Socio-Technical
Design of Knowledge Work & IT
A Case Study

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ABSTRACT

This is a case study of a public insurance company's conversion of long-standing paper-based work processes to an electronic document management system, "E-File", with imaging, data integration, and automated workflow. Simultaneously, significant redesign occurred in jobs and organization structure, business processes, and people development. The E-File experience is an imperfect but powerful illustration of the challenge and potential of designing social and technical elements of knowledge work concurrently and interactively. The hypothesis of a "socio-technical" approach to "jointly optimize" the potential of information technology, while achieving positive potentials from organization design to up-skill jobs, was validated by an outcome where over 90% of the highly skilled employees surveyed in this white-collar organization regard the new "E-File" system as a substantially positive change. Innovative job and organization structures have also maximized the business potential of the technology, in helping to develop a customer service culture. This longitudinal study and project was developed within a framework of action research to illuminate human dimensions of information technology in relation to knowledge work, and to help manage the change process.

Keywords

Case study, information technology, knowledge work, socio-technical design, labor-management consultation, user participation, technological change, action research.

INTRODUCTION

The Electronic Claim File ("E-File") system was custom-developed for the claims adjudication and compensation division of a public insurance corporation, the Workers' Compensation Board (WCB) of the province of British Columbia, Canada. WCB employees' primary task is to gather information, weigh evidence, and apply specialized knowledge to make complex decisions about workers' injury compensation claims in a wide variety of industries.

An important part of the context for this work change has been a technological and organizational change consultation process established contractually between the WCB and the Compensation Employees' Union (CEU) representing the 1200 hourly employee E-File users.

The conceptual framework used by the parties involved a "whole systems" approach that views work organization as an open, socio-technical system (Fig. 1.) [3]. The challenge has been to make change comprehensively, and to jointly optimize the various dimensions of the work organization.

Figure 1. Socio-Technical Dimensions of Work Organization
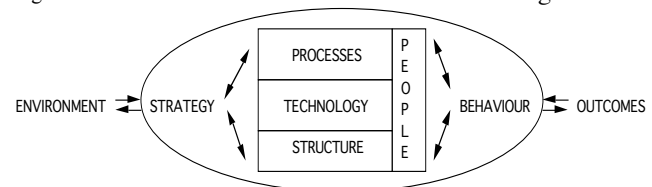
Procedures

The case study reported here is a by-product of the consultation process. As an independent external facilitator to the process, the author of this study conducted a series of before-and-after surveys and in-depth interviews, sanctioned and used by labor and management, to help them monitor impacts of E-File on the employee population, during the stages of pilot testing through to and after implementation, over a seven-year period, 1995-2002.

The surveys and interviews addressed four main content areas from the perspective of the E-File users:

- *effects on work processes*, for example, accessibility of information, ability to answer client inquiries, timeliness of decision-making, security of files, etc.;
- *effects on job aspects* such as control over one's own work, ability to help co-workers, workload and work-related stress;
- *software and hardware user-friendliness* in readability of screens and other ergonomic considerations, quality of document indexing, system speed and reliability; and,
- *competence and knowledge* in using the new system.

Ongoing assessment of user perspectives was completed as one research component intended to influence the systems design. Labor and management representatives regularly evaluated the survey and interview findings, along with their anecdotal, experiential perspectives, to help them plan and manage the systems changes.

BACKGROUND

Systems change in the Workers' Compensation Board had a very "mixed" impetus. In the increasingly service-conscious world outside, pressures had been building since the beginning of the 1990's. There were cries from injured workers and their representatives about "deteriorating service". For example, the "timeliness" of payment on claims from the date of injury was as high as an average of 45 days in early 1994. Employers and other stakeholders complained about "rising costs" for Short-Tem Disability benefits, approximately 10% per year. On the other hand, there were several "false starts" in efforts to address these issues, most notably, a proposal for "imaging" technology in 1991, which the union (CEU) and other parties successfully discredited.

Problems accumulated, culminating in what the WCB Senior Executive termed as a "service failure" in early 1994. Behind the scenes, a senior business planner in the Information Services Division of the WCB sketched out a proposal for an Electronic Claim File (ECF) System that would be more data-based than simply "imaging" technology. With a few colleagues, she developed a very rudimentary ACCESS prototype.

Quietly, in September 1994, the ECF concept received approval from the WCB Senior Executive Committee. On the initiative of a member of the senior executive, a seminar was convened of senior management and union leadership to review print and video documentation on participatory design of technology and work organization [1, 4, 6, 10, 11]. At this time in November 1994, the Compensation Employees' Union was also given information about the "back-room" ECF project. Based on shortcomings identified with earlier "imaging" technology, the union leadership was very concerned about this new development. Then, when the project was announced to the full union membership, many employees became extremely "fearful". Most had little or no experience with personal computer systems. Their work had always been based in a world of paper files.

