

Socio-technical Study of Teleworking:

From the analysis of employees' uses to the design of a virtualized and unified platform

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Abstract— In this working paper, we present the project "WITE 2.0". This project is at the crossroads of various issues related to mobility (mobility turn) and use of Information and Communication Technologies. Wite 2.0 is a part of the designing process of a collaborative communication tool: "a virtualized and unified platform". We define scenarios of teleworking practices, "equipped" by ICTs, and use these scenarios to better specify the platform. The project started at the end of 2010 for a period of 18 months. The analysis is based on several complementary methodologies: a qualitative study (47 semi-structured interviews), a quantitative survey (553 respondents), and an experimentation of the platform. In this paper, we present the main results of the interview survey through the following themes: remote management, skills, articulation of private and professional spheres, and the maturity of technologies. We also describe how these elements help to understand the workers' practices evolutions.

Keywords: teleworking; ICT; management; socialization; competences.

I. INTRODUCTION

The project WITE 2.0 (Work IT Easy) [10] is a research and innovation program supported by public funds. It is a multi-partner project (academic and industrial actors).

The aim of this project is to create a virtualized platform. This platform represents a unified work environment, based on virtualization, instant communication and interoperability of systems, and it allows the individuals to work anywhere (and possibly anytime).

The platform is a software solution that centralizes the access to a set of functionalities, originally offered by several applications: it's the principle of unified communications. Unified communications (UC) is the integration of real-time communication services such as instant messaging (chat), presence information, telephony (including IP telephony), video conferencing, data sharing (including web connected electronic whiteboards aka IWB's or Interactive White Boards), call control and speech recognition with non-real-time communication services such as unified messaging (integrated voicemail, e-mail, SMS and fax).

This platform is accessible from any connected terminal, either fixed or mobile (desktop, laptop, tablet, Smartphone, etc.). The WITE 2.0 platform will provide a wide range of communication tools that can be activated on demand in

different situations, and depending on users' needs (VoIP, discussion groups, instant messaging, email, etc.).

The project has four main stages, divided into several subsections each. It is supported by a socio-technical analysis. Telecom ParisTech has assumed leadership in the scientific study of the needs and uses by administrating semi-structured interviews with individuals regularly working "remotely". We wanted to better characterize these work situations: at home, on the premises of the employer but in geographically dispersed locations; in telecentres / co-working spaces / business center, with geo-distributed teams working.

The rest of this paper is organized as follows. In the Section II, we describe the different stages of WITE 2.0 project; we specify the notion of virtualization. In Section III, we expose the socio-technical study with the chosen methodology and the main results. We conclude by giving some research perspectives.

II. DESCRIPTION OF WITE 2.0. PROJECT

A. The project issues

Mobility at work is spreading in the context of the mobility paradigm's evolution [9]. The project WITE 2.0 intends to address the urgent need for solutions in the field of remote collaborative work. These needs include ways to collaborate, communicate and socialize, but also to access these features regardless of the location, and from any workstation. It will provide a unified interface integrating all the features, and having a wide range of communication tools selectable on demand.

B. The project stages

The project WITE2.0 is divided into four major phases. The first one concerns the study of employees' needs and uses, for remote collaborative work. In order to capture the needs and uses, we conducted two surveys: first, a qualitative study based on 47 semi-structured interviews and second, an online quantitative survey with 553 individuals. The object of this phase is to highlight the kinds of remote collaboration in order to make recommendations related to the design of the platform. The results are published in the report "Work, socialize and collaborate remotely" [5]. The

main preliminary results of this report focus on how to socialize in a context of teleworking, the question of remote management, and of the technical skills needed for the use of ICT. The recommendations focus on the access to digital resources, the business information systems, and on issues related to security.

The second phase of the project focuses on the technology. It is divided into two parts. The first part consists of the writing of functional and technical specifications of the platform WITE2.0. This document contains descriptions of service needs, and a comparison of various existing virtualization solutions. We notice that, since the launching of the project WITE 2.0, some other virtualization solutions have appeared on the market (Citrix, etc.) [10]. Through the comparison of different solutions, we highlight the distinguishing features and the technological services of the platform WITE 2.0. The second part of the phase 2 includes the implementation of all the technical elements necessary for the platform WITE2.0. These technical elements include the virtualization, the development of a socialization software solution, the services integration, the development of a unified software, and a beta testing of the platform.

In the third phase, the project partners have introduced new technological elements for the components and voice applications, the mobile profiles, and the SIP recorder.

C. The virtualized workstation

The major technical element of this platform is based on the virtualization of information systems (IS). The workstation virtualization solution that we are interested in is also called the "PC on demand."

