The Fully Mobile City Government Project (mCity)

Hans (Jochen) Scholl
The Information School
University of Washington
Box 352840, Seattle, WA 98195-2830
+1-206-616-2543
jscholl@u.washington.edu

Raya Fidel
The Information School
University of Washington
Box 352840, Seattle, WA 98195-2830
+1-206-543-1888
fidelr@u.washington.edu

ABSTRACT

The Fully Mobile City Government Project (mCity) investigates how Fully Mobile Wirelessly Connected (FMWC) applications are implemented and used in fieldwork at the City of Seattle. Seattle Public Utilities (SPU) serves as the case in point. The project applies a work-centered approach to data collection and analysis. In addition, stakeholder analysis is applied to relevant research questions. Based on the analyses we are developing a formative model representing the constraints, interactions, and interdependencies of the studied domains and their context. Using this work-centered formative model, we will develop requirements for the design and implementation of FMWC devices and applications. In this paper, we report on the progress and preliminary findings from the work-centered data collection and analysis.

Categories and Subject Descriptors

H.1.2 [**Information Systems**]: Models and Principles – u*ser/machine systems.*

K.4.2 [**Computing Milieux**]: Computers and society - *social issues*

K.4.3 [**Computing Milieux**]: Computers and society - *organizational impacts*

General Terms

Management, Performance, Design, Economics, Human Factors

Keywords

Digital Government, mobile Government, Fully Mobile Wirelessly Connected (FMWC), ubiquitous computing, pervasive computing, integration, interoperation, interfacing, e-Government, socio technical challenges

1. INTRODUCTION

We study the implementation and use of fully mobile applications in local government fieldwork. Fieldwork supported by mobile and wirelessly connected information and communication technology (ICT) is a new frontier in both the private and public sectors. Before the advent of that new technology, fieldwork—such as on-site exploration and assessment, construction and installation, repair and maintenance, cleaning, supervision, or emergency management—received relatively limited ICT support. With fully mobile devices and applications, fieldwork could now potentially enjoy benefits and huge gains in effectiveness, efficiency, productivity, and quality as formerly observed in production and back office modernization. Our study focuses on understanding the unique constraints of fieldwork, and how mobile ICT can help deal with those unique constraints. Our research is conducted with the support of the City of Seattle and our investigation is ongoing in the Fieldwork Operations and Maintenance Branch of SPU.

2. BACKGROUND

The City of Seattle was one of the earliest adopters of digital government concepts and FMWC applications in fieldwork operations [1]. The City's *GoMobile* project was implemented in 2001 using IBM's asset management system MAXIMO® [2, 3]. SPU was among the early adopters of first generation (1G) FMWC applications in its Water Operations Division, where fieldworker crews were equipped with FMWC-enabled ruggedized laptops, cell phones, and Personal Digital Assistants (PDAs). Since the introduction of 1G-FMWC applications to the SPU Water Operations field crews in 2002, numerous measured and intangible benefits have been accounted for – such as cost reductions, productivity increases, work process streamlining, increase of data integrity and quality, increased customer satisfaction, and reduced number of task delays among others [4]. These benefits are encouraging but SPU as well as City of Seattle ICT management, have become keenly aware of the multiple serious challenges when moving from a single-unit, small scale, and incremental pilot towards a multiple-agency, City-wide, ambience-specific deployment of FMWC applications. This study addresses some of these challenges.

3. FRAMEWORK AND METHOD

This study uses a theoretical framework that is a combination of an extended Orlikowsi & Robey framework [5] and of Cognitive Work Analysis (CWA) [6]. For a fuller description, see [7].

3.1 Data collection and analysis

Data are collected through field studies, observations and interviews at SPU with fieldworkers and managers. In addition to interviews, fieldworkers are shadowed when they go about performing their tasks. The data are analyzed using the ORF/CWA framework and based on this analysis we are building a formative, narrative model including task procedures and performance, the organizational context, collaboration and communication, information use and actor characteristics.

So far, we have collected data on 12 cases of 50 cases planned and analyzed 10, that is, our insights here are based on 20 percent of the eventually available data.

4. RECENT RESEARCH ACTIVITES

SPU serves around 1.3 million customers with water supply, sewage, drainage and solid waste services. Included in the infrastructure SPU maintains are 1,800 miles of pipeline for water supply, 1,491 miles of combined sewer and sanitary pipelines and 45,396 catch basins. Two of SPU's fieldwork divisions - Water Operations and Drainage and Wastewater - have gone mobile and are pioneering the use of FMWC applications in fieldwork operations. Fieldworkers are given handheld devices on which they receive their work orders and information on work procedures. Furthermore ruggedized laptops are in use. Via FMWC devices, some crews can access the stationary backend systems for information access and entry.