The Business Case for Change

The Electronic Claims File Project was established in March 1995 as a joint venture between Information Services (ISD) system support and Compensation Services of the WCB. Most importantly, final project oversight rested with senior management of the line business, Compensation Services, for which the Electronic Claim File (E-File) project was the "cornerstone" of a Service Delivery Strategy (SDS).

The strategy component of this organization design was itself, "socio-technical" [2]. SDS had 3 concurrent objectives. (1) *Customer Service* was expected to improve through better "Timeliness" of claims payment, and improved response to client inquiries. (2) *Financial Savings* were projected through improved workflow, cost management information, and reduced Short-Term Disability (STD) duration (average days of STD benefits paid on a claim). (3) A *Better Working Environment* for WCB staff was sought through a skill-enhanced workforce, and reduction of routine activities such as paper filing. This "three-pillar" approach also posed **the fundamental action research question** shared by the stakeholders, which was how these 3 objectives, of questionable compatibility, could all be achieved.

The intent was to replace a linear, paper-based claims processing system with a state-of-the-art system of electronic document management and electronic workflow. Productivity gains were expected insofar as key claims information would be received by the WCB via electronic transmission. Physical handling of files would be minimal or non-existent. Furthermore, the new system was to remove old bottlenecks due to competing demands among staff for each claims file. Information would now be accessible simultaneously by multiple users, thus enabling more interactive and efficient claims administration. The intention was to integrate the system with new business processes and a realigned organizational structure.

E-File was very much an "infrastructure" project, seen as the first step in building a holistic information highway or platform for many future functions in the WCB. In more dramatic terms, E-File was viewed by many of its proponents as a "catalyst" that would "revolutionize client service delivery" and "shift the organization culture to a service versus an enforcement orientation".

Union and Management Consultation about Technological Change

Key members of WCB senior management understood that the success of the Electronic Claim File project would depend very much upon the willingness and ability of employees to develop new skills and work practices. Thus, management wanted to dampen fears that could interfere with a commitment to change. Therefore, in the summer of 1995, the WCB and the Compensation Employees' Union negotiated a provision into the collective agreement for employment and wage (not job) protection of staff affected by the introduction of technological change. (Note: The workforce could still be reduced over time by attrition.)

Over 75% of staff (in a later survey) confirmed that the provisions for employment protection made a positive difference in their acceptance of E-File. The agreement appeared to send a message that people would be given time and support to learn the new systems. It also made it more possible for union and management to focus on how to make the new technology and organization work.

A significant part of the collective agreement is a requirement for management and union representatives to hold, within a specified time period, "constructive and

meaningful consultation *in an effort* to reach an agreement on solutions" to any problems arising or anticipated from intended change in work technology, organization or procedures affecting a significant number of employees.

From the establishment of a "Tech Change" forum in the fall of 1995, the parties went beyond the strict terms of the agreement and met bi-weekly or monthly for *proactive* information sharing and problem solving. (To assist the consultation process, the parties employed the author as a mutually agreed upon facilitator.) Proactive consultation in this forum was initially a challenge for both the CEU and the WCB, which had experienced several years of strife after a strike in the previous contract negotiations.

Although final decision-making authority rests with WCB management, and despite instances where its advice has not been taken, the union and the "Tech Change" forum have exercised significant influence. As new work roles and organization structure were developed concurrently with the new information technology, union and management innovated transition processes that avoided time-consuming postings and declaration of surplus staff. Throughout the life of the E-File project, the "Tech Change" forum guided and encouraged substantial (user) participation of employees in the detail of system and organization design.

DEVELOPMENT OF THE TECHNOLOGY
Since 1989, WCB staff had become accustomed to a Legacy system. "Dumb" emulation terminals linked to a mainframe provided only for e-mail messaging, claims registration, and rudimentary file tracking. This technology could not enhance changes to business processes, nor could it provide timely information about costs or any other aspect of the business. Moreover, it was clear by the early '90's that not much would be gained by simply "imaging" technology (that could only translate print material into a portable electronic image).

What was now proposed was a distributed data system. This would break from the mainframe tradition with which the WCB Information Services Department (ISD) was familiar. However, a network infrastructure with LAN communication protocols was expected to provide faster response time. The system would include imaging software, but essentially, it would be a data-driven system with automated workflow and data integration capabilities.

A "Proof-of-Concept" (POC) System
From March to November 1995, Compensation Services' senior management established a project team composed mainly of external consultants to build a "Proof-of-Concept" (POC) system from off-the-shelf products. DOX was the document management software product used to capture, store and retrieve electronic documents. (After the scanning of print documents, the images were stored in a database, from which several users could simultaneously retrieve and view these images on their individual monitors.) FloWare was the other main component software product, used for automatically routing or transferring electronic files, based on a predefined set of business rules.

Meanwhile, internal ISD staff concentrated on development of several "bolt-on" tools such as an interface to facilitate interaction with the existing mainframe system. ISD staff also set up the desktop workstations, (IBM Pentium PCs running Windows 3.1) linked to a UNIX server in the WCB central administration building. On November 27, 1995, a small number of WCB staff went "live into production" with the POC system in a "pilot" Service Delivery Location (SDL) in the Coquitlam suburb of the city of Vancouver.