The virtual workstation *displays* a virtual image on the user workstation that is *executed* on a remote server (not virtualized). This technology has several advantages (the list is not exhaustive):

- Centralizing logical components i.e. the operating system (Windows or Macintosh) but also applications (such as Word, PowerPoint, Skype);
- Checking the lifecycle of workstation: One can decide to create or delete virtual PC on demand);
- Managing storage resources: as the main storage element is no longer the physical position of the hard drive on which the employee works;
- Access to a virtual portal: to recreate a selection of applications (i.e. a library of applications) each time the PC is created, and customized for each company;
- Access to an individual virtual PC guaranteeing better mobility management of the employee (the employee creates and destroys the PC to the demand for mobility).

Virtual workstations will address a number of challenges compared to "ordinary" workstations (especially at the administrative, security and deployment of machines levels). Virtual machines, for example, can decrease functional costs (maintenance, etc.), and technical problems

such as obsolescence of the workstation. With VDI architecture, the ISD has no longer constraints related to maintenance and administration of its fleet of workstations. The user is no longer dependent on a single physical computer and can connect to his "own PC" from different physical devices, even from terminals like thin clients.

Hence, virtualization is an already existing technology. The value of the WITE 2.0 platform is to combine this existing technology with a collaborative tool (unified communication). The aim is actually double: in one hand, to reduce (or eliminate) the problems due to data security, and on the other hand, to improve the level of collaboration between employees.

III. A SOCIO-TECHNICAL STUDY

A. What about "remote collaborative work" ?

In a context of managerial culture based on "face to face", the new paradigm of mobile work does not seem to establish in French companies. Some forms of work organization are deeply rooted. Some managers and IT system directors still reluctant to introduce new developed technologies because of the security of the data circulation. Our bias is to say that the paradigm shift can take place now if we take into account the issues of teleworking in "sociological" and "technical" terms: hence, the importance of analyzing the practices of work organization and use of ICT, and also the experimentation of the virtual platform.

B. What is teleworking ?

In our analysis, we are interested in a key notion: the concept of "teleworking" that we have considered in its most classic form (the homework), but also in the most diverse realities that it could be today: either, all forms of "remote working", i.e., forms of organization and / or performing work outside the classical unity of time and place. Indeed, many studies emphasize that the unity of time and place that characterized the traditional organization of work, would tend to disappear [2][3][4][6].

Thus, the definition of teleworking that we have selected is based on:

- The fixed place of work or alternating between several workplaces, provided they are removed from the hierarchy and/or colleagues;
- The relationship to the employer and colleagues, remotely and by electronic links, thus justifying the name of teleworking [8].

C. Methodology

The first results presented in this paper are based on a qualitative analysis approach. We have particularly studied the practices of coordination and cooperation in various configurations of remote work, more specifically in management practices supported by different communication technologies (fixed or mobile). We believe this kind of qualitative study is the most relevant because we make a statement about teleworkers' practices. As the virtualized

and unified platform technology is designing, we have realized that we actually had little knowledge about the current technologies' practices' realities. The classic typology of the four kinds of teleworkers – homeworkers, mobile workers, telecenter worker, virtual team worker [1] - should really be evolved. We have decided to question the realities of the teleworkers' practices to understand the evolution of the work organization et to link the technology to specific uses (or link uses to specific technology). Hence, we have thought that the most equipped teleworker will be the most graduated (with the most responsibilities). We have discovered that the uses of mobile ICTs evolved in a very paradoxal way.

During the operational phase of the study, from May to July 2011, 47 interviews were conducted face to face with workers performing work remotely. Our sample of interviewees was compiled from relays (managers and human resources services of companies).

These interviews, lasting an average of 1:30 each, were the subject of subsequent detailed accounts.

The sample is constituted with different profiles of employees. In our analysis, we specially separated three kinds of profiles, regarding the level of the management's activity:

- The entrepreneurs: they are supposed to be very autonomous in their work, self-managed, and often have their own company.
- The executives and intellectual professions: Graduated employees (engineers, etc.), they always have employees to manage. Relatively autonomous, they sometimes have to report their activity.
- The associate professionals and employees: Executives manage them. They have technical activities.

Spreadsheet 1: Sample

	Homework	Alternating homework	Mobile worker
Entrepreneurs	2	2	2
Executives and intellectual professions	1	17	14
Associate professionals - Employees	2	4	3
Total	5	23	19
Women	3	8	4
Men	2	15	15

D. First results of the analysis

The first results of the analysis cover various aspects of remote working of the surveyed employees:

The articulation of private and professional life. Moreover, a phenomenon seems banal, the activity overflow telecommuting seem becoming more and more important. This form of teleworking involves a regular work

done outside of the official working hours, most often at home. These activities are mostly related to checking and reply to emails. People build tactics to separate private and professional spheres. They are based, for example, on partial *reachability* over the mobile phone. People choose to disconnect and not to check their telephones after a defined period. This strategy is the most intuitive. But, some people choose to disconnect their mobile phone to work at home without being disturbed every time. Some of the interviewed said that it is difficult to concentrate on doing a task when:

- they are at the office (colleagues interrupt them all the time, or there is lot of noise, etc),
- they are at home when the mobile phone is switched on (or even when just the Internet is connected).