The Division we're currently investigating has a relatively young workforce, in relation to time on the job. 25% of the employees are within their first year and a half of employment with the City. The need for training is high and an official apprenticeship program for worker training, including the MAXIMO® system, is being implemented.

We found that workers have a high level of willingness to use fully mobile technology if it helps them do their job and satisfy the customer.

The system includes information on City GIS information, equipment and job specifications, and safety guidelines. We found that a large part of executing the tasks is dependent on tacit knowledge.

Tacit knowledge (the smell and texture of the soil, the sound the tip of a metal pole makes when it taps cement vs. debris at the bottom of a drainage hole, etc.), needs to be shared among workers. The system must be responsive and versatile enough to handle this data and workers are instrumental in providing some of this information which iteratively helps to create a more accurate and ultimately efficient information system.

4.1 Challenges to design

While some mobile components work well, many others pose major challenges to fieldworkers and management alike. The challenges are (1) related to human workers, (2) related to work and task, (3) organizational, and (4) technological. We found these challenges to be intertwined. For example, simply making accessible back office data and applications in the field does not yield the expected gains, since fieldwork conditions may vary widely in the most physical sense. Unlike shop floor or back office work, much of fieldwork is highly unstructured. Fieldwork is also rich with detail resulting in a high task complexity. Consequently, in large portions fieldwork-related knowledge is tacit. We find that many standard and routine-based applications provide poor fit to the much more challenging and changing requirements of fieldwork.

As shown in figure 1, as opposed to routine applications—in production, for example--fieldwork applications encompass higher degrees of tacitness and complexity. This requires a different breed of applications. The goal of our project is to identify the strategic choices and specify the requirements, which make mobile ICT in local government fieldwork successful even under its most challenging circumstances.

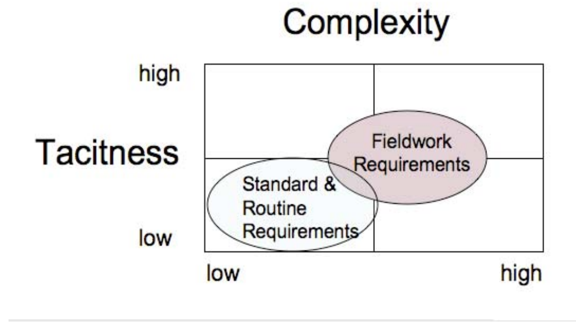

Figure 1. Fieldwork characteristics

5. IMPACT AND OUTCOMES

Our project will inform both academics and practitioners about the organizational prerequisites, consequences, and the specific requirements for the design and implementation of FMWC technology. The findings are expected to be applicable to both government and organizations outside of government.

6. ACKNOWLEDGMENTS

This project is supported through grant # IIS-0535088 under NSF program 05-551 (Information and Intelligent Systems: Advancing Collaborative and Intelligent Systems and their Societal Implications). We also thank the leadership and workers of the City of Seattle and of Seattle Public Utilities for their support and willingness to participate, in particular Robert Bleiler, SPU technology specifier.

7. REFERENCES

[1] Kaylor, C. H. The next wave of e-government: The challenges of data architecture. *Bulletin of the American Society for Information Science and Technology, 31*, 2 (December 2005), 18-22.

[2] Maximo Asset Management SE. http://www.mro.com/corporate/assetmanagement/maximo/index.php, Accessed February 20, 2007.

[3] Bleiler, R. *GoMobile Seattle Public Utilities*. (PowerPoint Presentation). Seattle: Seattle Public Utilities, 2003.

[4] Bleiler, R. *SPU Technology Project Post-Implementation Review*. Seattle: Seattle Public Utilities, 2003.

[5] Orlikowski, W. J., & Robey, D. Information technology and structuring of organizations, *Information Systems Research, 2* (1991) 2, 143-169.

[6] Fidel, R., Pejtersen, A.M. (2004). From information behaviour research to the design of information systems: the Cognitive Work Analysis framework. Information Research, 10(1), paper 210. Available at http://InformationR.net/ir/10-1/paper210.html

[7] Scholl, H.J., Fidel, R., Mai, J.-E., Unsworth, K. (2006). Seattle's Mobile City Project. Paper to the Second European Conference on Mobile Government, August 30-September 1, 2006, University of Sussex, Brighton, UK.