The 35 employees in the Coquitlam SDL had been given the option of relocation if they did not wish to be part of the "pilot" office. Most chose to stay. Unlike many of their cohorts, Coquitlam staff really wanted this new system to work. They had visited and were "awestruck" by a paperless claims office in the state of Washington, USA. However, staff involvement in design of the POC was extremely limited because of time and resource constraints. Thus, they were "surprised" or "horrified" when the POC system that was delivered in November 1995 seemed to be "so far off" what their work required.

The problems were not a surprise to the project team. DOX could not deliver the level of functionality required, and there were obvious shortcomings like no facility for multiple document viewing. Due to the seriousness of these issues, and with encouragement from the "Tech Change" forum, a business case was developed in December 1995 to build a "home-grown" replacement for DOX, namely, a customized WCB "E-File" System. Some would say the project team should have persevered and made DOX work. Others contend the decision saved the organization from digging itself into a technical "sink-hole".

First, however, the project team had to deal with all the pain of the users struggling with the POC system. Staff in the "pilot" office filled out reams of "purple sheets" that documented issues for "fixes" that were eventually installed in a series of POC Enhancement releases. Systems analysts were located in a training room adjacent to the "pilot" office, and interacted regularly with individual staff in response to their suggestions. Up to 20% of staff's time was now devoted to participation in systems development.

The "proof-of-concept" DOX system turned out to be something of a prototype, and even if it occurred by default, the extended time period devoted to prototyping enabled a high level of user participation and ensured that the choice of basic system design was appropriate to the business, and indeed, was a choice, and not a given.

E-File Phase One "Pilot"
The real test of the practicality of an electronic claim file was only now about to occur. It was a miracle that Phase One version of E-File was built, both so quickly, and also, by mainly internal Information Services staff who had never designed such a complex project. Moreover, users had substantially more involvement in development of E-File than with the POC system. One day per week for 6 months, a group of line managers (from the 'pilot" office and from across the WCB) met with the project leaders to vet detailed design proposals, and to ensure that what was being developed was appropriate to business needs.

Staff in the "pilot" office, who had earlier been viewed as having limited knowledge of electronic file systems, were now quite experienced, unfortunately, by their struggles with the POC system. Partly by default, staff had significant input ("purple sheets") through all of their POC issues and suggestions, insofar as the core of E-File Phase One was re-writing the DOX application.

Then, in late spring of 1996, once-a-week JAD sessions were initiated between ISD staff and POC users in the Coquitlam SDL. In June 1996, a "Users Group" was formed of some hourly employees from the "pilot" office and from other WCB offices. The sessions began with brainstorming at a high level about "all the things we want" for a new system. (For example, staff proposed the concept of a chronological claim log, like the memo section in the old paper file.) Then, over the summer of 1996, developers built the components of the system.

This "collaboration" between users and systems developers had tensions, but was not tension-filled. For example, in September '96 when the hourly employee users, (now referred to as members of a "Business User Group"--BUGs) were called back to review a "design document", they were presented with a "log" entry format that could hold only 255 characters. The feeling of users was "where did these ideas come from?" Eventually, Phase One of the new system would be released with an expanded "claim log" format. However, this situation was symptomatic of a tendency for users and ISD personnel "to speak different languages". Eventually, users learned to provide more detail in their requests, and for their part, ISD personnel provided more prototypes or "sketches" of their solutions.

Meanwhile, time was perceived by senior management to be of the essence. In July 1996, the WCB Board of Directors had approved implementation of the new software system and expected its installation in the "pilot" office before the end of the year. In what ISD personnel referred to as a RAD process, staff in the Coquitlam "pilot" office were now regularly pulled away from their desks to a large room upstairs in their building, where they evaluated prototype screen layouts for the new system. Meanwhile,

the BUGs were working full-time off-site to develop test cases to run on the new system.

By this time, staff in the "pilot" office had assumed considerable "ownership" in the development of the new E-File Phase One system. In surveys regularly taken under the auspices of the "Tech Change" forum, they requested that they be allowed to evaluate Phase One before the E-File system was "rolled out" to their peers in other offices.

As promised, E-File Phase One was installed for evaluation in the "pilot" office on December 2, 1996. In the estimation of staff in the "pilot" office, E-File Phase One was a very definite improvement over the POC system. Thus, in late spring of 1997, a start was made on the rollout to the rest of the organization of an enhanced version of E-File, one year later than anticipated, though almost precisely on budget.

DEVELOPMENT OF CONCURRENT CHANGES
Although the E-File project began as a technological innovation, it was part of a "whole systems" perspective. Very quickly after the start of this project, job and organization structure changes, business process improvement, and new training programs were developed concurrently with various phases of E-File system design. This relied upon a high level of coordination (Figure 2.), by senior management in Compensation Services, and de facto through the "Tech Change" Forum that regularly brought together persons responsible for diverse dimensions of the whole system design. As well, each group responsible for a particular dimension of the overall design sought to involve in their own planning, "delegates" from other teams or departments. This was an imperfect but vital process.