Forms of remote "socialization": social networking tools seem to be effective. This proximity can develop communicative relationships of trust, explaining in part the stability of the worker community [7]. For example, the unified communication and the social media, that employees use, seem to be very convenient. They use to talk to each other through the *chatrooms* without ever see each other in real life. They become friends in other social media (Facebook, etc.) and they develop a real relationship of complicity and friendship. It's difficult to say if this relation is also based on trust.

New forms of remote management: ICT are, for certain categories of workers, as a digital control infrastructure, replacing the physical presence of the manager (control connection time, obligation of permanent reachability via the mail or instant messaging). The current technology controls very well the activity of the employees. The managers can hear the phone calls between employees and clients without the employee's knowledge. In this case, the statut of presence and the activity on the chat are essential to prove that the employee is working.

In other cases, some managers construct tactics of "motivation" by using ICTs as a lever of the collective dynamics (*Chat* between colleagues).

Skills development: It appears that many people working remotely learn to use ICT more or less on a mode "self-taught", "on the job". Some of them practice forms of "tinkering" computer, as the diversion of scripts use of some business applications, etc.

Analysis of current technology: current technology does not allow to maintain conditions comparable to those offered in the premises of the employer. Sometimes, these conditions are not reproducible. In this case, the employee is forced to fragment his work activity. He will assign, for example, specific tasks to places where he works according to the possibilities offered by his work environment. Furthermore, this segmentation may come from the desire to choose a specific work environment, quieter and less disruptive than in the enterprise to perform tasks requiring more concentration.

Based on the results of the qualitative study, we suggest some recommendations for the WITE 2.0 platform:

- Firstly, the WITE 2.0 platform must be integrated in the IS of the companies: a lot of interviewed workers practice some "tinkering" because of the restrictions of the IS of their company. Workers want to access to the tools that they need, without having problems with the technical services.

- Secondly, we suggest adding some filters to specify the time of reachability and the time of disponibility. A lot of workers are often disturbed by their colleagues during their activity; because the colleagues do not check if they are busy or not (at the office and, also, at home by ICT). These filters could be used for teleworking and for presentiel working ("I check if my colleague is available before disturbing him in his office").

- Finally, we suggest to labeling the information flows received everyday. We propose to label these flows in function of the emergency of the data, the nature of the data, the working group which is concerned, and the person who send the data, etc. For example, email box could be integrated to the social media as a secondary function and people could juggle with different media (chat, email, timeline, etc) subject to their needs.

IV. DISCUSSION AND CONCLUSION

There were several configurations of "remote working" that we observed that changed our usual representations of the "teleworker." We propose here three "stereotype" representations.

First, the figure of the teleworker, exclusively at home, whose teleoperator is an ideal-typical figure. He uses a desk in a corner of the room or the bedroom, not in a room dedicated solely for homework. However, the boundaries between private and professional life are maintained due to strong control of his activity by the ICT. In fact, ICT is, for him, a "control infrastructure". Despite of the physical distance, hierarchy is near: hours are controllable via the use of ICT, including instant messaging to verify that the teleoperator is well behind his computer. The remote control via ICT is like a substitute of direct managerial control.

Second, the figure of the mobile worker who sometimes works at home. ICTs provide a permanent reachability that does not always correspond to their availability. Technologies act as strong regulators of space-time job. On the contrary, the executives act more like disrupting their working space in confusing the virtual presence status (reachable / available). Sometimes, the mobile worker can be considered as a "techie" worker, clamped in his uses of ICT.

Third, the figure of the worker in a co-working space or in a telecenter: with a high degree of autonomy in organizing his work, the worker uses this structure to "frame" his activity (immerse himself in a group is a way to put boundaries between private and professional spheres), but also to densify his socioprofessional network IRL (In Real Life). The worker in a co-working space will tend to regulate his working hours, helping to build boundaries between private and professional spheres. He can also use the dynamic shared places to gain in competence, although it is

usually relatively independent with technology (although this may evolve with the growing phenomenon of collaborative workspaces).

The precise definition of teleworkers is difficult to establish, as the profiles are varied and the situations are diverse (new working configurations including practices of re-sedentarization activity). The characteristics of these new positions (the nature of risks, for instance) question both at the managerial level (the hierarchy acceptance) and technical level (the ISD acceptance). They also question the employees themselves who sometimes try to make self-regulation. Embedded in a double paradigm (technological and organizational), teleworkers seem to evolve in unexpected ways, even paradoxical. In order to understand the realities of working remotely, one is asked to investigate the tools for teleworking in their collective aspect of interaction management, the security of sharing data and the practices of professional social tools. The technical characteristics of these tools are revealed only through the "remote" collective dynamics and vice versa.

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