degree of operational discretion is supported by IT, whilst generally allowing tactical and strategic control through traceability of actions and decisions</td>
<td>Work is highly collaborative and mobile IT allows for much more flexible collaboration between officers in the field and with the control room</td>
<td>The critical reliance of face-to-face interaction in most incidents implies that the police radio is only IT that offers sufficient ubiquity</td>
<td>Mobile IT supports evolution of information and interaction management in the police</td>
<td>Mobile IT mediated relationships between control room and officers and encounters between police officers</td>
</tr>
<tr>
<td>7</td>
<td>Health professionals</td>
<td>Work highly situated with remote control sought mediated through IT</td>
<td>IT failed as it sought to impose detailed control over operational activities</td>
<td>Mobile IT supported increased collaboration between remote professionals and the center – but failed</td>
<td>One factor in the failure of mobile IT was the opaque nature of the technology in many situations</td>
<td>The aim was for mobile IT to transform the relationship between the learning centre and the remote learners. This failed</td>
<td>Mobile IT failed at the intended mediation of relationships between the central management function and the distributed professionals</td>
</tr>
<tr>
<td>8</td>
<td>Security guards</td>
<td>Work situated and IT interactively records unfolding activities</td>
<td>Work characterised by a very low degree of individual discretion and IT emphasises this further</td>
<td>Work traditionally independent but mobile technology supports management’s increased collaboration with and remote management of security guards</td>
<td>Mobile IT replaced a system not much different, form the perspective of the guards, so it rapidly gained ubiquitous status</td>
<td>Mobile IT signalled an incremental cultivation of existing practices</td>
<td>Mobile IT strengthened and mediated the relationship between the individual security guard and the central system recording activities</td>
</tr>
</tbody>
</table>
## Appendix 3 – Study 9–11: Summary of themes characterizing enterprise mobility challenges

<table>
<thead>
<tr>
<th>#</th>
<th>Workers</th>
<th>Interaction</th>
<th>Management</th>
<th>Collaboration</th>
<th>Technology</th>
<th>Organisation</th>
<th>Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>Industrial waste management</td>
<td>Work situated. IT mediates link to management. This causes tension</td>
<td>Work characterised by some discretion and tension arise when IT makes remote control easier</td>
<td>Work traditionally independently conducted by teams but with mobile IT increased remote collaboration and management possible</td>
<td>As mobile IT allowed remote management and control previous impossible, it frequently presented itself as in the way of getting work done</td>
<td>Mobile IT was aimed at incrementally cultivating existing practices but in turn transformed aspects of remote management deemed negative by workers</td>
<td>Mobile IT mediated and strengthened the relationship between remote waste disposal workers and central management function</td>
</tr>
<tr>
<td>10</td>
<td>Delivery Drivers</td>
<td>Work situated and IT supports remote management and support</td>
<td>Low degree of individual discretion and IT further strengthens the possibility for remote and systemic control</td>
<td>Mobile IT supports increased collaboration and remote management between drivers and central control functions. It also supports direct collaboration between drivers and customers, which can cause conflict with centralised control function</td>
<td>Work was very much managed and controlled through mobile IT, which therefore became integral to conducting work and therefore ubiquitous to the drivers</td>
<td>Mobile IT transforms the organisational capabilities for remote management of work and for tight integration between business process elements</td>
<td>Mobile IT mediated and strengthened the relationship between remote delivery drivers and central management function</td>
</tr>
<tr>
<td>11</td>
<td>Professionals</td>
<td>Work can be both situated and context independent. IT mediates connections to people and informational resources</td>
<td>A high degree of discretion where IT offers support for information management and decision-making</td>
<td>Work highly distributed and highly collaborative. Mobile IT enables strengthening of the remote collaborative arrangements</td>
<td>Whilst much of the mobile IT was ubiquitous in daily use, technical issues such as connectivity and battery life constantly made the IT a subject of discussion</td>
<td>Mobile IT further cultivates the abilities to engage in remote collaboration</td>
<td>Mobile IT mostly mediated light-weight encounters between professionals and their colleagues and clients</td>
</tr>
</tbody>
</table>
References


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