Figure 2. Coordination of "Socio-Technical" Design
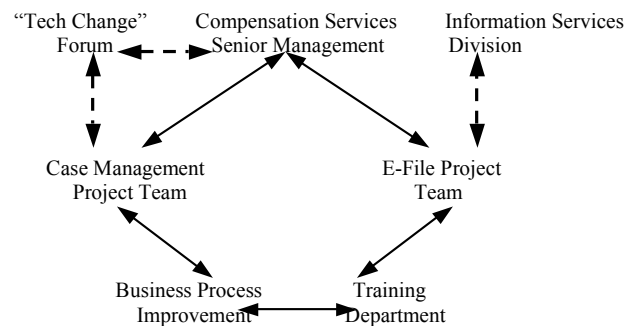
Job and Organization Structure Changes
E-File Phase One changed Compensation Services' business processes and workflow (Figure. 3.), which also created a need and opportunity for changes in job structure. While some "old" tasks were phased out, (for example, paper filing done by File Clerks), pre-existing tasks could now be re-organized into new roles such as a proposed Client Service Representative (CSR) function.

Figure 3. Workflow (After E-File Implementation)
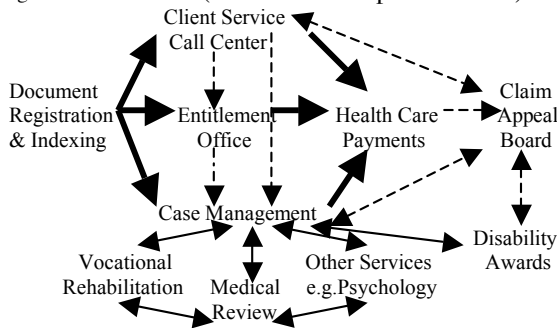
In working with the "pilot" office, the E-File project team had anticipated these impacts, but with a very sketchy concept of how to accomplish the joint objectives of improving customer service and to "up-skill" jobs. The proposal was for the employees in a new computer-aided CSR position (now, with more immediate and accurate information) to answer many of the phone inquiries previously handled by Phone Control Clerks, plus do some of the administrative work of Case Assistants. CSRs were also to adjudicate non-complex claims previously handled by first-level Claims Officers. The multi-task nature of this proposed new role created real job design challenges.

Under the mandate of the "Tech Change" forum, employees in the "pilot" office did an analysis of issues in the work process and developed their own job design proposals that significantly enhanced the original concept for the Client Service Representative role. CSRs developed among themselves a "task" rotation between the "phone control" activities of handling incoming telephone inquiries, and the processing of non-complex claim files.

The organization structure for these jobs was also changed. Beginning in the spring of 1997, simultaneous with the phased rollout of E-File, all of the CSR positions serving 17 Service Delivery Locations were centralized in 4 Call Centers. This change in the organization structure was based upon an analysis of variance in staffing requirements to meet fluctuating claimant inquiries, along with a desire to reinforce consistent training and development of new business practices. Since most document registration feeds directly into the CSR function, centralized Operations of Scan and Index, claims registration, and mail distribution were also developed or moved into these 4 hub locations.

Then, on a trial basis, in the summer of 1997, Officers handling adjudication of most complex claims for 6 Service Delivery Locations in the most populous region of the province were moved into one central "Entitlement" Unit. This was a contentious re-structuring undertaken by senior management, contrary to an analysis done in the "Tech Change" forum, (that suggested entitlement decision-making was more closely tied to the newly emerging case management function decentralized in the regions).

The issue of where and how to draw organizational boundaries in the overall processing of injury claims was, however, resolved with the benefit of experience from this trial. Eventually, the organization adopted a decentralized structure for the complex claims Entitlement function. This happens to be an organization structure that is enabled by innovative use of the "E-File" system. Consequently, many staff moved to new Area Offices, located for direct contact closer to the geographically dispersed client community.

Throughout this same year of 1997, under the watch of the "Tech Change" forum, staff members in one Area Office participated in a major organization design experiment for which "E-File" was the information technology platform to expand (not just enhance) the work of the organization. Employees were asked to prototype new work processes and design new job assignments for "Case Management". Although it involves entitlement of some claims, this new organization structure places a heightened emphasis on injured workers' rehabilitation and return to employment.

Using the information and network capabilities of E-File, knowledgeable WCB staff can now intervene in the diagnosis and treatment process, supplementing the work of attending physicians and therapists. The system facilitates, and new work roles of Case Manager and Team Assistant consolidate interdisciplinary collaboration among Medical, Voc Rehab and other specialists internal and external to the WCB to expedite injured workers' safe return to work.

Unfortunately, this experimental process re-engineering and job design done very effectively by staff at the "back-end" of claims handling could not be fully integrated (until much later) with the development of the E-File system. Thus, when the new work roles were introduced across the organization, many staff members struggled with an E-File system that required them to do duplicate data entry, all the while they were learning their new job responsibilities.

Work roles and organizational boundaries have generally become more permeable, and even temporary, as the E-File system has matured. For purposes of "load balancing" and serving special service needs, work now moves to the worker and to specific expertise, rather than the worker moving (location) to pick up the work.

Business Process Changes
A constraint on the project from the very beginning was that there had been no detailed mapping of business processes to inform systems design. As in many white-collar workplaces, Compensation Services had a lot of implicit business rules and "idiosyncratic" work practices that had developed over the years in the paper world. Yet, frustration was so great with previous aborted efforts to sort out these issues that there was "no appetite" to start the E-File project with an analysis of business processes.

Nevertheless, a commitment to standardize and formally document E-File business processes and rules became necessary, once E-File was extended beyond the "pilot" office. The issue was made obvious, when different users in different offices put the same information in different locations within E-File, thereby jeopardizing a main objective of the new system, effective collaboration among co-workers with simultaneous access to files.

Ironically, in most of the period while the E-File system was being implemented, one key aspect of business process did not change—active and re-activated paper claim files did not disappear, and even grew in volume. If employees had a choice, they concentrated on the E-File claims, to the disadvantage of prompt closure of paper files. Lack of an effective strategy to deal with "old" paper-based work would have a substantial negative impact on initial, overall productivity in the "new" world of claims processing.

Training Systems

Not only did staff members have to learn an entirely new medium in which to do their work, but many of them had also to learn a new job, perhaps in a new office location. These challenges for recruitment and training were not so apparent until 1997, when E-File rollout began.

In the "pilot" office, the managers were very computer literate and knowledgeable about E-File, and users learned a great deal just by their months of involvement in POC and E-File systems design. By comparison, in the "rollout" offices, PCs were made available six weeks before E-File installation, with an external contractor to train staff and managers alike in basic PC skills (e.g. Windows NT, Word Processing), and basic E-File application training.

The intention was that job specific training would be done on-the-job by the user representative BUGs. Thus, one or two members of the Business User Group (BUGs) were assigned to each office to which E-File was rolled out. Nevertheless, within 2-4 weeks after initial training, the BUGs often had to abandon the office in which they were mentoring, to prepare for the next office in the rollout or to contribute to ongoing systems development for which the BUGs were always key resources. The fortunate offices were those that had staff who were "super-users".

Once E-File was up and running, even "super-users" had difficulty supporting the ongoing training requirement associated with the many E-File enhancements. Changes were usually announced to staff via e-mails that they had neither the time nor the ability to understand.

The competence that a majority (85%) of employees achieved with E-File is mastery of the very basic system functionality. Staff has not had the time to learn or keep abreast of the many short cuts, and infrequently used but powerful enhancements added to the E-File system.

In response, under the aegis of the "Tech Change" forum, two users were appointed (in an 18-month rotating assignment) as Technology Officers. Ongoing, one-on-one peer mentoring and trouble-shooting provided by these Technology Officers has been evaluated by staff and managers, as the most effective form of E-File training.

Overall, the cumulative effect of E-File system changes, new work roles, and the "churn" of employee re-location to accommodate the organization re-structuring has severely challenged training and staffing resources. It has been an uphill and only gradually improving struggle for a training department to meet staff development needs.

PEOPLE'S EXPERIENCE OF WORK WITH E-FILE

What follows are highlights of findings from interviews and surveys conducted during and post-implementation with front-line WCB employees, asking about their experience in working with E-File. On an ongoing basis, the "Tech Change" forum has reviewed these findings, to understand the deeper human impacts from the new information technology, and then, make or encourage adjustments in technical systems and work practices.

At the conclusion of three years' experience with E-File, 91% of staff reported that, all things considered, the E-File system is better than a paper-based work process. For all categories of staff, immediate accessibility to claims information outweighs any specific concerns with E-File.

Accessibility of Information and Being "In Control"

Compared to the days when, for example, a Vocational Rehabilitation Consultant would "lose" a file to a Medical Advisor who needed it right away, staff in all roles see a substantial benefit in having the electronic claim file "always at hand". There is, however, for some staff, a side effect of being "overwhelmed".

Because each staff member can see messages, memos, and new documents coming electronically onto the file virtually every day and many times on each day, there is a tendency to feel that one must deal with all of this information right away. Before E-File, there was less of this documentation, and much of it "moved in the background" where a Case Assistant or File Clerk would stuff a memo into a paper file unbeknownst to an Adjudicator or Medical Advisor. In the words of a WCB Case Manager, a person has to be very "self-controlled" to work effectively in this environment. Otherwise, "the system manages us" via a visible "stream" of daily messages, actions, and new documents on file.

An "information overload" effect can occur in another way. In the paper world, many of the files in one's active caseload would be out of the office, while another Officer worked on the file. Now, with E-File, in the words of some staff, one's entire caseload is "screaming at you" every day.

What for some staff may be "information overload" is for other employees a means to anticipate what needs to be done on a claim file. According to staff, the key is "desk management" skills. The organization has learned it must provide training for these skills that, in the E-File world, are even more required than in the paper world.

Scrolling Screens vs. Flipping Pages

Approximately half of workers in those functions that deal with long duration and more complex claims, (with numerous and lengthy documents) find E-File to be more difficult than the paper medium for claim file analysis. The difference with the other half of workers in these same functions, who *seldom* feel a need to printout documents for analysis is explained by different individual styles of "cognitive processing", or by individuals' greater proficiency with E-File tools to filter and sort information.

Staff members say that to work effectively with E-File (vs. paper files) involves a different "mindset". Some staff are able to click from computer screen to computer screen to "develop a picture" of a claim in an electronic file. Other staff feel compelled to lay out a set of printed documents on their desk for "hands-on" cross-referencing. Psychologists refer to this as a difference in the characteristic ways that individuals organize and process information [5], and it affects both one's ease in navigating through an electronic system and the way one works with lengthy documents. The learning for the organization has been that, for some individuals, and for some "fat" files, an accessible printout capability is needed, even in a paper-*less* office [1].

Another factor complicating file review can be errors in the indexing of documents (e.g. incorrect date) at the "front-end" of claims processing. Also, when a Client Service Representative does not put subject matter references on log entries, or does not attach descriptive comments to a list of documents placed on a file, a Case Manager later in the life of a claim has to open each individual document and log entry. Because many staff have not been able to depend upon "electronic filtering" or "indexing" as applied by their co-workers, searching for relevant information can be time-consuming.

Standardization and Business Rules

Most staff members have come to understand that E-File has tightly connected individuals' work at different stages of claims processing, and that consistency in procedures for working with E-File, (e.g. rules for file documentation) is necessary in order to make the system useful.

This has been a tough issue, nonetheless. Claims Officers are employed to use their judgment in applying knowledge and analytical skill to adjudicative decisions. They prefer to exercise similar discretion in how they do their job. Therefore, E-File business rules (such as headings for log entries) may be taught but may not be "heard" by some staff. The value of some rules may be difficult to see for one's own use of an electronic claim file, (for example, detailed documentation of reasoning for a claims decision), but may be extremely beneficial for other claims Officers working in parallel or in later stages of claims processing. Enforcement of standards for data entry has been an issue. In fact, quality issues have generally become more apparent in E-File than with paper files where it was sometimes difficult to read a claims Officer's writing.

There is a tendency to believe that procedural issues can be simply resolved by building-in structure through templates, forms, and forced data entry. The dilemma for system designers has been that, while users may want simplification, when new forms are drafted, users will often say that a particular form will not work for them.

The E-File project has taken a gradual approach to the addition of forms and templates. This has been viewed generally as helpful, given that "background" business processes have been clarified, and that the user population has been consistently involved in Focus Groups to identify specifications and evaluate possible enhancements. To balance consistency and flexibility, users have been asked to identify what is minimally critical to standardize.

Personal "Touch" in an Electronic World

Only 20% of all staff find that E-File limits their ability to put a personal "touch" on their work. Nevertheless, some staff say they feel more "detached" from a claim in E-File. The claim itself feels more "institutional".

One visible difference is that "yellow stickies" are gone. "Yellow stickies" were reminders of work-in-progress, that used to be scattered throughout a paper file. However, staff have been creative with E-File, using an "actions" window like "a giant yellow stickie". Work-in-progress notes are filed as speculative actions, and if they eventually require no follow-through, the "action" item can be deleted.

Nevertheless, E-File has made it more difficult for claims Officers to undo memos. Generally, one's work on an electronic claim file is more "transparent", more open to constant review by one's co-workers. The result is both more "sanitized" information and more accountability.

Communication and Teamwork among Staff

E-File has also resulted in a degree of synchronization among staff. "Everybody is on the same page". People feel "more connected", since their actions on a claim file are visible to each other. Ironically, this "connection" among staff is achieved increasingly through electronic conversation (vs. personal communication), as people spend more time at their desks with their computers, instead of walking around moving paper files.

Over 75% of staff in all roles report that the multiple access feature of E-File has made it easier to ask colleagues (even located distances apart) to view a claim and give their technical advice, or to provide coverage for one another during short-term absences. What has also occurred is the "cumulative" effect of parallel processing. Different specialists like a Medical Advisor and a Vocational Rehab Consultant are able to "pick up" immediately where the claim log shows that each other's actions left off.

Yet, E-File has been an "enabler", not a "developer" of "integrative" teamwork [9]. Even though multiple access by staff to claims information assists preparation, the quality of meetings held by case management "teams" has been more a function of the leadership provided by staff and management in those teams. It is apparent that to develop "teamwork" more broadly will not be a product of technology, task-relatedness, or physical adjacency (i.e."open offices"). Distinctly human factors must be developed, such as consciously shared objectives and shared (versus hierarchical) leadership styles [8].

Incorporating Clerical Tasks into Knowledge Work
Prior to E-File, typing of reports, letters, and many memos was done by Stenographers. When E-File was rolled out, management expected claims Officers to use the computer to type their own documentation as much as possible.

Although many staff members were initially concerned about their typing skills, less than 20% of staff now believe that a lack of typing skill detracts from their efficient use of E-File. Those people whose typing skills may not have improved have compensated by reducing the length of their data entries, (i.e. two lines versus two paragraphs), which has created a quality issue in some cases.

What remains a question is whether typing duties are a good use of Officers' time. There is staff on either side of this debate. Overall, a higher percentage says that typing their own memos and shorter documents enables them to be more proactive, more responsive with clients and co-workers, and more efficient in not having to refresh their memory after a proof-reading draft returns from the steno.

Most staff would agree, however, that the volume of data entry into E-File is greater, (as opposed to the number of memos filed in paper form). There is more e-mail type messages exchanged between staff working on the same claim file. There is also more phone contact with clients, and thus, more telephone messages to record.

If the computer can be "big boss", the telephone can be "little boss", "driving" some claims Officers to "distraction" with telephone "interruptions". With E-File came elimination of the position of Phone Control Clerks who used to screen calls while Officers hunted down the required information. Now, Officers can respond directly. However, voice-mail and IVR technology have, as yet, been only part-solutions to help with "call management".

What Compensation Services staff take satisfaction from is the much greater ability that E-File affords them to answer claimant, employer, and other stakeholder inquiries. Over three-quarters of staff in all occupational roles believe that E-File has contributed to a stronger service orientation, enabling staff to be more involved in ongoing management of claims and coordination of services for injured workers.

Cubicles and other Ergonomic Issues
One-third of all users report having experienced eye or vision problems that they feel are related to their work with E-File. The percentage is higher among occupations requiring a more continuous focus on the computer screen, like the role of Client Service Representative (CSR).

Employees acknowledge that a WCB ergonomic specialist will usually respond "at a moment's notice" to any reported problem. However, neck, shoulder, forearm, and hand strains that are not always reported as injuries remain as bothersome "ailments". Employees believe that regular ergonomic audits should be done proactively, since people get into bad posture and work habits. Employees are aware that they should take periodic breaks from the computer, (as reinforced by provisions in their collective agreement). However, it is very easy to "get caught up in work". The computer can "draw you in, like a drug". One Entitlement Officer has discovered that the only solution for her is to have an alarm clock that reminds her to take micro-breaks and rotate her shoulders, etc.

For other employees, the greatest ergonomic issue is office background noise and lack of privacy while working in cubicles. What aggravates this experience is that many Case Managers had walled offices in the paper world. Moving into cubicles was the most unpopular aspect of conversion to E-File. In the words of one employee, "it is like living in a box, looking at another box".

At least one potentially stressful ergonomic issue has, however, been avoided in the E-File environment. Union and management in the "Tech Change" forum resolved early on that there would be no "silent" remote monitoring of telephone work performed by CSRs and other staff.

System Information for Management and Workers
Managers do generally believe that E-File affords them much greater ability to "manage" through monitoring and adjusting workloads and workflow. E-File also provides up-to-date performance data and trend information. In fact, there is too much information. Managers would prefer that system data be condensed into a consistent, smaller "dashboard" display.

Once there is sufficient historical data with E-file, there will also be available to both staff and management on-line, "best practice" information showing recovery patterns for various treatments of different types of injury.

OUTCOMES FOR KNOWLEDGE WORK
Service Indicators
Consistent with claims Officers' experience of their improved ability to answer client inquiries, independently conducted client satisfaction surveys have regularly shown 80% client satisfaction during the post E-File installation years, as compared with 70% or less in prior years. Surveys indicate that future gains are also possible insofar as E-File enables large employers (e.g. food chains) and whole industries (e.g. mining) to have a "single point of contact" for work locations scattered across the province.

A very important measure of service is the average number of calendar days that it takes a claims Officer to make a payment to an injured worker on an accepted claim. This timeliness of payment has been reduced from 22-28 days in the pre-E-File period of the 1990's, to a fairly consistent average, during the years 2000-2003 of 16-19 days.

Productivity Outcomes
One of the key productivity and financial objectives of the E-File and its related project activities has been reduction of Short-Term Disability (STD) claim costs, including wage loss, rehabilitation and health care costs up to the time of the injured worker's return to work.

Contrary to the original justification for E-File, STD claim costs actually increased during the 1998-1999 period of intense E-File rollout. It is only in the years 2000-2003 that a substantial ($230 million) decrease in STD claim costs has occurred. As STD claim costs continue to decline, they are now at a rate 25% lower than in the pre-E-File period.

The delay in productivity returns is likely a function of many factors. Some of it can be attributed to changes in the "mix" of WCB claims since 1997, namely, more severe and more "soft tissue" injuries that are difficult to diagnose and treat. Another significant factor was the loss of focus on aging paper files (while the electronic system was being rolled out), and thus, the dramatic increase in 1998-99 of claims inventory. Compounding all of these factors was a loss of expertise in Officer positions as a result of the staff "churn" in movement to new jobs and new decentralized offices. Finally, there was a staff and organizational "learning curve" with E-File itself.

The origins of this issue go back to the initial miscalculation of the probability of direct returns from the E-File system, given its characteristics as an "infrastructure" type of application [7]. Nevertheless, the future possibility for sustained productivity improvement derives from additional initiatives that build on the E-File

platform, as well as from resolution of outstanding issues in how people work with the system.

Outcomes from the Workers' Perspective
Over 90% of staff believe that they can now provide faster response to client inquiries. However, there are more inquiries. Over 90% of staff are convinced that, to varying degrees, multiple-person simultaneous access to E-File has provided efficiencies. However, the quality and extent of collaborative decision-making among users is still highly variable. Over 75% of staff say that E-File contributes to a "good use" of their time, with limited delays and faster access to documents. However, almost all staff say that the system, and how they are expected to use it, generates more messages and documentation to process.

The flip-side of the "clericalization" of knowledge work is that, four years after rollout of E-File, there are now only one-third as many File Clerks, one-quarter as many Phone Control Clerks, and one-half as many Office Assistants and Stenographers. Through application of collective agreement provisions for re-training and re-deployment, almost all employees displaced from these clerical positions are now occupying "up-skilled", more highly remunerated jobs such as Client Service Representatives, Team Assistants, and Entitlement Officers.

Moreover, in virtually all job categories, 50% or more of staff feel that there has been a substantial enhancement of their job skills through their work with E-File. Furthermore, working with the E-File system is also said by 60% of all staff, to have contributed in some degree to making their job "more meaningful and interesting". No matter what concerns have been experienced in the transition to an electronic work world, over 80% of staff surveyed express "satisfaction with the job that I now have, using E-File".

SUMMARY
Enduring Challenges for "Socio-Technical" Design of Knowledge Work
More standardized documentation (e.g. standard fields and limited field sizes) could significantly reduce data entry (with enhanced auto-fill capabilities), and also facilitate the review and analysis of lengthy claim files. However, the challenge will be to realize these potential technical benefits, while maintaining the initiative and quality of judgment exercised by skilled workers like claims Officers.

Meanwhile, these very technically skilled workers will function increasingly in "virtual" teams, physically dispersed over a wide geography of the province. To maintain professional standards and develop best practices will be ever more challenging. Perhaps, with effective socio-technical design, including new peer roles like an advanced form of the Business User Group representatives, E-File will be able to provide an "enabling" platform for knowledge management and "communities of practice" [9].

Another challenge likely to continue for individuals and the organization is to achieve an efficient balance in how the integrated office technologies incorporate clerical tasks (of word processing, answering client inquiries) into the knowledge work of claims investigation and adjudication.

Moreover, to whatever degree a system like E-File provides greater accessibility of information, workers need the "desk management" skills to prioritize their work and their use of the technology. No matter how advanced our search engines and how "smart" the filters we apply to information, the speed of the most important "processor", the human brain, isn't any faster.

Lessons for IT and Organization Design
The information system is the new "internal environment" and "technological component" that mediates much of the quality and *effectiveness* of social relations in the knowledge economy workplace [3]. Moreover, this case study manifests the principle of "Technological Choice". Software is potentially much more flexible than hardware. Customization or "configuration" of software can enable integration of IT system design with organization design.

The E-File experience demonstrates the value of the "line business" having oversight to major IT initiatives. True prototyping enables an organization to make real choices of appropriate technology. Having strong social objectives like the E-File "three pillar approach" makes it much more likely jobs will be meaningfully up-skilled. And, job and organizational innovation is vital in order to maximize and extend the business potential of information technology.

Nevertheless, a "whole systems" approach that aligns new information technology with new business processes and new organization structure requires exceptional resources. Without sufficient resources, individuals and the organization can be overwhelmed if too many changes are made concurrently in these systems. It may be helpful, where possible, to sequence the implementation of changes.

Regardless, a major dilemma involves accurate projection of financial returns. The actual time required for employees to integrate a new system into their daily work and thereby realize full productivity gains is often likely to conflict with shorter corporate timelines for return on investment [7].

The reality as demonstrated by the experience with E-File and its many enhancements is that, once a conversion is made to work processes based upon information technology, change is constant. Thus, individuals and the organization find themselves in a form of permanent transition. Transition is an unsettling condition for most people. It is full of uncertainty, incomplete results, and often, feelings of incompetence. A mainstay during this transition in the WCB context has been the stakeholder "Tech Change" forum, informed by "neutral" source action research findings. The forum and action research process has fostered coordination, consultation and participation throughout the organization.

Knowledge workers in this organization pride themselves on their investigative and analytical skills. Traditionally, the "tools" of their trade have been the unobtrusive pen and paper. E-File is a much more substantial "tool" that changed the person-object relationship to the extent that some workers felt their identity as a "professional" was at risk. Consultation and participatory design of the information system *and* the organization have helped staff to make a major transition with more dignity and a sense of accomplishment. Participative "socio-technical" design needs to become an ongoing mode of operation in the knowledge work enterprise.

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